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ABSTRACT

This proceedings of the 2000 Society for Information Technology & Teacher Education International Conference contains 459 papers organized in the following sections: Concepts and Procedures (23 papers); Distance Education (24 papers); Diversity & International (9 papers); Educational Computing Course (13 papers); Educational Leadership (8 papers); Faculty Development (29 papers); Graduate & Inservice (35 papers); Instructional Design (19 papers); International (25 papers); Mathematics (18 papers); New Media (19 papers); Preservice Teacher Education (56 papers); Research (31 papers); Reading, Language Arts, & Literacy (15 papers); Science (19 papers); Simulations (10 papers); Special Needs (8 papers); Social Studies (9 papers); Technology Diffusion (26 papers); Telecommunications: Graduate & Inservice (16 papers); Telecommunications: Preservice Applications (8 papers); Telecommunications: Systems & Services (19 papers); Theory (12 papers); Young Child (5 papers); and Invited Papers (3 papers). (MES)

Society for Information Technology & Teacher Education International Conference:

Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000)

Volumes 1-3

Dee Anna Willis, Jerry D. Price, and Jerry Willis, Editors

Society for Information Technology & Teacher Education 2000

11th International Conference

Proceedings of SITE 2000–

February 8-12, 2000
San Diego, California

General Editors –

Dee Anna Willis
Jerry D. Price
Jerry Willis

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AACE Association for the Advancement of Computing in Education

Volume 1

Society for Information Technology & Teacher Education 2000

11th International Conference

Proceedings of SITE 2000–

February 8-12, 2000
San Diego, Califonia

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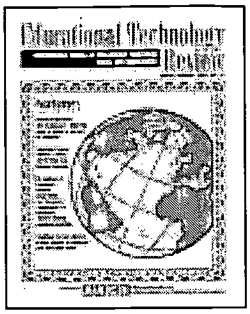
International Forum on Educational Technology Issues & Applications

(ETR) ISSN# 1065-6901



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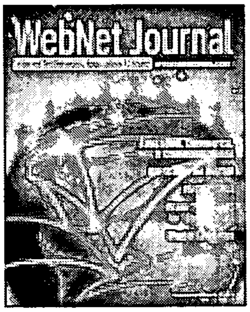

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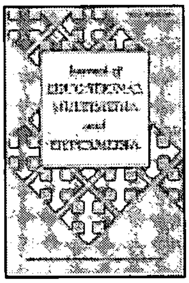

Designed to provide a multidisciplinary forum to present and discuss research, development and applications of multimedia and hypermedia in education. The main goal of the *Journal* is to contribute to the advancement of the theory and practice of learning and teaching using these powerful and promising technological tools that allow the integration of images, sound, text, and data.

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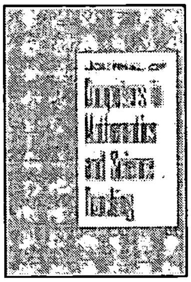

JCMST is the only periodical devoted specifically to using information technology in the teaching of mathematics and science. The *Journal* offers an in-depth forum for the exchange of information in the fields of science, mathematics, and computer science.

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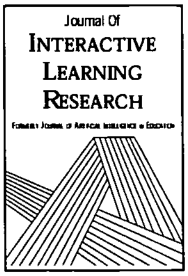
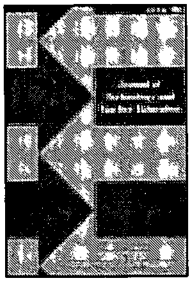


The *Journal's* published papers relate to the underlying theory, design, implementation, effectiveness, and impact on education and training of the following interactive learning environments: authoring systems, CALL, assessment systems, CBT, computer-mediated communications, collaborative learning, distributed learning environments, performance support systems, multimedia systems, simulations and games, intelligent agents on the Internet, intelligent tutoring systems, micro-worlds, and virtual reality based learning systems.

Journal of Technology and Teacher Education

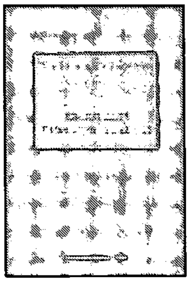
(JTATE) ISSN# 1059-7069 *Quarterly*



A forum for the exchange of knowledge about the use of information technology in teacher education. *Journal* content covers preservice and inservice teacher education, graduate programs in areas such as curriculum and instruction, educational administration, staff development, instructional technology, and educational computing.

International Journal of Educational Telecommunications

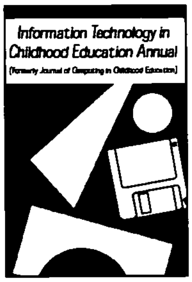
(IJET) ISSN# 1077-9124 *Quarterly*



IJET serves as a forum to facilitate the international exchange of information on the current theory, research, development, and practice of telecommunications in education and training. This journal is designed for researchers, developers and practitioners in schools, colleges, and universities, administrators, policy decision-makers, professional trainers, adult educators, and other specialists in education, industry, and government.

Information Technology in Childhood Education Annual

(ITCE) ISSN# 1522-8185



A primary information source and forum to report the research and applications for using information technology in the education of children—early childhood, preschool, and elementary. The annual is a valuable resource for all educators who use computers with children.

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12th International Conference

MARCH 6-10, 2001 • ORLANDO, FL USA

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Preface to the Millennium Edition!

Now that we have had our celebrations about the coming of a new century and a new millennium, purists are pointing out that we are not really in the first year of the new millennium but in the last year of the old one! "What?", you say. I vacationed in Turkey this Christmas (thanks to Dee Anna Willis being willing to shoulder most of the load for getting the section leaders' comments in and organized) and the English language paper in Turkey ran an article about the way the monk who organized the calendar we use today started it. Instead of making the first year, 0, he made it year 1. Thus, the year 2000 is actually not the two thousandth year, it is the 1999th year. So, if we want to do the whole thing over again next year, we can.

What about the Annual? Is this the 9th or the 10th year of the Annual? That too is a bit complicated. The first conference was held in 1990 which means this is the 11th conference. (We did not think far enough ahead to hold the first conference in 1991 instead of 1990 so it would be easy to keep up with.) Everything being equal this should be the 11th Annual, right? Well, not quite. The papers presented at the first conference were not published in an Annual. Instead, they were Issues 1, 2, and 3 of the 1990 volume of the journal, Computers in the Schools. So, when it comes to Annuals, the year and the number of the Annual is consistent. This is the tenth Annual.

Ten years! For the Annual. And eleven for the conference! Not long in the grand scheme of things but a long time when it comes to conferences. I would estimate that there are 80% more "First Annual" conferences than "Second Annual." And, if we extrapolate a bit my guess is that less than 5% of the academic conferences are around for an eleventh incarnation. SITE is a survivor for several reasons. One is that it does a good job of meeting a need. There is a growing community of scholars and professionals who have a strong interest in technology and teacher education. SITE is THE conference if that is your interest. A country singer whose name eludes me had a popular song a few years ago that had the lyric, "I was country before country was in." SITE was here, with a focus on teacher education before that was an "in thing."

Today, technology and teacher education is an in thing. The U.S. Department of Education's $75 million dollar grant program on preparing teachers to use technology has raised the interest level and attention of teacher education, as have a number of other activities such as the AACTE report on technology in teacher education. Technology was not always in the limelight of teacher education, however. In introducing the special issue of Educational Technology Research and Development on technology and teacher education, Bob Hannafin (1999) commented that in the past teacher education and instructional technology "lived quite happily in separate worlds, neither really knowing - or caring to know - what the other was doing" (p. 27). Hannafin edited the special issue of ETR&D on technology and teacher education because he felt this was an emerging field that deserved the attention of the IT community. I am happy to say that of the seven authors involved in writing articles for that special issue, all except one are regular participants in SITE. Two have been or are presidents of the organization and several others have won awards for their papers at SITE.

The USDOE grants program, the work of NCATE, ISTE, and AACTE; and special issues of journals like ETR&D, are all indicators of the changing landscape of technology and teacher education. SITE and its membership has many opportunities to form collaborative relationships with other organizations. The time is right for that, thus the theme of the conference, Bridges Among Professional Associations. I hope you have a productive and enjoyable conference and that you become an active and energetic part of the process of building bridges in this time of high interest and attractive possibilities.

Jerry Willis
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Professor and Director,
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Concepts and Procedures

Section Editors:

Deborah Bauder, ***Rome City School District (NY)***
Rosemary Mullick, ***SUNY Institute of Technology at Utica/Rome***
Ronald Sarner, ***SUNY Institute of Technology at Utica/Rome***

This year's papers tend to cluster into three broad areas: (1) teacher preparation, (2) distance learning, and (3) integrating technology.

The teacher preparation group consists of three selections. Michael Shaughnessy of Eastern New Mexico University notes the importance of preparing teachers to use educational software effectively and describes a software clearinghouse to encourage entering professionals to evaluate a variety of computing applications. In the second selection, David McCurry of Monmouth University (NJ) describes the use of videotaping, not only for purposes of self-reflection, but notes that it can also be used for a sociological assessment of teaching practices in a broader sense. In the final paper in this cluster, Kathryn Matthew and Kimberly Kimbell-Lopez, both of Louisiana Technical University, describe the importance of model technology classrooms that are used in their teacher preparation program.

Twelve papers in this section deal with aspects of distance learning, including the use of portfolios, ethics, and descriptions of ongoing projects. Gertrude Abramson and Timothy Ellis from Nova Southeastern University provide an excellent overview of the role and challenges of distance education in teacher preparation. In particular, Abramson and Ellis take pains to establish differences in attitudes and priorities between adult learners and traditional age college-students. We would do well to remember these differences as we read the other papers in this section.

The use of portfolios to organize a course and to document student achievement generates considerable interest. Lissa Pollacia and Richard Tarver from Northwestern State University (LA) present a course portfolio, "a coherent set of materials, compiled by the instructor, that provides insight into how a course is being managed and/or facilitated." The authors provide guidelines for compiling a course portfolio, and describe accommodations that are necessary for on-line courses. The paper by Douwe Wielenga from the Amsterdam (Netherlands) Faculty of Education is an overview of the role of integrative assessment. Terry Corwin from Valley City (ND) State University describes an interesting project through which students are required to compile a digital portfolio and, as a capstone experience, complete the portfolio by burning it onto a compact disk. Françoise Sandoz-Guermond and Gérard Beuchot, both from INSA de Lyon (France) describe a method for evaluating computer-mediated training.

Two selections deal with computer ethics. Jennifer Summerville from Emporia State University (KS) cites the need for an explicit ethics policy for on-line college courses and describes some of her experiences. Stig Rask from the Foundation for Knowledge and Competence Development in Sweden provides guidance on ways to instill ethical internet behavior among elementary and secondary school children.

Daniela Marghitu and Roland Hübscher from Auburn University discuss lessons learned from their use of computer-based training (CBT) applications. Robert Gilian, Karen McFerrin, and Frank Fuller from Northwestern State University (LA) report on a middle school staff development initiative, and the conversion of their materials to the world wide web. In "A University Design Team Approach: Developing Courses for On-line Distance Education, Timothy Youngman, Lee Gotcher, Shahrzad Vafa, Sharon Dinsmore, and Orval Goucher all from the University of Houston - Clear Lake present a team-based systematic course design process. Finally, Kay Allen from the University of Central Florida provides guidance for planning an interactive television course.

The final group of papers deal with the integration of technology and instruction. Alexandre Graeml from Centro Universitário Positivo in Brazil and Pierre Ehrlich from Escola de Administração de Empresas de São Paulo in Brazil present an insightful literature review comparing attempts to evaluate the return on investment in information technology with ways of assessing the benefits of formal education. Eric Seemann, Walter Buboltz and Lamar Wilkinson of Louisiana Tech University present a reflective paper assessing changes to student and faculty demographics over the last generation or two. From the demographic changes flow changes in skills, attitudes and beliefs on the part of students and faculty alike.

Another aspect of change in the educational landscape - the need to deal with students with individual differences is the subject of a paper by Barbara Moore from the University of South Florida. Moore argues that technology, in the form of a web-based resource termed a "digital bridge", is the key to dealing with students with gaps in content knowledge.

John Ouyang from Kennesaw (GA) State University, James Yao from Texas A&M, and Henry Wang from Lon Morris College (TX) have two selections. In the first, "Technology for Teachers: Another Perspective of the Implementation," the authors review teacher computing literacy training, providing a historical overview that traces programming-centered training to a computing-curriculum focus and finally to a problem-solving approach. Their other paper, entitled "A Farewell to the Traditional Instructional Media and Technologies in the New Millennium," concludes that "computer-based instructional media and technology has far more greater advantages over traditional media and instructional technology in almost all the aspects," and suggests that now is an appropriate time to abandon "traditional media and technology."

Lawrence Tomei from Duquense University seems less anxious to declare new technologies victorious. His paper entitled "The Technology Facade" is an indictment against the "use of technology in a school without benefit of a necessary infrastructure of support its application as a viable instructional strategy."

Linda Espey from Heartland Area Education Agency 11 and Drake University (IA) presents a case study of the Boone (IA) Community School District that explores whether the development of a technology plan facilities meaningful use of technology in the classroom. She concludes that the Boone CSD was very successful in developing and implementing a technology plan, but that more work remains before teaching and learning change significantly.

In "Effective Curricular Software Selection for K-12 Educators, James Marshall from San Diego State University and Marguerite Hillman from Hillman Consulting outline a model, which they term 4DIEM (the four Ds are Describe the objective, Determine if software exists and if so, what type is required, Decide on which appropriate titles to review, test Drive - followed by Integrate, Evaluate, and Modify) that is used to evaluate educational software.

In the final selection Thomas Scappaticci from King's College describes the technique of "concept mapping" and its implementation in a product called Inspiration Software.

The Role of An Educational Software Clearinghouse in Undergraduate Teacher Education Programs

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Abstract: As teaching and technology changes, access to educational resources and technology becomes increasingly imperative in order to prepare pre-service teachers to work in an increasingly technologically rich environment. This paper discusses the importance of an educational software clearinghouse in the preparation of undergraduate teachers. The paper will discuss the critical elements of exposure to educational software and educational and assistive technology.

As we enter the new millenium, colleges and universities are increasingly confronted with the problem of training pre-service teachers in methodology, assessment, classroom management, special education, inclusion and school law. Colleges and universities are increasingly confronted with students who are academically unprepared and computer illiterate. University instructors are confronted with transfer students who have minimal skills in educational technology, and who may need orientation to a vastly different modality of teaching.

At the same time, companies are increasingly putting educational software and educational products on the market for parents, teachers and librarians to purchase. However, prior to purchasing, what is often very expensive software, the buyer must be able to ascertain if the software is appropriate for the specific use, appropriate to the reading level of the student, and whether the software is easily accessible and what the strengths and weaknesses of that software are.

Several years ago, the New Mexico Educational Software Clearinghouse was established by Mark Isham and Janna Siegel to provide teachers in the State of New Mexico with a centrally located facility to review software prior to purchase. The NMESC is currently directed by this writer and it's functions have expanded to expose pre-service teachers to educational software and educational technologies that may be useful to them in the future.

The realm of education and teaching training has expanded considerably in the past two decades. Increasingly, teachers are responsible for multiply handicapped children that are being included or " mainstreamed " into regular education classes (Shaughnessy, 1996) At the same time, parents are increasingly concerned about their children's test scores and progress in their schools.

Teachers are also dealing with students who have been raised in a very visual medium, with some sources indicating that many children watch as much as seven hours of television a day.

Teachers must be first aware of the educational technology available to them. They must be able to quickly load software onto the computer and deal with any glitches that they may encounter. Teachers must use instructional time wisely and be able to incorporate Educational Software into their classes for review, and also for the incorporate of higher order thinking skills as well as critical thinking skills. At the same time, they must be able to help students master certain basics, such as addition, subtraction, multiplication and division. There are a number of viable C.D.'s available for this purpose. In addition, teachers want to expose children to reading and enhance their reading skills and abilities as well as their comprehension. Teachers must be able to procure appropriate software quickly and have students be able to " log on " rapidly and begin at a level of difficulty that is appropriate for them.

Teachers need to be able to critically distinguish between educational software that is challenging and enlightening, as opposed to software that is simply visual and loaded with a number of "bells and whistles". All too often, many software companies overdo the colorful aspect to the neglect of actual learning and information procuring and dissemination.

In order to be able to distinguish between the wheat and the chaff so to speak, teachers need to be exposed to a wide variety of educational products. There are a number of companies that produce excellent, thought provoking software products that will enhance the cognitive abilities and cognitive growth of their students. On the other hand, there are a number of companies that misrepresent their products and alienate parents and teachers with false claims. In fact, some educational software is not " field tested " on the groups of children that they have been designed for.

Teachers need to be sensitive to programs that " freeze " or " lock up " or force students to review four to five minutes of credits at the end of the program. Students are not always interested in who produced, directed and did the art work for various software products. Much time is wasted and educational time and instructional time is a very valuable commodity. Increasingly, teachers are being asked to cover more and more material in the same space of time. And, many teachers and students abhor the concept of homework. By the same token, an educational C.D. may prove engaging, challenging and stimulating and may not be onerous to the child.

Preparing Teachers to Use Educational Software

Teachers need to be able to employ educational software either in large group settings or individually. Some software packages require extensive amounts of time to

Become familiar with. Other software packages are very simple and easy to load and require very little prompting or assistance. Teachers need to be able to quickly review the documentation that comes with software and find the " gist " of the program quite rapidly.

Some educational software companies now advertise on the world wide web and teachers can sometimes purchase software at greatly reduced prices, if they know what companies are reputable and reliable and have return plans and which companies are new and developing, but may have educational materials that are not " user friendly ".

While there is a presumption among many administrators that all college students are computer literate, there are some students who have never turned on a computer. Such students are going to need to learn some computer basics. This takes instructional time away from other areas of interest. In effect, the instructor in undergraduate teacher education programs must make very wise prudent, judicious decisions about what is to be taught and how much time to spend on certain topics. An educational software clearinghouse is a valuable resource since students can spend as much time as they want reviewing software that is of interest to them and relevant to them, rather than having to sit through demonstrations of math or science software, when their instructional areas may be language arts or social studies.

Educational Decisions

Teachers must make many educational decisions as they enter the classroom. One such decision is when to use what type of software, to teach what type of lesson to what type of student. Embedded in this question is the issue of inclusion, where a teacher may have a very heterogeneous group of students. They may not all relate to the same software, nor will they have the reading comprehension skills to master the software or even keep up with the program. If there are gifted children in the class, the software may actually be boring. In such cases, teachers may need to send that child to an individual computer so that child will be challenged at a level commensurate with his ability. There are learning disabled students who may benefit greatly from educational software, if the reading level is appropriate. If the reading level is too difficult, the child will be frustrated. If the reading level is too simple, then instructional time is wasted and the child will be bored.

Some children may enjoy the stimulation from some educational software, but children also need to learn to concentrate, pay attention, participate in class and engage in classroom discussions., Teachers need to heed these aspects of instructional pedagogy and not overuse educational software. As with any new aspect of technology, there is a bandwagon effect. Curiously, many administrators believe that educational software is going to play a major role in remediation of students with deficits. While that may in part be true, in order to ameliorate some academic deficiencies, good old fashioned hard work may also be needed.

Incorporating Educational Software

Teachers must be trained as to when to use educational software, just as they need to be trained as to when to use a movie, slides, a filmstrip or any other educational aid. However, this is an art, and not a science as some currently believe. When instructional time is used for the presentation of software, the educational software should be relevant, appropriate and contain content that directly relates to the topic or lesson.

With the advent of the Individualized Educational Program or Plan, some educational teams may actually advocate for specific educational software to be used as part of a student's educational plan. In some instances, with students with special specific needs this may be most appropriate. However, the team must be sensitive to the fact that there may be a " boredom " factor after repeated viewings of a certain educational software program. We must all be sensitive to these issues and bear in mind that students do grow, develop and mature over time.

An Educational Software Clearinghouse in Your University ?

Should your college or university develop a software clearinghouse to allow students to preview software prior to purchase or prior to use ? There are a number of factors to take into consideration.

1. Space- Computers and storage for the Educational Software and the disks is needed. In many universities, office and storage space is at a minimum.
2. Paper- Letterhead, envelopes and postage will be required to request software to be placed in the clearinghouse.
3. Computers- Educational Software typically consumed a good deal of space on the hard drive and instructors must be aware that other items such as word processing programs may have to be deleted.
4. Labor- A graduate student or a work study student or a volunteer may be necessary to insure that educational software is not stolen or removed without permission. Theft is a major problem. Some students who check out software for use at home may never return the software and may never return to school. This is a problem.
5. Administrative understanding. Administrators do not often understand the changing nature of technology in education and are often oblivious to the fact that there are dictionaries and encyclopedias and art galleries on educational software disks. A tour of a software clearinghouse may help convince them of the usefulness of this endeavor.
6. Instructional Resource Centers can often provide some assistance to Software Clearinghouses. Basically, they are very much in the same situation and deal with the same complexities.
7. Some State Departments of Education may have grants to help subsidize or assist with the growth and development of a software clearinghouse. They may be very supportive and may actually offer suggestions and ancillary items to be requested or purchased.
8. Once established, and once on a mailing list, the Educational Software Clearinghouse tends to take on a life of it's own as brochures and catalogs begin to pour into the Clearinghouse.

In conclusion, an educational software clearinghouse or some facility for the preview and review of educational software is becoming increasingly necessary in today's world. Just as libraries were of critical importance in the last century, so do will software review centers become critical in the new millenium.

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Technology for Critical Pedagogy: Beyond Self-Reflection with Video

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Abstract: This paper*[i] opens with a story of what was once cutting-edge, state-of-the-art technology and its integration into preservice teacher preparation. It is a story of the technology, in this case video recording, the theories applied to its educational use and a specific teacher training method – microteaching. The historical context of microteaching with video recording feedback is presented. The further evolution of this technology in self-reflective methods is explored by considering the combination of inner development of the individual teacher with the outer, critical examination of social contexts of teaching. The final part of the paper attempts to construct a critical framework for utilizing both inner, self-reflective models of video feedback with models of critical video ethnography, used by the author in overseas educational development work in Africa, that examine situational practice. This paper will explore the theory foundation of these models in search of common principles to inform the practical use of video in new models of critical inquiry and reflection in professional development.

Once upon a time in teacher education...

In the mid 1960s a group of pioneering teacher educators at Stanford University in Palo Alto California began an experimental use of a new technology, video tape recording. At roughly the same time, among the ferment of ideas contributing to many facets of academe, processes of group interaction and the boundaries of individual growth and human potential were being explored. How do people effectively communicate in groups? How do individuals relate to one another in group settings to accomplish group oriented tasks? The fields of social and humanistic psychology were at this time generating relatively new ideas related to everyday activity in the workplace. Therapy groups, transactional analysis, creative problem solving (i.e. Synectics, see Gordon, 1971) and social learning theory formed a conceptual environment which some would use to apply to the process of teacher training. While various approaches situated in humanism contributed ideas about the development of the individual, other approaches to increasing the threshold of human behavioral efficiency also influenced inquiry directed towards learning and knowledge transfer. Sub-fields such as cybernetics and computing technology were beginning to influence practice through research into learning, cognition, training and the use of technology, largely from an efficiency model (how to increase learning with the least possible input of resources in the least amount of time). Research supporting these latter models were often funded by the US government through Department of Defense related contracts in search of more efficient training systems.

It was in this context that teacher educators would develop a process called microteaching, predicated on a few specific concepts. First, teaching behavior, and all complex behaviors for that matter, can be identified as a stream of activity which can be further atomized into discrete "micro" behaviors and that, once identified, can be studied, modified, practiced and learned (Acheson, 1964). Second, a powerful force in changing one's behavior is an external application of feedback, through peer interaction and internalized through personal, self-critique. A necessary set of pre-conditions is assumed to exist in that one has to be willing to accept the input of feedback towards the process of self-improvement and development. A central psychological concept, self-confrontation, is applied to this process of teacher training in small groups through peer feedback and self-analysis.

Self-confrontation then, just as now, is a process where individuals are exposed to information about how others see them in an "external" view. Theoretical antecedents are positive and negative feedback, feed-forward models, and behavior modification. In these models, one's own behavior or actions are re-introduced through some form of "feedback" (in this case, through videotape and verbal feedback in peer-critique). The very nature of such feedback is necessarily taken in "critically" by the individual and assumed to influence desired changes in behavior based on suggested or modeled practice (Nielson, 1963). As a general practice of professional development, however, such methods are highly limited to the individual (and often emotionally coupled to his or her own personality and ego development) and to the immediate context of the environmental variables present at the time of observation or recording. Social contexts and their influence on behavior are intentionally minimized as variables affecting the subject or simply not dealt with. In traditional models of microteaching this often has meant using other students in the class as "surrogate" pupils when modeling practice lessons. Microteaching then and now, attempts to develop improvement in discrete teaching behaviors by a process of focussed observation, feedback and modification of isolated teaching behaviors. Thus the process of teaching and learning, through these various influences, became "technologized." In the 1980's, teacher "training" gave way to teacher "preparation" with associated models built on reflective practice and constructivist educational theories.

Video in a Reflective Practice World

Certainly linked to Dewey's notion of critical reflection informing practice and following the influence that Donald Scöhn's work has had on the profession, it can be said that we in the field of teacher preparation live, to varying degrees, in a "reflective practice world" (Scöhn, 1983). The "reflective practitioner" is a stated goal of many teacher preparation programs and appears in the discourse on nationally proposed standards (Chiarelott and Klien, 1996). Given the different theoretical underpinnings of current approaches to teacher development (holistic, authentic and socially constructed) one may ask "does microteaching have a place in a reflective practice world?" Microteaching, as a specific method of teacher "training", is also still used in teacher education programs although to what extent is difficult to document. Carlgren (1998) has pointed out a need to further explore both the theory and practice of "doing" reflective practice. Video technology is also described as a useful tool for self-reflection models in teacher development and assessment (Holodick, Scappaticci & Drazdowski, 1999).

Self-reflection is a proven way of extending the feedback models used in earlier approaches to professional skills development, including microteaching (Frieberg & Waxman, 1988). Here again the emphasis is on the "self" in relation to professional contexts involving negotiated behavior among colleagues, students, parents and the community. While the encouragement of self-reflective practice lead to better understanding of the self in these contexts, they do not necessarily help the individual form a critical approach to understanding those contexts. The result may be teachers who are competent and comfortable with their own growth and development, albeit in a relatively static reality that they are unprepared and unequipped to engage in proactive ways. The improvement of individual practice through self-reflection and self-assessment models is assumed to lead to the macro-improvement of social and institutional settings for education. This is to be accomplished (or so it is assumed) by raising the individual quality of instruction in the classroom as a unit of evaluation. Such approaches to quality improvement are dependent on quantity effects achieved through, among other things, coherence with national standards or criteria for professional growth and entry into the profession itself. Reflective practice as a goal of teacher development is echoed in the national standards (NCATE, 1997) for teacher education programs.

The uses of video in these models largely reflect the same framework for self-reflection as an extended form of peer-feedback. Video offers the reflective practitioner a tool to gather information about the self in authentic practical settings. Video technology is now used in a wide range of existing and emergent models of professional development, founded on theories of self-assessment and self-reflection with recording of practice for further analysis and reflection occurring in the field. Concurrent with the professional development models used is newly embraced constructivist theories of teaching and learning that are primarily represented by the work of Vygotsky (1978).

Through the looking glass: Beyond self-reflection as a professional development model

Critical self-assessment and self-reflection are powerful tools in the development of professional teachers who are committed to lifelong learning and continuous improvement of their skills. Self-reflection models and associated practices (reflective journals, reflective group discussion and feedback) are now very common in teacher preparation and development programs. Such models have followed holistic approaches that seek to overcome limitations inherent in technical skills related methods such as microteaching. The professional development of the "self" should always be part of programs that seek to foster improvement among those who desire to engage in a profession. There is a distinction, however, between process-oriented constructivist and social-constructivist paradigms which apply not just to professional development models but to the theories of classroom teaching which professional development models are aimed (Hung & Chen, 1999).

Amidst new reforms in education there are emergent models of professional development which focus not just on the individual in a type of setting (classroom teaching) but examine a more complex range of professional development characteristics across social and community boundaries. Schools, and the processes of teaching and learning, are only one part of this model. In these models, the individual is an actor in a rich and complex social and cultural milieu that forms the context of the professional development activity. A new paradigm for professional development includes a critical dialogue with a broad population of stakeholders such as parent groups, professionals from other fields (academic discipline experts from university settings), community organizations and local business and include learning theories with social and organizational dimensions in addition to theories which are largely concerned only with the individual. In particular, expectations for teacher educators will now focus on developing the ability to work with groups of teachers as organized professional units in the school. Associated skills would include group feedback and critique and the ability to continue their professional development through inquiry models in their own professional settings (Stein, Smith & Silver, 1999).

Such changes are a challenge for professional development programs which in the past typically attempted to impart the "pedagogy of teaching" as sets of technical skills in higher education settings. Video technology has been used in various forms throughout this evolution. Although it is far from a "neutral tool", neither is video deterministic in nature. Characteristics of video recording and data collection need careful analysis related to the intended field setting. Video recording (and the use of the resulting data) carries potential in a new paradigm of professional development. Its use in models of professional development that go beyond technical "micro" skills development or self reflective, personal assessment models will depend on being able to widen the "field of view" beyond the limitations of a single teacher standing in front of a classroom of learners and beyond the inner-reflective use of "video journals". Models of use that fit with inquiry-based approaches to "wide-field" analysis of social contexts already exist in ethnography and could provide powerful frameworks for the incorporation of video technology into new paradigms of professional development for teachers.

The brief foray into the historical context of one technology innovation in teacher training and its subsequent evolution as a tool for teacher development is simply pointed at the axiom: It is not so much what tools are available as what we do with them. If we desire new activity or constructions, based on new paradigms for teaching and learning, then we will use available tools, adapt them and re-shape them if they do not "fit" or create entirely new tools to accomplish the desired actions. In terms of preparing new teachers, there is now a mandate, reflected in the ISTE (1996) technology standards for teacher education to expose them to the possibilities which new information technologies seem to hold. We assume in the discourse on technologized education, that value and "power" are intrinsic in the mere access to information, not in the active use of information for processes of social justice, environmental preservation and economic equity. Active processes of learning require being able to use information in new ways, integrated with and built upon prior knowledge in the minds of the learner and framed by a critical analysis of the social construct in which the knowledge is formed and used. The use of this technology and all of the "new information technologies" which teachers have now or will have at their disposal will not amount to much unless they are grounded in a theory of application, itself part of a general theory of education.

As world problems mount, precisely at a time when information technology is creating shorter paths to wider communication and information exchange, the focus of education should rightfully be on

providing the information and skills necessary for present and future generations of learners to engage these problems and form solutions which are viable in a democratic and culturally diverse society. Critical pedagogy, which forms a theory-based practice of teaching and learning directed at the critical analysis and "discovery" of social and political inequity at the root of society ills, provides one theory-context for pursuing the "meaningful use" and integration of new information technologies into teaching and learning. In short, the past uses of technology (like video) in teacher development have been directed at improving the individual as an autonomous entity, capable of "improving" and modifying behavior towards an accepted or demonstrated ideal state. Reflective practice provides a rich extension of this mechanistic model to "skills development" but is still highly individualistic in nature. For models and theory that provide a greater sense of purpose and meaning for educational activity educators need to look farther afield. Arthur Pearl and Tony Knight (1999) have offered a convincing "general education theory" for democratic education, in which the use of technology, especially information technologies, would make sense. They posit four general requirements of a general democratic education theory:

1. Knowledge should be universally provided to enable all students to solve generally recognized social and personal problems.
2. Students should participate in decisions that affect their lives.
3. Clearly specified rights should be made universally available.
4. Equal encouragement should be given for success in all society's legal endeavors.
(Pearl & Knight, 1999, p. 2)

Critical discussion of how the current push for technology integration into teacher education and teaching in general will benefit society as a whole is sorely missing from much of the discussion in the literature. Most accounts focus on the practical, myopic view of what works (within limited definitions of evaluation criteria) or simply examine what is possible through a limited demonstration of "cutting-edge" uses and re-configuration of existing technology. Pearl and Knight further elaborate a 9 point model for problem-solving curriculum directed at building competence for dealing with social and personal problems. These range from environmental issues to economic justice and inequality to workplace democracy and human rights, nonviolence, elimination of world poverty and, in discussing technology, challenge curriculum in a democratic education to

> [Marshal] technology for socially useful purposes. Technology has intended and unintended consequences. Most current presentations of a high technology future are dystopic. Students need to examine how technology can be organized to better serve humanity. Students need to distinguish myth from reality in the highly promoted "information society." They need to be given the opportunity to perform research that will enable them to distinguish information from disinformation. Students need to be able to weigh the difficult ethical issues related to the use of technology. (p.38-39).

Quite a departure from the current discourse on integration standards most frequently cited in technology in teacher education forums.

Towards a Model for Using Video in Self and Situational Critical Reflection on Practice

Given its historical role and limitations in earlier microteaching approaches as well as in more recent reflective practice models, can video still be considered a useful tool in alternative approaches to teacher development? Turning the camera around to explore the context and setting of the classroom is a daunting task. Videotaping practitioners *in situ* can reveal rich data for analysis both by the subject (the teacher engaged in teaching practice), by peers (degree program candidates and colleagues) and by other participants like students and community members with an interest in the process of education in specific settings (Karasati, 1997).

A further extension of this practice which incorporates a critical awareness of the classroom as a setting for social and cultural development would be to create video data which examines not just the individual as an "actor" in the setting but as a participant in the setting itself. In this model, ethnographic

video methods can be used as a method of data gathering and analysis (McCurry, 1995). At least a few areas of activity associated with teacher development overlap with video ethnography and ethnographic field methods in general: authenticity (data collected in real settings), contextualization of experience (placing events and their analysis in the broad social and cultural context in which they occur), iterative processes of producing "meaning" (sharing observations to confirm or refute assumptions and ascribed meaning to actions) and the formation of an inquiry approach to practice that encourages teachers to actively pursue understanding the "field reality" of their own life and professional circumstances. Further thoughts on some of these areas in relation to the use of video technology are considered below.

Authenticity: Video recorded for the purposes of modeling behavior for any type of further analysis should be collected in real environments. Simulations have some utility but their unauthentic nature will always be a distraction.

Digital video data: Video data, whether originating in analog or digital formats, offers the possibility for inclusion in portfolio for assessment or to demonstrate performance. This is a particularly interesting area since little is available on protocols for collecting such data and using it for auto-analysis or as part of peer or colleague mediated assessment. Data needs to be gathered in authentic environments, edited into "exemplary moments" based on critical judgement about one's development and performance.

Shared communication of feedback: Traditional peer feedback models developed over three decades ago need to be revisited given a new purpose to self-reflective models of teacher development. Perhaps mentor or colleague support systems in the school environments could accommodate video data gathered at the learning site for purposes of improving practice. Interpersonal communication models still seem to be a valid form but are not made explicit in many programs.

Contextualization of the data: Focussing less on the individual's behavior in isolation and more on the observed practice in real settings.

Participatory video production for reflective practice and practitioner inquiry: Based on models developed in international development education, video production is a yet to be exploited potential tool for the development of practitioner knowledge with preservice teachers.

Conclusion

Video, as one technology with its own evolution and characteristics, has been used successfully in support of differing approaches to teacher training and development. It has supported the use of micro-behavioral training methods as a feedback tool and has been used in constructivist models as a presentation media and tool for knowledge construction. Underlying these uses are broad, and quite divergent, theories of teaching and learning to which the technology, as a fundamental telecommunications tool, has been adapted. The more important consideration of the specific characteristics of any technology should be with these prevailing theories and they way methods and media based on these models are supported by the current state of the technology itself. In this paper, I have attempted to derive a framework for using video to support a socially constructive teacher development model that further supports a theory of democratic education. Such a framework and model for teaching includes the necessary broadening of the "field of view" of video use beyond the individual behavior of the teacher as a subject towards the complex social and cultural environment in which the teacher practices the art of teaching. Such an approach engages the teacher as a critical inquirer not just of his or her own practice but of the entire process and context of education, in all its complex social and cultural dimensions. Implications for the use of technology in teacher professional development under this approach are substantial.

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Model Technology Classrooms in Teacher Education

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Abstract: Model technology classrooms at the university and in local schools provide preservice teachers with opportunities to see technology use modeled and to practice teaching with technology. Observing technology being used in classrooms and teaching with technology assures that new teachers will infuse technology in their classrooms. Since teachers teach the way they were taught, it is essential that they be taught with technology. However, since the majority of teacher preparation faculty were not taught with technology, they need resources and support as they learn to integrate technology into their teaching and change from teacher-directed to student-directed learning.

A report compiled by the American Council on Education's (ACE) Presidents' Task Force on Teacher Education (1999) stated that college presidents must either make teacher preparation a top priority or get out of the business of preparing teachers. Based on the task force's findings they proposed an action agenda for university presidents. One component of the action plan calls for universities to provide the equipment, the facilities, and the personnel required to teach preservice teachers to integrate technology into their teaching. Further, university professors must be encouraged to model teaching with technology in their teacher preparation classes, and they must be given the resources and training they need to be able to do this effectively.

A national survey conducted by the International Society for Technology in Education (ISTE) commissioned by the Milken Exchange on Education Technology found that teacher preparation programs are not preparing teachers to effectively teach with technology (Moursund & Bielefeldt, 1999). Results of this survey indicate that teacher preparation faculty do not model technology use in part because they lack the skills to do so, and they lack the necessary hardware and software. The results also indicate that methods and curriculum courses that integrate technology into the curriculum impact new teachers' use of technology in their classrooms more than stand alone technology courses. Additionally, student teachers need opportunities to use technology in their student teaching under the supervision of classroom teachers who effectively integrate technology into their teaching.

To prepare preservice teachers to meet the expectations of the school districts that hire them, it is essential for students to have technological expertise and opportunities to use technology to teach in their preservice education (O'Bannon & Matthew, 1998). These opportunities must be available at the university level throughout preservice teachers' curriculum and in classrooms where they have opportunities to work with inservice teachers and their students. For preservice teachers to become technology proficient they need a wide variety of technological resources at the university and in schools where they observe and teach. These resources must be relevant to the planning, development, management, and evaluation of instruction. Preservice teachers must participate in classroom activities designed to provide experiences in enhancing instruction with technology to meet the individual needs of students.

Preservice Teachers and Technology

In P-12 schools technology has moved from the periphery to the center of instruction, the same must happen in teacher preparation programs (NCATE, 1997). In order for preservice teachers to integrate technology into their classrooms, they need to see it modeled in the university classes they are taking. If they are not required to use technology in their teacher preparation classes and they do not see it modeled by professors in their classes, they will not use technology in their classrooms. Preservice teachers will teach tomorrow the same way they are taught today (NCATE).

Teacher centered lectures are one challenge facing the integration of technology into the classroom (Ritchie & Wiburg, 1994; White, 1999). The successful integration of technology into teacher preparation programs requires student-centered constructivist teaching. Educational reform requires changes in the core relationship between teachers and students. This core relationship requires teachers and students to become learning partners. Together these partners construct knowledge, rather than students being the passive recipients of knowledge transmitted by the teacher. In order to do this teachers must focus on how students learn rather than what is taught (Johnson & Blair, 1999). Rather than the textbook as the sole source of knowledge, students and teachers need to explore multiple sources of information as they work together to construct knowledge. These student-centered classrooms allow students to use a collaborative, hands-on approach to learning as they question, explore, organize, and reflect on problems (Cohen, 1997; White). Technology provides students with the tools necessary to construct their own knowledge as they ask questions and conduct research to find the answers.

A single technology class in the teacher preparation program is not sufficient to assure that new teachers will be able to successfully integrate technology into their classrooms. Halpin (1999) found that preservice teachers who participated in a methods course that integrated technology into the curriculum were more likely to use technology in their classroom during their first year of teaching when compared to students who learned computer skills in an isolated technology class. Preservice teachers need opportunities through out their teacher preparation program to observe professors modeling the use of technology in model classrooms with a rich collection of electronic resources.

Preservice teachers need opportunities to learn to use educational technology in realistic school settings (Pan, 1998). To foster changes in how teachers use technology in the classroom, universities and schools must form partnerships to insure that preservice teachers have opportunities to integrate technology into instruction in classrooms (White, 1994). Universities need to provide leadership for schools as they work to integrate technology (Pan). This collaboration between universities and schools will assure that novice teachers transfer their technology knowledge and skills into their classrooms (Bennett & Daniel, 1999). Preservice teachers who are required to use technology in their courses, who see technology use model in their classes, and who have opportunities to teach with technology will use technology to teach in their own classrooms.

Teacher Preparation Faculty and Technology

Since the majority of teacher preparation faculty do not use technology for their own research and teaching, they do not know how to teach preservice teachers to infuse technology into their teaching (NCATE, 1997). Only if professors learn to use technology and model the use of technology are preservice teachers going to transfer their learning from the university to their classrooms (Bennett & Daniel, 1999). In order to model technology use, university professors must know about current hardware and software available for use in the classroom. Hence, there are several challenges to overcome if university faculties are to use and model technology in their teaching.

Dusick's (1998) review of literature revealed that several factors impact whether or not faculties use computers for instruction. These factors include: 1) administrative support, 2) computer availability, 3) resources, 4) support staff, and 5) training in the use of computers. Reporting on a three-year program focused on infusing technology into a teacher education program Thompson, Schmidt, and Hadjiyianni (1995) identified these essential factors for success: 1) easy access to technology; 2) allowing faculty to become personally comfortable with technology before using it for instructional purposes; 3) having technology integration as a department goal; 4) receiving strong support from the administration; 5) inviting participation in the program; and 6) one-on-one mentoring for faculty. Drazdowski, Holodick, and Scappaticci (1998) faced similar challenges during a three-year plan to infuse technology into their teacher preparation program. Additionally, they concluded that: 1) long range planning, 2) curriculum development, 3) faculty support and willingness to try new technology, and 4) the patience of the faculty member responsible for the changes were essential to achieving their goals.

One-on-one mentoring of faculty assures that their individual technology needs are addressed. Stewart (1999) describes a one-on-one mentoring program that paired a college of education faculty member and a doctoral student in the college technology program. The faculty member's increased comfort level with technology led her to encourage her students to use a variety of hardware and software for their class assignments. Receiving

individualized attention focusing on what the faculty member wants to learn, a self-paced approach to learning, learning in a comfortable setting, and ongoing support during the learning experience make mentoring a viable option for teaching university faculty to use technology.

Overcoming challenges to the integration of technology into teacher preparation courses requires resources and support. Resources are needed in the form of hardware and software in faculty offices, university classrooms, and school classrooms where preservice teachers observe and teach. Administrative support and technical support are essential. Faculty also need support in the form of ongoing faculty development in the use of technology as well as support in curriculum development as they restructure their classes to include technology.

Model Technology Classrooms

Two recent grant awards have provided needed resources to enhance the integration of technology into our teacher preparation program. The Louisiana State Board of Regents Support Fund provided a literacy/technology model classroom in the College of Education and a United States Department of Education Capacity Grant provided three model technology classrooms at the university lab school, as well as, faculty technology coaches. The resources and support provided through these grants in combination with other technology initiatives in the College will assure that our teacher preparation students see technology modeled in their university classes and practice teaching with technology at the university and in the lab school. Providing model technology classrooms and support for faculty as they model technology integration assures that our preservice teachers have opportunities to not only master basic technology skills but also to be able to transfer their use of technology across contexts for collaborative problem solving in classrooms with students.

The model technology classrooms contain at least five multimedia computers with Internet access, printers, a scanner, a digital camera, projection system, a document camera and open-ended software such as Microsoft Office, HyperStudio, and Inspiration. Further, the literacy/technology classroom at the university contains a wide array of print materials and software to enhance literacy development. Preservice teachers see technology infusion modeled in their methods classes as they use multiple sources to question, research, and reflect on the best ways to teach students. Then, they have opportunities to use these resources as they work with students in similarly equipped lab school classrooms under the direction of teachers who have successfully infused technology across their curriculum. The model classroom at the university is also available to faculty in the arts and sciences who teach courses required in the teacher preparation program.

Grant funds have also provided ongoing technology professional development for faculty in the College of Education, faculty in the arts and sciences, and faculty at the lab school. The content of these professional development sessions are determined by faculty input and are scheduled at a variety of times to assure that all faculty members have opportunities to attend. Faculty feedback at the end of the sessions is used to make changes in the presentations to assure that the sessions meet the needs of the faculty. As faculties in other colleges across campus have learned of the sessions, they have requested that sessions be held for them, too.

Thompson, Schmidt, and Hadjiyianni (1995) and Stewart (1999) discussed the importance of one-on-one faculty mentoring sessions and grant funds have provided technology coaches for faculty directly involved in teacher preparation courses. These technology coaches are available for one-on-one technology mentoring and support in faculty offices and during classes. These technology coaches are education majors who are paid a stipend for their work and receive additional technology training to be able to assist faculty. Using education majors as technology coaches gives them additional opportunities to use technology for teaching and learning.

Summary

If new teachers are going to teach with technology, then it is essential that teacher preparation faculty model technology use in their teaching and that preservice teachers practice teaching with technology in authentic classroom settings. Teacher preparation programs often lack the resources and support needed to model technology integration in their teaching. As the resources and support become available there are still challenges to overcome as university faculty learn to use the new technology and change the way they teach. Faculties need one-on-one, ongoing support to learn to use technology. Then, they need assistance as they change from teacher-centered to student-centered classrooms where students use multiple sources to question, collaborate, research, organize, and reflect on their own learning. Universities must collaborate with local schools to assure that preservice teachers practice teaching in technology-rich classrooms under the guidance of teachers who infuse technology in their

teaching. A concerted effort is needed to assure that new teachers will be prepared to teach effectively with technology.

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Defining a Distant Environment for Teacher Education

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Abstract: Virtual classrooms are rapidly becoming alternate acceptable delivery systems. One of the major challenges facing professors in higher education today is the creation of the best possible adult learning environment in our cyberspace classrooms. This paper describes some of the issues involved in refining Internet-based, asynchronous conference forums to meet the learning needs of adult students in distant inservice and graduate courses.

Introduction

At the crossroads of real and virtual colleges, limitless opportunities for professional development and lifelong learning are made possible. Academic institutions are faced with decisions about where to focus their human and fiscal resources. Every instruction delivery system (IDS) has its strengths and weaknesses. This paper will focus on an analysis of existing IDSs and attempt to make strides toward the identification of optimal environments for in-service professional development courses. We are addressing the needs of classroom teachers/graduate students who have selected to take part in the learning process based upon a job requirement or a personal want. These remarks may be generalized to most adult post-baccalaureate learning environments.

Traditional Campus

The traditional college campus is located in buildings to which students must drive or take a bus or train assuming they do not live on campus. Classroom instructors generally require that students be present at specified times and dates for at least 14 meetings per term. Even when attendance is optional, there is an expectation that students will attend class. Libraries, bookstores and administrative offices, where matters of registration, financial aid, and record maintenance are attended to are other familiar components.

Traditional, gainfully employed graduate students live within commuting distance of the campus. They invest time and money in travel, parking, and in walking to the classroom. Most are classroom teachers or substitutes; some serve in administrative capacities. Students whose job responsibilities or time frames change during a term are often forced to withdraw from classes. Students whose jobs end during a course of studies must choose between keeping job searches local or abandoning the program. Once a commitment is made to pursue a degree program, the student is "planted" in the physical location. In today's world of rapidly changing jobs, this is a frequently occurring conundrum. Many adult students have child-rearing responsibilities as well. Going to the campus makes it necessary to hire and train a caretaker. An element of stress exists as the student waits each week for the caretaker to show up. Many students report that they dash home from work, make supper, supervise homework, and only then begin the process of being students.

Class organization takes several forms. Graduate education classes are best when limited to no more than 24 students. However, class size is often dictated by enrollment not best practice. Classes with approximately 30 students and one professor enable some interaction mostly for the more aggressive and/or articulate students. Large lecture classes with up to hundreds of students are strictly professor to student delivery systems. In some places, members of these very large groups, divided into breakout or recitation groups, meet with a doctoral student who works under the direction of the lecturing professor. Lab classes provide hands-on learning with and without instructor guidance. Almost all on-campus courses are time bound.

Virtual Campuses

Distance learning has taken a variety of forms over the years. Recently, the focus appears to be on web-based courses using text-only, text and still images, or in some cases, text, video and audio (Abramson, 1998). A common thread obtains whether one uses one of these Internet-based forms or the older videotape, television, satellite broadcasting or even posted mail for distance learning. That is, the student does not need to be in the same physical space as the professor. Also, increasingly, course offerings are asynchronous, meaning that the student may "attend" at a different time than the instruction is presented. Anytime/anyplace learning has become a major player in adult education (Gibson, 1998), in general, and in teacher education to a lesser degree.

Much has been written and discussed about the learning needs and learning styles of the distant student and how curriculum may be presented and revised to meet these needs. The literature is replete with concerns over the loss of the personal touch and real-time teacher/student interaction. Issues such as technical support, faculty preparedness, copyrights, testing, attendance, class size and authenticity of authorship are under heavy discussion alongside course delivery and quality of interactivity. The fact remains that there is a new player in the game so our options are to master the rule or be left on the sidelines.

The Adult as a Student

All classroom teachers involved with in-service professional development may be classified as adult learners. However, just because most professional development takes place in a college or university does not mean that the teachers become college students. Differences between traditional college students and adult learners will be approached from four perspectives: age, needs, desires, and goals (Bowden & Merritt, 1995). The traditional college student is an 18 to 25 year old person who continued on to higher education immediately or very shortly after completion of high school. "Adult" students can range in age from their late 20s through their 70s or beyond and typically have been separated from an educational environment for a number of years (McNair, 1994).

The needs of these older students are influenced by a constellation of factors, including relationship responsibilities as parents and spouses, organizational affiliations, and commitments that place demands on their time and financial resources (Boucouvalas & Krupp, 1989). Perhaps as a result of these multiple and often conflicting needs, adults as students typically desire two things from their learning environment: a direct connection to their past experiences or current concerns, and a pragmatic, problem-solving approach within the learning environment (Brookfield, 1989).

Adults perhaps can best be understood as students in terms of their goals for participating in an educational program. Although the specific goals cover a very wide spectrum, in general, the immediate, practical applicability of material is extremely important to the older student (Bowden & Merritt, 1995). Knowles (1977) observed that, for the adult student the "…time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem-centeredness" (p. 39).

The educational requirements of the adult learner extend beyond the rather practical considerations identified by Bowden and Merritt (1995), Boucouvalas and Krupp (1989), and Brookfield (1989). There is evidence that the process of assimilating knowledge is different for the older learner than for the younger student. Adults approach the learning environment in a different fashion, expect different things from that environment, and react to the various aspects of the environment differently than the traditional college student. Zemke and Zemke (1995) observed that, although a single-faceted theory was inadequate for identifying the unique needs of the adult as a learner, some general principles regarding the adult as a student are apparent. Timing is vital in adult education; adults usually have rather small 'windows-of-opportunity' during which they are receptive to learning a new task. The learning process must incorporate practical application of the subject matter and be problem-centered. Finally, facilitation, as opposed to the lecture approach, is much more likely to be successful for the older student.

Self-directed, autonomous learning is important to the adult student and should be acknowledged by the actions of the professor (Tennant, 1991). Although the need for self-directed learning is widely accepted within the literature, Griffin (1991), in an exploration of the impact of social theory on adult learning, identified a very interesting paradox regarding the goals for adult learning. The impetus for an adult to return to an educational setting is often related to the need to adapt to changing circumstances in the workplace or greater environment. At the same time, adult learning practices are predicated on the need for self-direction. An adult learning environment often must meet the somewhat contradictory goals of addressing the needs presented by external forces such as employers while at the same time affording the student maximimum control over the learning process.

The Adult as an Online Learner

In general, the needs of the adult as a student potentially match well with the strengths of an Internet-based online learning environment. A point-by-point comparison of the general needs of adult as learners as outlined above with the characteristics of an online learning environment follows.

Flexibility of Schedule. An online environment can offer the student a time- and place-independent academic setting. Owston (1997) reviewed the online offerings available from several institutions of higher education located in both Europe and the United States. He uncovered numerous examples of programs specifically targeted at providing adult students with educational opportunities that could be accommodated within a busy schedule of family, social, and work responsibilities.

Direct and Immediate Applicability of Material. Computer-enhanced learning environments can simulate the application of material that would be impossible to include in a traditional classroom setting because of safety, cost, or moral issues. Hatfield (1996) described the use of computer-simulated environment used to help pre-service mathematics teachers experiment with teaching approaches they would have been hesitant to try if working with live students. In a virtual classroom setting, these prospective teachers were able to experiment with the effective use of educational approaches such as mathematical modeling, group problem solving, and the use of manipulatives. This virtual experience enabled the students to grasp the concepts and internalize the thought processes underlying the application of these pedagogical approaches more thoroughly than students learning the same material in a traditional setting. The multimedia-based virtual classroom offered a realistic setting in which the student felt safe to experiment with new approaches, thereby promoting greater personal involvement in the instruction.

Positive Connection to Previous Experiences. Internet-based online environments significantly change the role of the student in the educational process. The relationship between instructor and student is altered; Kilian (1997) observed that Internet-based education is, in fact, changing traditional academic roles by encouraging an egalitarian, mentor-apprentice relationship between teacher and student. Perhaps more significantly, the relationship between student and subject matter is modified significantly within this environment. Dyrli and Kinnaman (1996) observed that in the Internet-based online environment students can become much more involved as information producers rather than information users as is typical in the conventional classroom setting.

Problem-Solving Orientation. An Internet-based online learning environment is essentially problem-oriented and active in nature. Hazari and Schno (1999) outlined how the interactive tools such as forms, threaded discussion forums, and interactive 'chat' rooms available in a World Wide Web based environment can promote a problem oriented environment by stimulating interaction with course content, instructor, and other students.

Self-Direction . The role of the learner in an Internet-based online environment is inherently one of increased power and control. As detailed above, the increased flexibility in scheduling, capacity to experiment in a safe, virtual environment, and active orientation combine to make the student more a partner in the learning process than a passive receipient of knowledge. The nature of personal computer systems in general and the Internet in particular, furthermore, promote personal independence by the control in sequencing and pacing they afford the user.

Dangers Inherent in an Online Environment

Each of the characteristics of the adult learner discussed above can present challenges to the instructor, especially in an online environment. The need for flexibility in scheduling often manifests as missed assignments, inability to participate in group learning experiences, and deferred completion of courses. The demand for direct and immediate applicability of material may, in fact, be a retreat into concretism, while the desire for a positive connection to past experiences might mask a resistance to new ideas. The need for a problem-solving orientation, often expressed as, *I'm a 'hands-on' learner*, can be an unwillingness to engage in a rigorous thought process. Similarly, the demand for a self-directed learning environment might be a sophisticated term to describe a power struggle between student and teacher.

The online learning environment is not a panacea for the adult student. Although an Internet-based delivery system may address many of the needs of the older student, this approach to education raises concerns as well as offers solutions.

Many of the challenges the older learner presents as a student are potentially aggravated by the online environment. Brunt (1996) emphasized the need of adult learners for personal support, especially early in the

learning process. Since adult students bring with them *baggage*, such as personal difficulties, financial hardship, lack of confidence and negative memories of previous learning experiences, the need for personal support can be crucial. He warned that, although distance approaches enhanced by technology such as the Internet, might be attractive to the adult student for several reasons, many adult students might not be able to benefit because of the lack of meaningful, personal support.

A headlong rush into replacing traditional classrooms with online learning environments for adult students is certainly unwarranted. Hara and Kling (1999) quite effectively cataloged the potential frustrations for both students and instructors involved in a Web-based online learning environment. Although online environments present the potential to quite effectively meet the needs of the older student, there do appear to be an equal number of potential hazards.

Graduate Education Programs at SCIS

Let us look at the environments within which we teach across distances. Although our graduate programs are all distant ones, we have a real campus at which most of the professors may be found daily. While the students are distant, the faculty is remarkably collaborative. We network extensively and support one another as we strive to build the best possible programs for learning. Our classes are presented in three different formats.

- MCTE is a totally on-line masters program in computing technology in education. At this writing, even orientation is an on-line experience. Faculty and students never meet face-to-face and students do not know one another. There are four 12-week terms each year. Students who take two courses each term can complete the program in 18 months.
- DCTE Institute is a partially on-line doctoral program in computing technology in education. Faculty and students meet for one week (forty hours) each five-month term. There are two terms each year, separated by a month. Students take two courses and one project course for four terms before beginning the dissertation phase of the program. The day before a student's first term is an on-campus orientation experience. All further interaction is computer-based.
- DCTE Cluster mirrors the Institute with one exception. Instead of the two weeks on campus, students and faculty meet for four weekends, at the beginning and middle of each term (20 hours plus 20 hours).

The Learning Place at SCIS

The physical entity that replaces the classroom during distant course components is the computer. Each professor has an office and a resource center located on his/her home page. See, for example, http://www.scis.nova.edu/~abramson and http://www/scis.nova.edu/~ellist. There, one may find a photo of the professor, and, for some courses, link to images of classmates, thus reinforcing "real people" identities. Syllabi are available so students may preview a course before signing up and may download clean copies should theirs become lost. PowerPoint slide shows created to support classroom presentations are easily saved as html documents and linked to the home page. Alternately, useful links to research gateways may be provided for student research.

Our classrooms in cyberspace are multi-threaded forums, which are elaborate, interactive bulletin boards. When the professor has the time to set up properly, classes begin with established sets of discussion topics to which students may respond on an as-needed basis. The beauty of the system is that it is there whenever it is looked for; it cannot be accidentally erased. All remarks posted to the forum are available to everyone in the class. If anyone wishes to retract a posting, the professor can do it with a delete command. The professor may also correct spelling and punctuation if indicated. The intrinsic value of the forum is identical to any class: It is a combination of the professor and the students and the efforts put forth in the learning process.

Keeping within the guiding principle of computer-based, distance learning, there is a vehicle for submission of homework assignment electronically called Electronic Student, Electronic Teacher (ESET). This application allows students to upload (and thus submit assignments electronically) different kinds of documents. It also provides for acknowledgement and grade tracking. Importantly, should an instructor ever misfile or misplace a student assignment, another copy may be downloaded since everything is archived.

Another heavily used tool is electronic mail (e-mail). At the beginning of each new class, an Address Book is set up so that messages may be sent to the entire group by typing the class alias in the TO: line (e.g. IDS0399). Of course, personal communications and assignment feedback are easily carried out with e-mail. It is a real thrill to send a message to Japan or Israel and to find a response from the student the next morning. These asynchronous

(anytime) tools make for much more immediate satisfaction than do setting and keeping mutually acceptable meeting times (Abramson, 1999).

How do students feel about these options? Student satisfaction runs extremely high as do completion rates for all programs. All three formats have grown in double-digit rates since 1995.

Distant Instruction at SCIS

SCIS, as a graduate school, is less than 15 years old. We like to believe that we move with the times and that our use of distant modalities is state-of-the-art. One of the unwritten rules that has been handed down anonymously is that the computer (and not video or TV) is our instruction medium. That does not rule out the use of textbooks or other ancillary materials. As Feenberg (1999) reports, writing is the basic medium of online expression, the skeleton around which other technologies and experiences musts be organized to build a viable learning environment. Each course is accompanied by a syllabus that explains required work in very great detail. Syllabi are updated constantly to reflect student feedback and technology changes.

The masters courses tend to be subject-content oriented and the forums structured. Commonly, the professor will post questions relating to the different readings and students are expected to respond, amplify and extent the thoughts of others. Doctoral forums tend to be more flexible. The professor or any student may open a discussion and everyone is then free to jump in. Our experiences have shown two very important constants: The quality of the interaction is a direct function of the quality of students in that particular section. Also, the seriousness with which students approach the collaborative explorations is a function of how their contributions relate to the course grade.

For the most part, student work is evaluated by performance in the form of written documents and/or computer product development depending on the particular course. Using constructivist, performance evaluations largely negates questions that are often raised about cheating and integrity in distance learning.

Moving Toward Optimization

To summarize, let us repeat some assumptions about adult learners that hold true for classroom teachers seeking professional development:

- Students enroll in classes because of a perceived need or want.
- Mastery of course material is essential if the need or want is to be met.
- Nothing magic occurs by bringing one's body to class.
- Different people have different communication and interaction needs.
- Time spent in traffic is better spent doing homework.
- When stress is minimized, receptivity to new material is greater.
- Job requirements take precedence over school requirements.
- Home demands compete with school demands.

We concur with Phipps and Merisotis (1999) that technology cannot replace the human factor in higher education and hope that our face-to-face meetings provide enough real contact to "carry" the learning process. Over the years, we have learned to read emotional needs within printed messages (Feenberg, 1999) as we might from student facial expressions. As a collaborative faculty, we work to develop the qualities that make a good distance-learning teacher (Roblyer, 1998). Despite our best efforts, we are still unable to define optimal environments. Nevertheless, we hope the variables identified and discussed will move the profession in the direction of best practices for the distant, professional development of teachers.

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COURSE PORTFOLIO: A TOOL FOR ONLINE TEACHING

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ABSTRACT: A *course portfolio* consists of materials that instructors collect and organize to demonstrate how a course is taught and facilitated or managed. A course portfolio can include any relevant documentation such as the syllabus, exams, exercises, problem sets, samples of student work, etc. It is important to include a ***framing statement*** that places the course in its institutional context and summarizes the major aspects of the course.

In addition to the advantages of maintaining a course portfolio for a traditional class, a course portfolio for the online instructor provides many more advantages. It can help to prevent "academic amnesia" (what did I do last term?), it can help the instructor reflect on aspects of the course, and it can provide a means for assessment of the course by an academic administrator. Administrators are generally unfamiliar with the online environment, thus a portfolio provides documentation in a familiar printed format.

1. The Course Portfolio

A *course portfolio* is a coherent set of materials, compiled by the instructor, that provides insight into how a course is being managed and/or facilitated. The course portfolio may cover an entire course or a subset of the course. The term *course portfolio* used here is to be distinguished from a *student portfolio,* which we mean to be one developed by a student to demonstrate knowledge or skills within a particular course. In this paper, the term course portfolio will mean materials collected by the instructor to summarize the teaching and learning that takes place in his/her course.

Compiling a course portfolio to explain what we, as instructors, do in a course helps us eliminate the problem of "academic amnesia". We often have a good idea during the course of a semester but by the time next semester rolls around, we remember that idea just as we're in front of the class teaching it again. Developing a portfolio encourages us to pause and reflect upon our teaching and how we can improve the quality of instruction and learning. It provides a mechanism by which others in our field may review our teaching, and it allows us to share successful approaches.

2. Guidelines for Compiling a Course Portfolio

Although there are no hard and fast rules about what should be included in a course portfolio, the instructor will want to include materials that illustrate the three aspects of teaching:

- Preparation
- Process
- Product

For preparation, include a document that describes any preparation work that went into a unit or lesson. For illustrating the process of instruction, include tests, activities, problem sets, lab exercises, and any other materials that provide insight into how you go about achieving the learning objectives. Provide comments for an external reader where you feel additional explanation is appropriate.

The product is, of course, student learning. This is demonstrated by including samples of students' work, from A+ to failing level. This could be students essays, e-mail messages, projects, test papers, etc. The project/papers should show graded comments, if applicable. You must get the students permission to use their work.

Instructors usually have the majority of these kinds of documents together in a file box or filing cabinet. What is missing is the organization of these documents into some sort of easily viewed format, and a *framing statement* that will give an overview of the course and the institutional context. In the framing statement, summarize the curriculum of the course and your approach to teaching it. Describe the students who populate the course, and any special problems, e.g. the course is Freshman-level with very large sections. The framing statement should be written so that it is understandable by a person from outside of your field of expertise.

At any place in the portfolio, you may also include a *reflective statement* that describes your views on an activity, lesson, unit, etc. This statement allows you to think about the success (or lack thereof) of this particular activity, lesson, or unit. Did this activity meet your expectations? What would you do the same next term and what would you change? How did you address special problems or challenges? The reflection may or may not include a solution to the problem. The key here is to *document*--write it down so that you can continue to improve and others can become aware of any problems.

Some useful DO's and DONT's in compiling a course portfolio: [WWW1]

- DO be succinct in your writing and selective of the documents
- DO use your portfolio to develop, reflect upon, and improve your teaching
- DON'T include all of your course materials--it will become too cumbersome even if it is organized

Some institutions have gone so far as to recommend that the portfolio be tailored to its specific usage, i.e. *development* (improvement of instruction) vs. *evaluative* (promotion/tenure/merit decisions) [WWW1]. However in most instances, a well-organized portfolio can suffice for both purposes. For more information on constructing a course portfolio, the interested reader can refer to [WWW2] and [Dunbar et.al.].

3. Special Case of the Online Course

The case for developing a course portfolio for an online course is even more compelling than that for a traditional course, particularly with respect to evaluation. Traditional sources of information for evaluating an instructor's teaching effectiveness are: classroom visitations, systematic student ratings, opinions of colleagues and administrators, and self-evaluation [Cashin, 1978].

The online course presents special problems and challenges for the evaluator, many of whom are not yet familiar with electronic learning and the online environment. How does one conduct an online "classroom visitation" to an asynchronous class? How will other colleagues and administrators form a valid opinion of the teaching effectiveness for online classes?

As online facilitators for over two years, it has been our experience that the evaluator is reluctant to engage in an online classroom "visit". We have provided department heads, deans, and other administrators with username, password and written instructions about how to proceed; but we have met with very little success. Unless we sat with the administrator and walked them through it, they would not even attempt to view the class. Even if they had succeeded in entering the class, to someone unfamiliar with electronic learning, it seems as if "nothing" was going on.

This is where the portfolio, with concise well-written explanations, can be invaluable. It provides the evidence of how we are teaching and facilitating our students' learning. It gives the administrator or evaluator sense of what the instructor is thinking about concerning the various aspects of the course. Samples of student work validate the achievement of the learning objectives. In addition, the printed material provides the administrator with a familiar medium so that s/he can concentrate on the teaching/learning--not on using the technology.

4. Conclusions

Keeping a course portfolio has been extremely useful in the development and continued enhancement of our online courses. We have included such items as class announcements, assignments, as well as any other type of communication that we use over and over each semester. There is even a section

containing instructor responses to common mistakes. By saving these communications as word processing documents, they can be re-used next term. This will save you some time, which is very important for a time-hungry online course.

Our idea of a portfolio is an organized three-ring binder containing printed materials, but some have proposed taking the portfolio idea one step further: the *electronic portfolio* [Barrett, 1999] and [Aschermann, 1999]. Although these ideas are proposed for preservice teachers, the concept is the same. The portfolio can be created using authoring software, utilizing various forms of media, and creating hyperlinks between the various components, as in a web document.

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Student Digital Portfolios on CD-ROM: Assessing Ability-Based Projects

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Abstract: The paper describes the diffusion of an innovation, digital portfolios on CD-ROM, into the curriculum. During the completion of each student's degree requirements, the student compiles projects that demonstrate the eight Abilities endorsed by the university. The projects are created within the courses completed for general education and the student's major. Each project demonstrates content knowledge and one of the eight Abilities. The student decides which projects to include in the final Senior portfolio. The framework for the portfolio is determined by the Abilities emphasized in each academic program.

Outcome

Beginning in 2002, each graduating senior will organize a digital portfolio and burn a CD-ROM for program assessment purposes and for use by prospective employers. The Division of Education, as a leader on the campus, presently offers students the option of completing a paper or digital portfolio. Beginning in the spring of 2001 all Education graduates will be required to complete digital portfolios. At present, graduates have completed approximately fifty CD-ROM portfolios.

Problem Statements

Over the past three years the faculty of Valley City State University have endeavored to modify the general education objectives. The purpose of the change was two fold: 1) to make the objectives more assessable and observable and 2) to help student understand the connection of general education courses to their major curriculum. To facilitate these changes, a campus wide committee of faculty was formed. The committee identified a set of eight abilities from the existing objective statements see [Table 1]. It was determined that students should demonstrate the eight abilities not only in the general education courses but throughout the undergraduate's academic career. The Abilities were each assigned skills that could be demonstrated and five levels of difficulty were determined for each of the skills. Projects created in the academic classroom are based on content knowledge and also demonstrate the student's level of competency in a given Ability.

1. Communications	5. Problem solving
2. Collaboration	6. Technology employment
3. Effective Citizenship	7. Aesthetic Responsiveness
4. Global Perspectives	8. Wellness

Table I: The Eight University Abilities

Documenting and assessing these Abilities became a topic of discussion on the campus. The portfolio assessment process was seen as a practical tool that would allow students to demonstrate competence levels in the eight abilities.

Process

Two changes occurred on the Valley City State campus that allowed the faculty to choose the CD-ROM format for the portfolios. First in the spring of 1995 a campus technology committee made the decision to create one of the nation's first notebook computer campuses. Beginning in the fall of 1996, every full time student and faculty member received an IBM notebook computer. The notebooks allow students to create and save materials on there own hard drive. The campus network also allows for fairly simple movement of large files from computer to computer. Both make the saving of materials and creation of the CD-ROMs feasible for a large number of students (Tykwinski, Brown. & Holleque, 1997).

Second, in 1996 the campus secured a five-year Title III grant from the Federal Government. It funded equipment and support for faculty training. The grant enabled the CD-ROM portfolios process to become a campus wide initiative see [Figure 1].

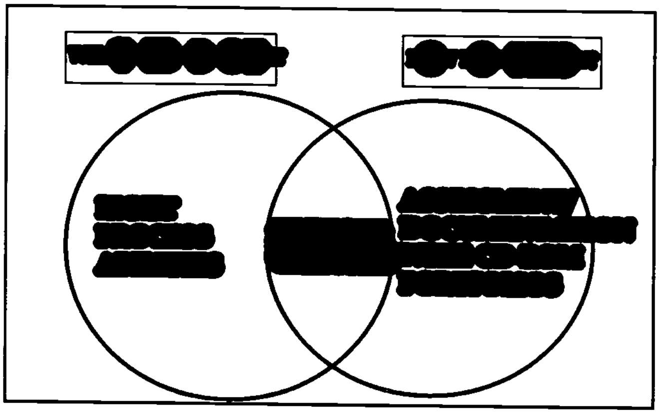

Figure 1: The Campus Process

Diffusion into the Curriculum

Faculty

To begin the process with the faculty, a ten member learning team representing every academic division was created. These individuals began discussing the portfolio process and making decisions concerning the purpose, audience and expectations for the senior portfolio. Among the articles read and discussed by the team were Shiengold & Frederiksen, 1995 and Gillespie, Ford, Gillespie and Leavell, 1996. The members of the group also received training on hardware and software needed to create multimedia projects. The second year of the implementation process included one-on-one mentoring for ten more faculty. The process continued until, by the end of the fourth year, 85% of the faculty had been involved in the process. In the fifth year a priority was placed on mentoring new faculty. Also during the fourth year of the process, faculty stipends were provided for those who wished to create Ability based projects in their courses or to create program assessment plans that included the abilities and portfolios.

Students

During freshman orientation following the distribution of the notebook computers, a four-hour computer basics session is held. The senior portfolios are demonstrated at this time. Hardware and software skills necessary for multimedia projects are included in a required general education course taken by 95% of freshmen. These skills include web page creation, scanning, and audio & video capture. All other necessary skills are integrated into existing curriculum and are included in the course content as needed for the projects. Each division determines how and

where their students begin to develop the portfolio and which of the Abilities are be included in the senior portfolio. The projects are created with assessment indicators that students must respond to when completing the project. The faculty in each academic program determine the assessment of Senior portfolios however, using a day during finals week seems to be the prominent choice. At the present time portfolio courses are available for students who wish extra help in completing their portfolios. As the portfolios become required for all seniors, portfolio seminars in each division will meet the needs of the students. The process is outlined below in Figure 2.

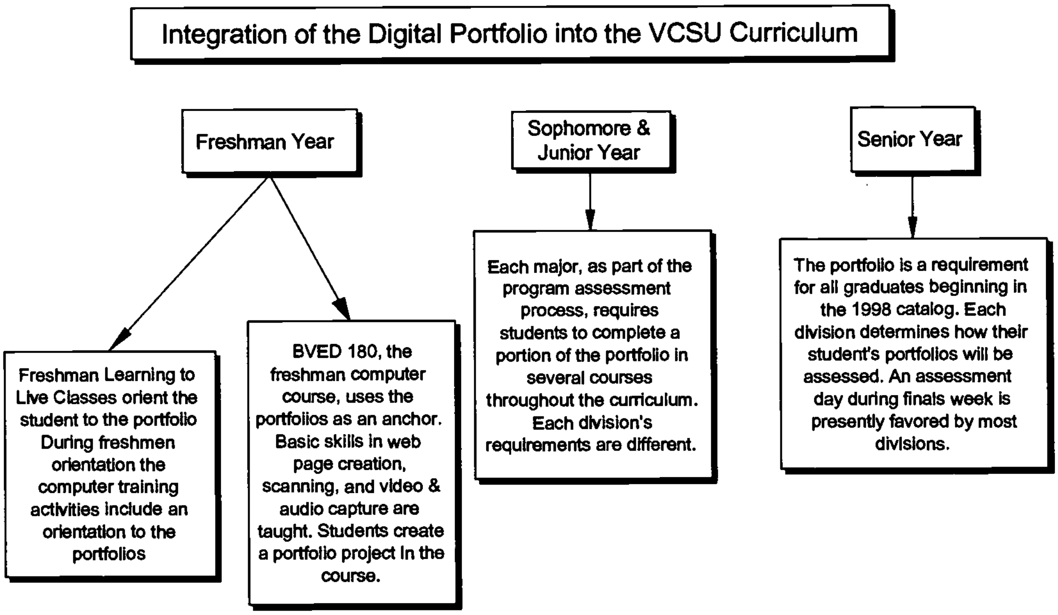

Figure 2: Curriculum Integration for Students

Tracking Student Progress

A web based tracking software is currently being considered for use. The web site is connected to a database that allows students to submit their best work in each of the Abilities. A checklist of completions is then available to the students and advisors and individual projects can also be accessed. Assessment committees both on the campus and off can also access student work. A demo of this software is available on the Rose-Human Institute of Technology website at this address: http://www.rose-hulman.edu/ira/reps/.

Expected Outcomes of the Portfolio Process

1. VCSU students will become self-directed, self-assessing learners. The use of portfolios in general classes and the completion of a CD-ROM portfolio gives students more ownership in their own assessment.
2. VCSU will increase the appropriate use of instructional technologies, including notebook computing for improving teaching and learning. The student notebook computer initiative is central to the creation and saving of portfolio materials.
3. VCSU will produce graduates who demonstrate that they meet established standards of knowledge and skills. The demonstration of the eight abilities through the CD-ROM portfolio provides the vehicle. VCSU will streamline and reduce duplication courses by focusing each course on unique contributions to expected competencies for graduation.

4. The ultimate aim of the CD-ROM portfolio project is to complete a major transformation of institutional culture and practice that began with a mandate from the State Board of Higher Education in 1990, from a traditional teaching institution to a student-centered, innovating, technology based institution.
5. Students are increasingly perceived and treated as full partners in the learning process and institutional governance. A strong emphasis on what students must know and be able to do is surmounting traditional orientation toward courses and credit hours as the measures of learning achievement.
6. Faculty are diversifying toward innovative teaching strategies. For example, a 1994 survey showed that a minimum of half the faculty used behavior modification, futuristic forecasting, independent study, field trips, role-playing, and student journals.
7. Daily faculty use of computers for instruction is more than double the national average rate (Green 1996). Nearly all are integrating technology-based instruction into their courses. A new multimedia classroom is used several hours each day.

Institutionalizing the activities involved in this project, in a very real sense, requires the entire University budget. Only by directing all time and money toward becoming an innovative, technology-based, student-centered institution will we complete the transformation process. The CD-ROM is one piece of this process.

Assessment of the project:

1. A faculty survey conducted yearly since the 1996 indicates that in 1999:
   - **30%** of faculty require multimedia use in their courses
   - **48%** of the faculty use multimedia in their teaching.
   - **30%** of faculty require students to use CD-ROMs in their courses.
   - **81%** use CD-ROMs in their teaching.

2. The faculty's use of technology has continued to rise significantly each year since 1996. The 1999 percentages of use are as follows:
   - **77%** of faculty reported that their computer is essential to their teaching (Marcinkiewicz, H. & Welliver, P. 1993)
   - **67%** of the faculty reported that they require students to use **5** or more types of technology as part of their course requirements.
   - **74%** of the faculty reported using **7** or more types of technology in preparation for their teaching or as part of the in class activities.

3. A student survey given for a third year in 1999 reports the in-depth opinions of our students concerning their learning and the use of technology as part of that learning. The Survey was created and correlated by Dr. Kathryn Holleque, 1999 Division of Educational & Psychology. Highlights are listed below and complete results may be found on the VCSU web site
   - Using a computer increases my communication with other students. 93%
   - Having my own computer broadens ways for me to receive and/or present information. 97%
   - Having my own computer saves me time. 95%
   - It is important to me to have computer access at any time, day or night. 90%
   - Using various technologies enhances my learning experience. 90%
   - I use my computer daily. 90%
   - Using a computer provides a variety of settings for learning (e.g., working by myself, working with
   - others, working as a member of a team). 90%

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An Evaluation Methodology for Computer Mediated Teletraining Systems

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Abstract : We propose here a contextual evaluation method. The difficulty of this kind of evaluation comes from the complexity of the real situation to which it applies : the procedure being contextual, it is practiced on the situation, in real time and not in condition of laboratory where one observes some critical factors by neglecting others and often the finality of the task. Consequently, we have sought to understand the context of each computer mediated training systems situation. Methods that we propose are based on a quantification of results of the work in order to evaluate performance reached by the, analysis of communication types used during each activity to resolve the task in order to evaluate the behavior of actors and the behavior of the socio-technical system, and questionnaires on the perception and the usage of the different items of the environment in order to evaluate the satisfaction of actors.

1. Introduction

We propose here a contextual evaluation method. This type of evaluation is carried out step by step, by following the evolution of each group of trainees under observation in the experimental framework. In the taxonomy of evaluation methods, the contextual evaluation is an experimental evaluation because users are wanted to perform it

The difficulty of the contextual evaluation comes from the complexity of the real situation to which it applies: the procedure being contextual, it is practiced on the situation, in real time and not in condition of laboratory where one observes some critical factors by neglecting others and often the finality of the task. Techniques of evaluation have to be really adapted to the context and to objectives to reach. Consequently, we have sought to understand the context of each computer mediated training systems situation to seek there directly measurable characteristics (observations, measures) or there indirectly measurable characteristics (interviews, free discussions, results of the work, measures). Methods that we propose are based on:

- quantification of results of the work on a generally recognized scale (for example, for the apprenticeship, notes granted by the trainer at each evaluated stage) in order to evaluate performance reached by the trainees following the achievement of the training task
- analysis of communication types used during each activity to resolve the task. In this aim, we suggest to conduct objectives observations make by human observers and measures on the level and the content of the communication, during each session of apprenticeship (course, practical work and collaborative project. The measures are collected by software sensors in order to evaluate the behavior of actors and the behavior of the socio-technical system during each training session.
- questionnaires on the perception and the usage of the different items of the environment that make easy the communication during the training session (for example, the artifacts of telepresence, the multimedia

representation of concepts to learn,....) in order to evaluate the satisfaction of actors with working in the mediated environment and with the proposed role.

According to the specificity of each of these three sources of information, we have built tools to obtain necessary data for the evaluation. We present below this procedural approach.

2 Techniques and Tools of Evaluation

2.1 Evaluation of the Performances of the Trainees

The performances reached by the trainees (training outcomes) following the achievement of the pedagogical task are evaluated according to psycho-pedagogical evaluation methods. These methods are currently practiced in the training of engineers. In collaboration with the trainer, we orient the evaluation of the targeted cognitive level in collaboration with cognitive technology properties used for the communication in each type of session. The method of evaluation is the test for course and practical works sessions and a synchronous and continuous evaluation of the work for collective project sessions.

The evaluation by test is traditional for the classical training and is based on the measure of three distinct cognitive activities we can evaluate during training sessions. It concerns knowledge memorization, understanding and mastery levels. The test is filled by each trainee after the chained training session "course - practical works" . It is built by the trainer and contains questions related to the three cognitive activities (Sandoz & al. 97) :
The memorization of information is linked to the perception of visual information presented during the course in the textual or graphic form, hearing information transmit by oral way, by the trainer, during the course and visual and hearing information (information presented in the textual or graphic form and commented by oral way).
The understanding is the capability to solve identical problems (mainly in the context of practical works) where the trainee has to show that he has assimilated concepts by solving problems (a question or a problem similar to one met during the practical work).
The mastery is the capability to treat a new problem with the totality of knowledge acquired during the course and practical works session (a question - new problem, that requires a reasoning process on the totality of knowledge).

The pedagogical strategy of collaborative project aims to increase the knowledge level of trainees, their capability to analyze a problem, to apply knowledge in order to solve a problem, to synthesize and to evaluate the exactness of a solution. A multicriteria qualitative, quantitative and pedagogical evaluation is necessary. The trainer applies an evaluation to different stages of the project (failed stage or stage succeeded without faults, succeeded without fault but with suggestions by the trainer, succeeded but with small faults, initiated stage only) and graduated according to the quality and the independence of each group during the project).

2.2 Evaluation of the Actors Satisfaction

The satisfaction of actors that interact with and via a computer system is intuitively correlated with the quality of usage of the system. There are elements or states of the environment that stimulate or that inhibit the interaction. Although all experimental and contextual evaluation methods recommend interviews, free discussions and questionnaire as efficient means to appreciate the satisfaction, the majority of them makes no recommendation on theoretical aspects about the content of these means neither on methods of data analysis thus obtained. The experimental evaluation of the satisfaction is often an empirical approach.
To built a body of evaluation means efficient and helpful both for collecting data and for data analysis and interpretation related to the satisfaction of actors is not possible without an explanation of the concept of satisfaction by items, factors and process depending on the context of work and the activity of the actors. In this explanation, we make abstraction of the type of satisfaction (for example: satisfaction towards the communication with the other colleagues in the group, satisfaction towards the affluence and the performance of software tools, etc.) to deepen its production mechanism.

The satisfaction is a mental state that appears in response to an achievement (intern or in the external world) or to an interaction with the external world .This explanation of the satisfaction offers us the possibility to estimate the satisfaction as compared to the real quality of the achievement or the interaction, but it does not explain the relationship that is established between the satisfaction and process and factors that affect the achievement or the interaction targeted by the individual (Hecht 78) It introduces the role of the discriminating stimuli, or stimuli that make the difference (concept belonging to the behaviorist theory of Skinner) that exist in the environment of work of the user and that can strengthen or decrease the satisfaction. Thus it is possible to construct a strategy of measure of the satisfaction from observable categories: stimuli, behavior and strengthening. The research of Hecht has been oriented to the satisfaction towards the communication (Hecht 78). It has found a totality of items (questions to ask) including the discriminating stimuli that predict better the satisfaction towards the interpersonal communication : the personal interest in the content of the communication, the feedback of the partner, etc. (in total 19 questions). Its contributions to the conceptualization of the satisfaction are :

- the usage of the factorial analysis to determine dimensions of the satisfaction. He finds that the satisfaction with the interpersonal communication is a unidimensional category (the result of the factorial analysis on the totality of questions posed in a number of observations enough great to obtain a representative sample, especially 10 time the number of variables)
- the utilization of the scale to seven levels of Likert to quantify the contribution of each stimuli in the satisfaction. This scale allows to take into account the neutrality and the positive (strengthening) or negative (diminution) effect graduated on the satisfaction felt by each actor in the activity of the group.

These studies show that the satisfaction can be conceptualized and that questions for asking to users in order to measure their satisfaction do not have to be chosen at random. They have to be about decisive factors (although each new situation asks a" intuition "of these factors that has no always theoretical foundations). On the basis of anterior experiences, we have led our personal exploratory analysis on the satisfaction of actors in computer mediated training situations and we propose questions concerning some stimuli of satisfaction as the perception of teletraining environment; technical tool performances, the personal investment: concentration, motivation, the interaction with the other actors of the situation, the availability of information, the perception and the role of the telepresence.

Due to the increasing complexity of the task to achieve, we have to complete these questions in the situation of collaborative project, with others stimuli as the organization of the work, the absence of the paper support, the differentiated quality of the media according to their functional role in the execution of the task (video for the simulation, video of colleagues, audio to take a collective decision, etc.), the multimodality in the execution of the work (to analyze and plan, write and correct by using simultaneously several modes of computer real time mediated communication).

In phase of experimentation, if the mediated situation is completely new for the totality of the actors (they don't normally work in a such environment), the suggested questions are almost all based on a comparison with the traditional teaching. We give them nevertheless the possibility to express their personal opinions on the new environment.

Questionnaires used after course, practical work and collaborative project sessions are described in the annex. It presents the content of these questionnaires and points attached to each response according to the scale of Likert : low values indicate that the user is satisfied with the situation and the environment, medium values indicate a neutral viewpoint (or a normal situation) and raised values indicate the dissatisfaction (see Coutaz & Balbo 94).

2.3 Evaluation of the actors behavior and of the system behavior

The analysis of the communicative behavior and of the system performances during each session provides a lot of formative and summative information about the communication of the group in the mediated environment. Our methodological approach to undertake this evaluation is a type « quick and dirty ethnography » method [HKA94], issued of the ethno-methodology (Hughes et al. 1991) and motivated by the lack of time and humans means. By a triangulation of competence and views, we propose the following factors as being relevant for objectives of our evaluation and we observe them in each session context according to criteria presented Tab.1.

Actors and System Behavior	Factors	(measurable or observed) Criteria
Individual Behavior	Verbal behavior Not-verbal behavior Associative behavior resulted from personal motivation or re-organization of the planed work	Density of dialogue Type of dialogue Orientation in the working space Behavior in critical situations Information research Relationship with the trainer Relationships in the group Grouping together in order to achieve the task
Group Behavior	Length and sharing of work time Quality of the knowledge support	Length of each task during the session Verbal interaction length Capability to plan work Difficulty of representation Difficulty of manipulation of the support Reliability of the software
System Behavior	Quality of the response of the system Quality of resources	Periods of observability of actions on the interface Latency of reply of the system Latency of the network Input / Output Management Load of the CPU Load of the network

Table 1 : Important Factors and Criteria in the evaluation of actors and system behavior

These methodological approaches of the experimental evaluation in our framework imply that the evaluators use different techniques of quantitative and qualitative data collection classified hereafter:

Measures (quantitative results) require instruments and strategy development in order to quantify results of the training (notes and appreciation of the trainer for each trainee), critical temporal factors (period of reply in the human interaction, length of activities), software failure and the consumption of CPU and network resources for each activity.

Predictive or " ad-hoc " observations (qualitative results) are provided by grilles of observations during each session. They are related to the human behavior in situation, the system behavior, social relationships in the group and their dynamics, the organization of the work adapted to the situation created in the environment and to capabilities of actors and the feasibility of the task regarding to functionalities and interface of the environment.
The human behavior. is observed in different situation : failure (system, application or equipment), locking (impossibility to know what to do), difficulty (not to know how to do) or reply periods, organization of the space of work, research for help, collective decision, co-operative execution .
Several factors as quality of the equipment, of the operating system and of the graphic manager, quality of the applications, quality of the network characterize the system behavior.

Typical questionnaire interviews (quantitative and qualitative results) are constructed from items that can discriminate different levels of satisfaction or need in the context of each situation (see Rao 94)..

3 Considerations on the analysis of data and the validation of results provided by the evaluation

An other point which is seldom precise in studies about the experimental evaluation is how to analyze series of data and observations to which we attach different significance and which don't have the same nature when the evaluation methodology of evaluation is based on a multiplicity of methods.

The current tendency in the research on methods of evaluation is the adaptation to the situation with the exploratory analysis. This orientation presents advantages and disadvantages beside the probability to obtain valid results (results which could be used faithfully in similar cases).
The methodology of evaluation adapted to the situation is the result of the reasoning of the evaluators from the contextual situation and the objectives to reach. Therefore, it will depend a lot on information and knowledge a priori of the evaluators. Consequently, in a complex and new situation it is always desirable to use several methods and several sources of information to evaluate the same objective, and several populations which carry out the same task in the same environment.
The experimental evaluation has the advantage of the multiplicity of methods (redundancy of the information) and the incremental approach (to understand increasingly complex situations). The redundancy results of several sources of information on the same situation and nears us the truth on the reality. The incremental approach allows us to make inferences and then to generalize a conclusion based on knowledge of specific situations very specific and individual. These observations have been built to underline the importance of analysis techniques of results of evaluations and how to present these results. Techniques refer triangulation of different nature data (qualitative or quantitative) and expressing different viewpoints (different roles of actors, the pedagogical evaluator, the neutral observer of the session, etc.). This variety involves an interpretative approach in the data in order to synthesize results.
In the analysis of the training outcomes, it is necessary to interpret the cognitive level evaluation according to the characteristic of the trainee population and to cognitive properties of the media used in the training.
In the analysis of the satisfaction it is necessary to interpret answers to questionnaires that represent personal actor pedagogical and technical viewpoints
The analysis of consummated resources has to be made on different temporal scales according to whether one takes in consideration the supplier (machine, network which requires analysis to the second or in under) or the consumer (a group activity, an intervention of the trainer or a session which requires an analysis where the second is the less significant unit).
It is relevant to analyze each source of information. Thus, for training outcomes, we propose a statistical analysis from trainee marks at a first level (averages, distribution of values) to compare these results with training objectives. If the number of trainees is small, two strategies can be adopted to increase the faith in results : to test two populations with different level of initial knowledge but with the same general profile (for example, engineer students), or to analyze results in comparison with a well-informed population doing training in a traditional situation
In order to analyze responses to questionnaires about the actors satisfaction with the environment , we propose an analysis in different level. The analysis of unity of the tested population defines the correlation between actors and, between each actor and the other members of the group). The aim of a discriminating analysis of identified satisfaction levels is the verification of the clusters (hypothesis test on equality of averages clusters), the identification of discriminating factors (linear combination construction of items - questions that summarize at best the difference between clusters). The pedagogical and technical quality of the experimental framework is analyzed from marks assigned to discriminating and not discriminating items of the satisfaction
For analysis of actors and system behavior, we can interpret measures and observations to get a formative evaluation on the behavior of actors and on the quality of the system (the reaction and the knowledge support) in order to improve the design of the training environment , and a summative evaluation on economic criteria such as the time of work and resources consumed for this work in order to the concrete limit of distance training sessions and to better understand where and how we can consider optimization.

4 Conclusion

Evaluation is no good if it just considers the computer. The situation is also up for evaluation». Therefore we had to build an efficient and helpful body of evaluation means both for collecting data and for data analysis and interpretation. These means are: test of student achievements with training in CETTE environment (Gradinariu 99), questionnaires on actors satisfaction and on their opinion with this style of training, measurements to characterize tools, computer system and network utilization, measurements and observations of on-going sessions (actor's behavior and external, unpredictable perturbations).
Our works, we retain an analysis of the relationship that exists between the technical means quality and the quality of strategy results pedagogical that these means can support. This duality is classic in the theory of the evaluation of learning systems (Scriven 67) that anticipates as objective a quantitative evaluation (the validation

of the good usage of the technology) and formative-evaluative (analysis of means and pedagogical strategies when the both are in relationship of usage).

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Developing an on-line ethics policy

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Abstract: There are an increasing number of classes being offered via the World Wide Web. Although much of the information that we review regarding on-line learning seems positive, difficulties can arise. In particular, the anonymity that a web course can provide can be a blessing and a curse. In this article, the author suggests developing an on-line ethics policy detailing proper and improper conduct for the course. The author details prescriptions for the design and development of such a policy and how to manage potential problems before they begin.

Introduction

On-line classes have become a reality of our worldwide culture. Just two years ago, the National Center for Educational Statistics conducted a survey of various institutions of higher learning involved in some form of distance education. At the time of the survey, 62% of public four year institutions were offering courses via a distance, 23% planned to offer courses within the next three years and 14% were not offering courses and did not plan to offer courses in the future (http://nces.ed.gov/pubs98/distance/index.html).

Today, all one has to do is perform an Internet search using the terms "Distance Education" to discover what is available to students and faculty members alike in the way of courses and resources. A person can literally find everything from a web course in statistics, to textbooks, to articles touting the virtues of the on-line classroom. Much of the information that we review regarding on-line learning seems positive.

However, we may not hear of the "horror stories". We may not realize that at a distance, students can find a certain degree of anonymity--which has both advantages and disadvantages. These stories have almost become "urban legends" of a sort to those of us who teach via a distance. "Did you hear about the student who cursed at a professor in a chatroom?" Or possibly "Oh! I heard about a student who was so rude to other students on a listserv that no one wanted to post messages!"

Background Information

Unfortunately, stories such as these are often only told at conferences, meetings and informal gatherings of distance educators. Although they may be more the exception than the rule, nothing can be more damaging to a class that requires interaction than a belligerent student. A barbed tongue can literally shut down listserv, threaded-discussion, and chatroom conversations. Unfortunately, if group interaction is a part of student's grades, improper student behavior is something that can have a tremendous impact on course satisfaction, willingness to take/teach another course and even on individual student course grades.

Student handbooks are written to describe behavior that is acceptable on campuses. However, the virtual university is often times campus-free. Many students are unaware of how to act or behave in this new Cyberworld. Students may use the "ignorance" excuse for why they acted inappropriately or even why they neglected to ask questions. Things would be "different" if they were in a "real" classroom.

After one such incident involving this author and an on-line student, this author decided to develop an on-line ethics policy so that the danger of class discussion deterioration would be minimized. The purpose of this paper would be to help other professionals and/or institutions develop similar policies for their own on-line classrooms.

Prescriptions

To begin, an on-line educator should first consider the nature of his or her own classroom. If, for example, interaction is not a major component of the on-line class then perhaps only a "cheating policy" is necessary. On the other hand, if interaction is necessary and a requirement, it may be important to detail the consequences of destroying that interaction.

It is this author's experience that students are very appreciative when they know their rights and what is expected of them at the beginning of any class. Since the implementation of this author's own policy, there have been many instances where students have sent "thank-you" messages regarding the ethics policy. They seem to appreciate knowing both communication etiquette specifics and that their own rights as distance learners are being protected.

The next step is to find out if an ethics policy is already in place at the educator's institution. Often times there is a university or college policy on that which constitutes unethical behavior. This

becomes a simple base on which one can develop a policy. It is important for this institutional policy to be made available on-line to which the students can refer.

As an example, the Teacher's College at Emporia State University has an ethics policy detailing appropriate and inappropriate student behavior. In particular, academic dishonesty (plagiarism and cheating) and disruptive behavior are cited as being a serious breach of ethics and professional behavior. This document was used as the foundation for the ethics policy developed for this author's on-line classes. A copy of the document can be found at the following URL: http://www.emporia.edu/idt/id/tcpoeap.htm.

Further, consequences of such behavior must be made clear to the students. It is unrealistic to expect students to follow a weak policy. If a policy is developed that states that unethical/unprofessional behavior will not be tolerated but consequences of such actions are not detailed, then the implementation of consequences will be difficult, if not impossible. A copy of this author's ethics policy can be found at the following URL: http://www.emporia.edu/idt/id/ethics2.htm.

For example, in this author's class, if you disrupt the class by being belligerent or abusive to other classmates, students, colleagues, or teachers you will be removed from the class immediately. This is clearly stated, in writing, and becomes a part of the syllabus—a contract with the students.

There have been occasions where this author has had to warn students about their behavior but has yet to remove an individual from the class. Usually, these students do not violate the policy again but as a general rule do test the limits of proper behavior.

The students should also be told that it is improper to discuss personal issues regarding course content, amount of work, grades, etc. via open class communication. They should be directed to send such comments to the instructor instead of the class discussion forum. It is suggested that students refrain from using words such as "offends, insults, or angers" to get their point across. Students should be reminded that everyone is entitled to his or her opinion, not matter how "wrong" that opinion might be.

It is important to note that a student who has a propensity to violate the policy may still send the instructor offensive e-mail messages. As an instructor, you may receive e-mail that is difficult to read and is highly unprofessional. However, the goal of an on-line ethics policy is to create a safe and healthy learning environment for students in the class. You may choose to include personal e-mail under the umbrella of an on-line ethics policy. In this case, this inclusion needs to be detailed within the policy itself.

The final component is a disclaimer of sorts. It is imperative that the student realizes that he or she cannot use the ethics policy as an excuse for not participating in discussions. Students must be aware that they are responsible for their own learning.

It is this author's experience that on occasion, students have said that they were "afraid" to post because they might violate the ethics policy. The times that this has occurred, this "fear" has been an excuse. Even when the policy has been explained to these "fearful" individuals, they have continued to not participate in class discussions. It is important to note that students who are unwilling to participate might not simply be poor students. They may be fearful of an on-line learning experience itself. Again, this is where a detailed policy can help reduce these fears.

Conclusion

All of the information detailed above provides a rationale for using an ethics policy. The policy can help you as an educator keep order and peace in an on-line, discussion-based class format. An ethics policy can help classmates understand what is expected of them and that they are able to voice opinions without fear of peer insults. Finally, the policy can help foster a positive learning environment for each member of the class community and give that class a positive reputation for students of the future.

URL References and Examples of Ethics Policies

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Ethics policies: http://www.emporia.edu/idt/id/ethics2.htm, http://www.emporia.edu/idt/id/tcpoeap.htm.

Ethics and the Internet

Stig Roland Rask
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**Abstract: Even recognizing cultural differences, there is content on the Internet that most people would consider questionable for children?
What options do we have for addressing this problem?
Are censorship or filtering a good way of dealing with this problems, or will they just cause us to naively lean back and shirk our responsibilities?**

I believe that the development of the Internet necessitate that ethical issues must be given greater consideration. Developing methods that will develop the ethical awareness of the students is one of the most important tasks for a school today. Our experience tells us that the use of new technology can be one of the pieces in this very important puzzle. The Internet could be the solution to its own problem, the answer to its own question.

Introduction

My name is Stig Roland Rask, I was born in 1953 and have been working as a teacher in Music, Social Society and Religious Education at Fredriksdalskolan (Fredriksdal School) in Lidköping since 1980.

1997 I become the manager of a project named "Ethics and the Internet – soft issues and hard wares" which receives support from the Swedish Foundation of Knowledge and Competence Development. This foundation was established in 1994 by the Swedish government, and was endowed with over $450 million to promote the use of IT, to stimulate research in new areas at universities and to create knowledge transfer. Over $100 million of these funds are being invested in primary and secondary schools. The goal is to obtain concrete results and spread these results to the entire educational system to create a long-term ripple effect. Ethics and the Internet has developed into a special project area among the Foundation school project, and the students at Fredriksdal's School have become pioneers in this field. I am proud to say that our project "Ethics and the Internet" is one of the projects in this program that have attracted the most attention. Our idea of combining traditional and eternal ethical issues with modern technology has been viewed as surprising, exiting and interesting. Today I am working full time for the Foundation, trying to share my ideas and experiences to other schools.

Internet – the ethical marketplace

New technology always challenges our ethical views and the Internet is certainly no exception. Does not necessarily mean that we need to create new ethical opinions – our old system of ethics is still valid - but perhaps we need to re-express and reformulate our common foundational values, and apply our conclusions to this new area that the Internet has created.

The over all aim of the project "Ethics & Internet – soft issues & hard wares" is to develop pedagogical methods that will make it possible for questions of democracy, humanism and ethical values to find their place in a modern school. The appearance of the Internet just gives us one more reason to take these issues seriously. As a teacher I have a responsibility not only to transmit facts, but also to help the students in their emotional development and their growth into social maturity. I think that the way to understand oneself, society and the world we live in arises from a combination of theoretical knowledge, emotional ability, social maturity and ethical awareness. That's why we must involve both the brain and the heart in our considerations and try to pay attention to all of these aspects in our pedagogical plans.

I think that the best way to stimulate these ambitions is to bring the students face to face with ethical standpoints and let them take part of the debate. During this process we have found that the best way of getting in contact with all kinds of opinions is to use – the Internet! In a few years Internet has grown to become the main meeting place for ethical discussion. The Internet is the ethical marketplace where every kind of opinion, attitude and

view can be found. This means that in the same time as the Internet challenges our ethical viewpoints – it offers us a superior tool for developing methods that will stimulate our ethical education.

Soft Issues and Hard Wares

In the most concrete part of the project we let the pupils chose an ethical question that they are interested and engaged in. It could be everything from abortion to euthanasia, from child labor to animals rights, from weapon export to genetic engineering, etc.

The student's task is to produce a report based on seven given subheadings...

- presentation of the issue
- facts
- arguments for...
- arguments against...
- the actors in the discussion
- something about their own thoughts, ideas and reflections
- sources

If, for example, the students are interested in the issue of child labor they may want to visit the homepage of UNICEF, if they have chosen to study death penalty a visit to Amnesty Internationals homepage could be interesting, and if they engaged in environmental issues perhaps Greenpeace could offer one point of view. To help the students we have established a collection of links that will connect them to the ethical debate in a number of areas. This link collection is dynamic and new useful sites found by the students are immediately added to the list.

Their report becomes one chapter in an ethical book that every class produces, and this book will be the basis for a debate that takes place in the classroom. Our experience is that whatever ethical issue the students choose to study, the Internet offers them facts and opinions in seemingly endless ways.

The eight targets

We have formulated eight targets that we hope that our project will help the students achieve:

1. Ethical awareness – the students will be aware of that life contains a vast number of ethical issues that sometimes demand personal decisions and selections.
2. Computer competence – more a side effect than a goal, it is interesting to see how the Internet has changed the role of the computer from being a closed room to become the door to the outside world.
3. Pedagogical progression –optimal learning ability is reached when the students are searching for answers to questions that have been formulated by themselves. Establishing this pedagogical situation in the classroom is critical.
4. Increased international perspective – Internet has no geographical borders.
5. Awareness of the necessity of languages – The need to study English goes beyond the next English exam.
6. Social maturity – developing maturity requires tasks that demand maturity.
7. Emotional intelligence – information is not equivalent to knowledge - and knowledge is definitely not equivalent to wisdom.
8. Increased equality – we must offer reasons for both the girls and the boys to sit down the computer. Ethical issues on the Internet are an example of such a good reason.

The Answer to its own Question

Our experience tells us that if the ethical issues will show the way to Internet, the attitude and knowledge the students receive will follow them throughout their future use of Internet. This is an important and very positive effect. It is crucial for Internet users to develop their ability to be critical of the opinions and attitudes behind the information they have researched. It has been our experience that the students learn to be more critical of their sources if they are allowed to work this way. If the students use the Internet when they are reflecting on ethical

issues, they will achieve a new awareness through the information provided. The pupils will learn that the Internet is a medium providing subjective information, which need to be carefully reviewed. That is why we have come to this simple but perhaps slightly paradoxical and surprising conclusion that the solution to the ethical problems of the Internet is the positive use. The Internet is the answer to its own ethical question.

Protection and Preparation

So far I have only described Internet as an ethical possibility. But you can not avoid the fact that the Internet also contains information that is definitely dubious from an ethical point of view. Just a mouse-click away from a good and useful site, you can find another site that shares disinformation or even destructive material.

As far as I can see there are only two ways to protect from the Internet's dark sides: Isolation or vaccination. The same methods that we have at our disposal in the face of approaching disease. Both methods offer protection, but the problem with isolation is that its effects are not lasting. Vaccination, however, allows the disease to be faced without getting infected. There is just one problem left to solve – developing the vaccine! I consider the development methods to vaccinate our teenagers against the different destructive components in the information society, to be one of the most important questions that a modern school has to handle. We hope that our project in some way will contribute with useful ideas.

I think that it is a good idea to compare a good attitude toward the Internet with a good attitude toward deep water. When our children are small, we bring them carefully to the quay or the riverside. We hold their hand firmly, show them the deep water and tell them about its danger. After some years they begin to develop their own awareness. We can let them go on their own, but we still follow them with watchful eyes. Likewise, we put our children into swimming lessons. The best way of protecting our children from the danger of deep water is to teach them to swim. The water will be used as a pedagogical tool to solve its own problem. You can look upon our project analogously. We use the Internet in our ethical education in the same way a good swimming teacher uses the water in his swimming education. It seems like a good idea – doesn't it! Sitting on the beach and learning how to swim will be boring after a while.

The three levels

Even recognizing cultural differences, there is content on the Internet that most people would consider questionable for children? What options do we have for addressing this problem?
Are censorship or filtering a good way of dealing with this problems, or will they just cause us to naively lean back and shirk our responsibilities?

From my point of view you can find three levels in this debate. The first one is censorship and different kinds of technical filtering, the second one is about developing AUP:s (Acceptable Use Policy's) and the third level talks about how to give proper guidance and ethical education.
Let me illustrate this discussion by this little story...

"The park was a popular outing for groups of children from nearby preschools and kindergartens. The only thing that concerned the teachers was the nearby stream. It demanded great their utmost caution and there was no room for inattention. The children were made aware, through persistent lectures about the risks, that they were expected to take responsibility for their own safety.

The day the fence was nailed up as a shield against the threatening water felt liberating. The teachers could relax and no longer did they have to nervously follow every step the children took. The need for warnings subsided and the responsibility for the children's safety was turned over to the fence.

When the cause of the accident was investigated one came to the conclusion that the fence was defective and had several openings through which the children could climb. The feeling of safety that people had been lulled into had been deceptive and wrong. Rather they realized that the fence's inadequate construction had presented an obstacle to the children's safety, since its promise of safety had lead to passiveness and had reduced the sense of responsibility among both the children and the adults. Some even felt that the mere presence of the fence had challenged the children to search for its holes. The question of guilt was debated for a long time and bounced between those who decided to build the fence, the suppliers, the installers, and the inspectors without result any

result. How the fence had resulted in a reduced assumption of responsibility among other parties was also discussed".

Together with the introduction of Internet into the school system, a heated debate has risen about its dark sides. It has swung between impassioned cries for censorship and a rather naive lightheartedness. Whatever standpoint one takes on this issue, I think it is very important to realize that there are no fences, in the form of a censor or filtering programs, that can offer us a degree of protection that frees us from responsibility. Indeed, perhaps the fences just cause us to naively lean back and shirk our responsibilities. There is also cause for concern in the long run when one considers to the students' views of their own rolls in the question of personal accountability.

My cynicism toward technical filters is not based solely on principals. I'm concerned about their effects from a wider perspective. Above all, I am worried because they lead to passiveness and a reduction in culpability for ones own behavior. The adult world's obligation to oversee ethical and social development of the next generation can not be delegated to technology. The answers to ethical questions seldom lie in technical solutions.

Besides, if we equip our children with too many bike helmets, kneepads, lifejackets, parachutes, airbags, chastity belts, and all kinds of safety nets, there is of course a chance that we will forget to tell them that life is dangerous. Our good intentions can lead to a shift in accountability away from the individual toward the safety net system.

The day will come when our children leave the protection of the home and school environment. Outside waits a rough world full of temptations and pitfalls. If our children meet this world without having developed the necessary tools and awareness, they will be very vulnerable.

The question is not which ethical filters we can install in the computers, but rather which ethical filters we can install in the students.

New Technology Necessitate Ethical Guidance

As a teacher I have a responsibility not only to put ethical discussions on the agenda, but also to give ethical guidance. There are components in a democracy that are so fundamental that they should not only be discussed - they should be transmitted. Experience has shown that many young people view the adult world as unclear and lacking when it comes to providing the guidance they need. Has the school failed to live up to its responsibility of providing guidance concerning the ideals that make up our democratic society? I believe that the development of the Internet necessitate that ethical issues must be given greater consideration. Developing methods that will make this mission possible and successful is one of the most important tasks for a school today. Our experience tells us that the use of new technology can be one of the pieces in this very important puzzle. The Internet could be the solution to its own problem, the answer to its own question.

CBT: The Past, Present and, Hopefully, the Future

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Abstract: Computers are established today as a part of our day to day life. They are no longer just a professional tool but rather a commodity that helps people to work, communicate, shop or trade on line and at last, but not least, to improve the educational process. In this paper, we will discuss the lessons learned from our use of early state of the art Computer-Base Training (CBT) applications and what we hope to see in the future. Our presentation is based on the experience of the first author with large classes with over 700 students that used CBT like Virtual Tutor and PinPoint. Although our experiences are tied to specific tools, the lessons learned can be applied to a wide variety of similar tools. Actually, these tools tend to be more similar than not, which is rather disappointing considering there is not one approved way of "doing it right."

Introduction

Computers are established today as a part of our day to day life. They are no longer just a professional tool but rather a commodity that helps people to work, communicate, shop or trade on line and at last, but not least, to improve the educational process

The easy access to computers suggested the obvious educational application: automated training and testing. This technology-driven approach to computer supported training resulted in some early products that were not based on pedagogical theories (Docent, 1998), (VirtualTutor, 1999). The results were, not very surprisingly, rather disappointing. The situation has been gradually improving since then, yet there is still a long way to go.

Given the continuos increase in demand and the high level of expectations in the educational sector of our society regarding the educational potential of CBT applications, more and more companies are venturing into designing and implementing these type of applications. Actually, these tools tend to be more similar than not, which is rather disappointing considering there is not one approved way of "doing it right." However this large selection of CBT applications can rather confuse than help educators in choosing the "right one." Based on our theoretical and practical experience regarding CBT applications we address some of the questions educators might have in this regard and finally suggest some directions for further developments of CBT applications.

Study
The Past

In the early years of CBT, the approaches were rather technology-driven using simple technology and were often consistent, planned or by accident, with instructionism. The CBT applications did not provide much interaction and feedback was lacking to help students judge the effectiveness of their learning. Often, these systems were simply presenting a computerized version of a textbook, which often is much less useful than the actual book. Actually, this approach is still taken today by some publishers but can result in disastrous CBT.

The early systems were also lacking tools for managing the classroom. They did not include the students' records of grades and activities. They weren't portable but tied to a specific platform or networked. Single user systems available on floppy disks and later on CD-ROMs was the state of the art.

The Present

Many tools have been improved pedagogically (CBT Systems, 1999). They are interactive and help the students judge their own progress and how effective their learning is. However, since web based approaches are so fashionable now, we need to stress that these systems still tend to be inappropriate to support the learning process.

The current systems excel at helping manage the classroom in various ways. Many of the systems are networked and have many integrated functions. The systems record the dates when the tutorials were taken and also automatically grade multiple-choice tests and record the results. Thus, they help the instructors "peek over the students' shoulder" to see if they are doing the work and if the students are on track, e.g., by checking how much time the students spend on taking a tutorial and how good their test results are.

Unfortunately, these systems are only available for introductory courses that do not require too much flexibility. Also, they are often not comprehensive and stable enough to run easily with many students. Furthermore, the procedures for setup and the maintenance are quite complicated. So it might be difficult to find the faculty and staff to run such a system in a non-technical department. There are also no good tools to aid an instructor in creating educationally effective web sites. The systems are only minimally adaptive based on some pretest and they don't take much advantage of the possibilities of hypermedia. They don't allow for much exploration, i.e., they are quite linear forcing the students to go along with one of the few predetermined paths.

More and more systems are working in a simulated environment (in part to eliminate any incompatibilities between the lab networks and/or computers configurations and the requirements of the systems). Another reason for a strong trend in developing these type of systems is the increased chance of students to use it on their own personal computers without having to purchase the required software application.

There is also a strong movement toward developing integrated learning environment including training, evaluating, assessment and testing computer base application. These integrated learning environments can be Server-based or Web-based and tend to be pedagogically inadequate. Whereas the technology might have moved one step forward, the pedagogy of went two steps backwards (Mioduser, 1999).

The Future

So what would we like to see in the future based on our experience with these tools in the classroom and based on studying some related issues from a more research point of view (Hmelo, 1996, Hübscher, 1997, 1999).

We would like to see more adaptive tutorials based on preassessment and other feedback from the student with the goal of keeping the student in the zone of proximal development (Vygotsky, 1962). This would result in more individualized courses, more effective learning, and allow more self-directed path through the

learning material. If the student is kept in the zone of proximal development, it will also result in a more interesting and less frustrating learning experience for the student.

Support for content authoring that helps develop educationally effective presentations is desired. HTML editors surely don't do that.

Findings

In order to better evaluate the PinPoint CBT application (Kelly Services Co, 1999), before using it for our "Introductory to Personal Computer Applications" course (Marghitu, 1999) we ran a pilot test during one quarter. At the end of the quarter we used on line class evaluation involving students of the pilot test section and a regular section of the course as control group. These are the results of the evaluation.

Student Previous Computer Experience

All the students were non-engineering students with relatively little computer experience. The self-evaluation for the level of the students' previous computer experience was lower for the for the regular section (1.60) than for the PinPoint section (2.05). **Figure 1** shows the results of the students' self-evaluation, on a scale of 1 two five, for the level of previous computer experience (in percentage).

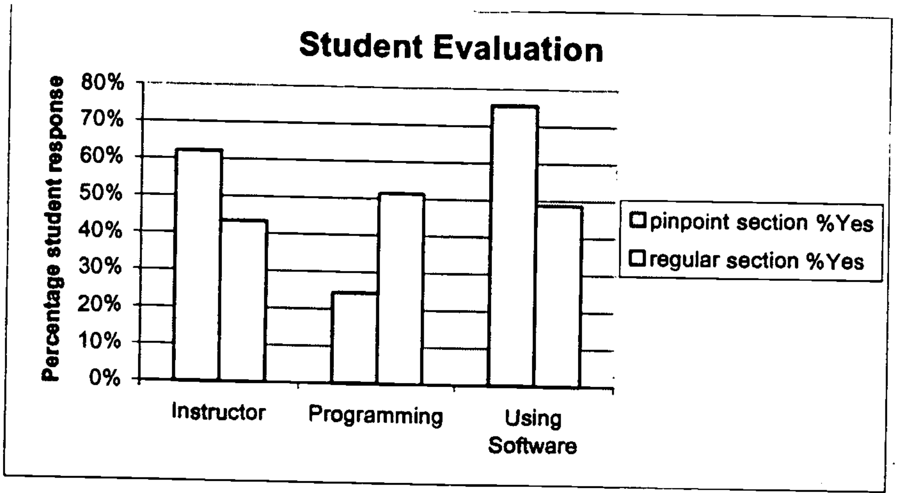

Figure 1: Chart representing the results of the students' self-evaluation for the level of previous computer experience

Student Evaluation

After the students had used the CBT system, we asked for their feedback. The questions we asked were:

- How would you rate your opinion of PinPoint?
- How would you rate your opinion of the COMP0100 WEB PAGE?
- How would you rate your opinion of COMP0100 TEXTBOOK?
- How would you rate your opinion of how much you have accomplished in COMP0100?

Figure 2 shows the results. Although there is a slight tendency in favor of the CBT, it is statistically not significant.

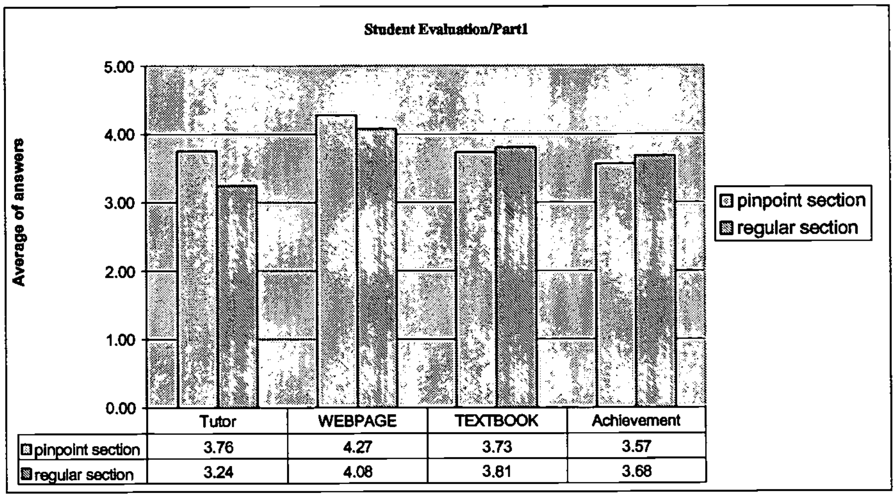

Figure 2: Chart representing the results of the Student Evaluation

We asked two more questions to find out how valuable they thought the PinPoint tool was with the following two questions. The results can be seen in Figure 3.

- Do you think you need more assistance from your instructor is required?
- Would you like to learn, in the near future, more about programming and/or using software applications?

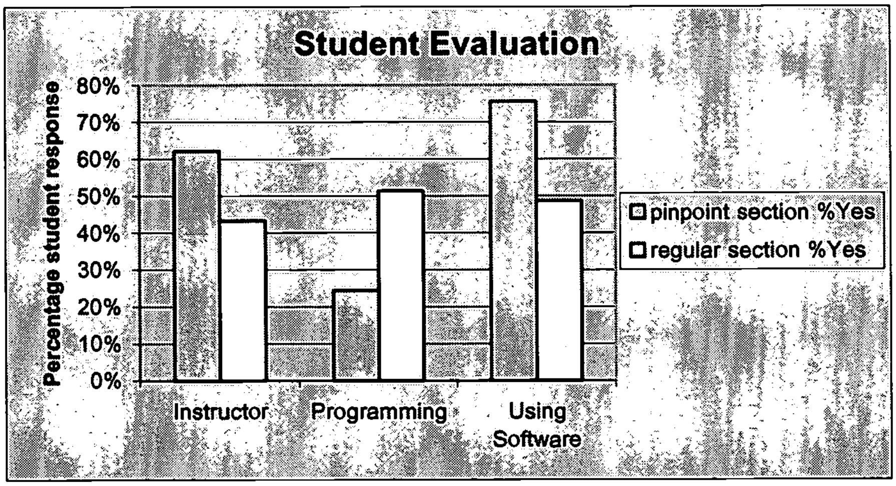

Figure 3 : Chart representing the results of the Student Evaluation

Instructor's evaluation

After using PinPoint in one section (out of a total of eighteen sections) we have started using PinPoint in all eighteen sections. Below are the conclusions reported by approximately ten instructors of these sections. We are planning to collect more data to find out whether the instructors' subjective reports match the actual performance of the students. The data reported is statistically not significant. The instructors are graduate

students of the Computer Science and Software Engineering department.

1. The interaction with PinPoint proved to contribute to successful learning (reading, typing, using the mouse, answering questions, and thinking). However, the use of too much video in a CBT product caused the students' brain to go into passive mode, thus reducing the effectiveness of the CBT :

   - the average grade of the students using a more dynamic & interactive upgraded CBT was higher

   - students using the upgraded CBT were more independent in doing the hands on projects so instructors could spend more time on pedagogical issues

2. CBT can be used effectively in small or large classes if they are customizable (or even minimally adaptive). They are good in creating richer learning environments and allowing students to learn at their own speed :

   - a customizable CBT helps instructors to create training modules that better match the student's background and goals, the textbooks (or concepts book) used, and the training modules and hands on projects selected

   - based on the results of a pre-test, a customizable CBT can help instructors create different learning paths for students helping students to be more effective. This includes

     - a self-paced multimedia approach for the students with an "above average" computer background
     - or a "CBT instructor-led classroom" approach for the students with a "below

3. CBT eases students' inhibitions about using and learning technology :

   - by helping students to become more independent in lab and also increasing their self-esteem a good CBT can also reduce students' inhibitions about using computers and their software applications

4. CBT can be very efficient learning tools in a classroom without taking away the vital importance of the instructor :

   - the results of the survey show clearly that students felt strongly about the necessity of instructor assistance

   - based on the detailed training reports provided by the management component of a competitive CBT, (see Figure 4) instructors can realize which subjects represent a real challenge

Timing results of Microsoft Word 97 Custom for Daniela Marghitu

Item No.	Item	Actual	Optimal	Correct	Did Show Me
4	Open a File	11	15	Yes	No
7	Replace Text	8	10	Yes	Yes (1)
8	Delete Text	4	5	No	No
9	Insert Text	10	10	Yes	No

Figure 4 : PinPoint detailed view of a training report

Conclusions

We have been somewhat critical about the past and present CBT systems. However, we feel that quite a

few systems are on the right track but are still lacking many elements directly related to pedagogy. For somewhat understandable reasons, these parts that are implemented are not difficult to do in principle, especially helping managing of classes and now also networking.

Nevertheless, an experiment in our 700-plus student classes to figure out the effectiveness of a CBT system (PinPoint) showed quite favorable results and we will keep continuing using CBT systems for our large introductory classes.

The results of the experiment suggest the following. Interaction with the system (reading, typing, using the mouse, and answering questions) contributed to successful learning. The use of too much video in a CBT product causes students to go into a passive hands-off mode reducing its effectiveness. CBT eases student's fear of using and learning with computer technology. This is apparently still a problem for many students—not all of them grow up with a computer under the pillow.

CBT can be a very efficient learning tool in classroom without taking away the vital importance of the instructor. We believe that CBT can be used even more effectively in small and large classrooms if they become more adaptive to the individual student and provide a richer learning environment allowing the students to learn in a more individualized fashion supporting the students needs.

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Staff Development, Distant and Direct:
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Abstract A new project, headquartered at Northwestern State University of Louisiana, offers comprehensive training for middle school teachers, supervisors, and university faculty through a series of workshops, Web discussion groups, and summer institutes. Participants may enter the training at several points, and interpersonal collaboration among participants is encouraged, both in face to face and Internet settings. Learners will have the option of participating in a variety of levels, and discourse among both program authors and participants through Web based training and discussion is integrated into the latter phases of the project.

This project is directed to the particular needs of middle school professionals, both in the subject matter of the instruction and in the style of organization and participant involvement. Though focused on state standards of accomplishment, the project and its World Wide Web focus will be both accessible and valuable to participants from other places, as well.

It seems almost to be a cliché: the middle grades are so easy to overlook. In a climate of policy and debate focused on the earliest stages of schooling, and on the transition from school to work or college entry, the middle grades rarely appear in the debate.

The situation isn't new, for a decade ago the Carnegie Commission (1989) deplored the nation's ignoring education in the middle years. We overlook these students at our peril – and theirs – "just as they are reaching a vulnerable and confusing crossroads. Young adolescents feel the tug of physical growth, emotions, social development, and academic needs.... Early adolescence offers opportunities to choose a path toward a productive and fulfilling life. The wrong choices, or the absence of the right opportunities and support, mean a greatly diminished future" (National Staff Development Council, 1997).

Teachers in the middle schools often feel as overlooked as their students. Prepared to teacher either elementary or high school, few find themselves teaching in either the place or subject area of their first choice. Many, indeed, are dealing with environs, developmental stages, and subjects that are all foreign, and sometimes formidable, to them (Scales, 1994).

"Middle grade students exhibit a range of physical, intellectual, emotional, and social development unmatched in other grades. To meet these developmental demands, their teachers must engage in staff development that increases their knowledge and skills, challenges their beliefs and assumptions about education, provides support and coaching to develop comfort with new practices, and engages them as active participants in the study and reform of the school culture" (National Staff Development Council, 1997). This

national challenge has local implications in Louisiana. Teacher preparation for the middle grades has been identified by the Louisiana State Superintendent, Cecil Picard, as a targeted area for concern.

To describe the situation of the middle school does not, however, require one to deplore it. The middle school teacher often greets the placement with enthusiasm, even in states that do not allow teachers to seek certification for teaching in the middle grades. The rewards of being part of "the last, best chance," as the Carnegie Commission (1989) described middle school teaching, are plentiful. In many ways, the task of middle school staff development is simply the task of letting the staff share among themselves and advertise to the world the joy of success in their particular realm.

The project at hand explores one way to celebrate the task, the challenge, and the special skills of middle school education. To meet this need, the NSU College of Education and its educational partners established a Web-based on-line professional development workshop series addressing the three areas of change identified with successful middle schools.

The Web-based professional development model seems to be particularly appropriate for middle school staff development for several reasons. The presence of the technology itself, as part of the training, has a heuristic effect, requiring participants to use – perhaps to master – skills identified as necessary to their practice. Such mastery is daily more important, for the Web's "value as a learning tool is a reflection of the teacher. The teacher must possess, among many other skills, considerable web expertise and the ability to plan individualized learning experiences" (Maxwell, 1997, 10).

More important, Web-based development means Web-based conferencing, and collaborative activities have been incorporated into every module. The best resource for any middle school – and any middle school teacher – is the company of professional colleagues who know and love children and learning in the middle years. This project is designed to have them working and learning together as much as possible.

The relative calm of middle education in the maelstroms of educational attention and reform are not the only reason to focus on collaboration, however. The NSDC *Standards for Staff Development* lists the outcomes that comprehensive school staff development should address, in context, process, and content. Among the twenty-seven standards, only one is identified as exclusively appropriate for middle schools. "Effective middle level staff development increases staff knowledge and practice of interdisciplinary team organization and instruction" (Hatch & Hytten, 1997). Collaboration, long identified as an important part of teaching with technology in any classroom (Koschmann, T. D., et al. 1994), acquires a signal importance in middle school classrooms when technology and the Web are used to teach and learn (Fuller, 1998).

The professional development series focuses on

- A Blueprint for Quality Middle Schools,
- Technology Integration in the Classroom, and
- Supporting New Academic Curriculum Standards.

The individual modules in each workshop series will be developed by leading middle school educators and technology experts throughout the state who are associated with or directing successful programs. Their efforts will be reviewed by a panel of experts comprised of outstanding teachers, administrators, SDOE, and college faculty.

The form of the each workshop follows a template that includes an Overview and Objectives, Introduction, Outcomes, Topic Information and links to examples and extension, FAQ's, Review, and Activities. The Activities are designed for individuals, small groups, and large groups to promote interaction with the module topic and preparation for the next module. Training was designed to reflect the middle school experience, the exigent elements of Louisiana education policy, and the expressed needs of teachers. The 26 training areas are listed in Table One.

The NSU faculty and graduate students will convert the modules to an interactive Web Format supporting on-line learning using ASP. Active Server Page Programming was chosen for its support of streaming video and database applications central to the large banks of information needed to support the site. The modules will then be piloted with focus groups from a target population, including NSU undergraduate teacher education students and in-service middle school educators at three middle school sites. Feedback for module refinement and development of support materials for local facilitators will be gathered.

Once a workshop is completed, it will be placed on a server. In its final form each module will have a companion Web conference to support interaction with the author, participants, and local leaders. As each on-line series is completed, a regional in-service presentation will introduce the workshop to local school districts and state college of education faculties. These workshops will provide an overview of the modules and supporting leader materials as well as promote the use of the modules.

<u>Turning Points (Introduction to Middle School Concept)</u>	Special Education for Middle School
Team Teaching	
Curriculum Integration	<u>Technology</u>
Middle Level Student Characteristics	Technology Integration
Advisory Program/Character Education	Technology Connected Lessons
Scheduling	TV in the Classroom
School/Community/Parent	Technology Management
Exploratory/Extracurricular Activities	Action Learning and Technology
	Standards Based Instruction
<u>Assessment</u>	Content Areas (Math, Science, Social Studies, Language Arts)
Classroom Practices	High Stakes Testing (LEAP, IOWA, etc.)
Learning Communities	
Gifted/Talented	

Table One: Twenty-two topic areas for Middle School Initiative

An intensive workshop will be conducted during the summer of 2000 to assist school district coordinators/leaders and college faculty in the planning and implementation of selected modules or an entire workshop series. This summer session will also provide district middle school coordinators the opportunity to meet and interact with many of the program developers and experts in middle school education.

During the implementation phase in year two, the project staff will continue to provide technical assistance, follow-up support, maintenance and upgrade. They will disseminate information and establish a telephone help-line. Authors of the modules will also serve as technical advisors by responding to email inquiries and by participating as consultants at scheduled workshops and institutes. By project completion, teachers, district coordinators and curriculum leaders, and the education faculty of the state's teacher education programs will have participated together in a project that both enters each participant's classroom and knits together the community of interest statewide.

In the end, there is an ironic permanence about a training series built so completely out of apparently evanescent materials such as conversation, collaboration, and the World Wide Web. The resonating effects of two year's collaboration among so many middle school professionals will be captured, amplified, and – possibly – institutionalized through Web-based focus groups and a continued need to use and develop the modules created during the project's scope.

No staff development lasts forever. Indeed, no staff development should last very long, for good development is individualized, specific, and changing. Nonetheless, the continuing nature of both the network of participants and the nexus of a discussion server may prove a kind of longevity and usefulness to this project that outdistances its life on paper.

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Acknowledgments

A University Design Team Approach: Developing Courses for On-line Distance Education

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Abstract: The University of Houston-Clear Lake has developed a systematic design process to use in facilitating the development of on-line distance education courses. The process incorporates three semesters, and during which, faculty members have the opportunity to consult with a design team that consists of instructional designers, web developers, graphic artists, media specialists, and instructional programmers. This paper presents an outline of the process, describes each step in detail, and provides a framework for formative evaluation.

Introduction

This paper addresses the implications for redesigning traditional university courses for delivery over the Internet. The University of Houston-Clear Lake has adopted a unique perspective whereby faculty members have a team of professionals who serve as consultants throughout a three-semester design process. Within this framework, a systematic procedure has been developed to facilitate the refashioning of the courses. Specifically, this paper outlines a theoretical perspective for the development of on-line distance education, discusses who should be involved in the process, presents a systematic procedure for development, and discusses methods for evaluating the effectiveness of the course.

Theoretical Background

Over the past several years an increasing number of educational institutions have begun to offer on-line distance education as a viable alternative to more traditional forms of classroom instruction. There has been a great deal of discussion about which pedagogical foundation is appropriate for classes delivered over the Internet. Historically, this debate has focussed on the differences between the Instructivist and Constructivist approach. This is a meaningful consideration since classes that were originally designed for the traditional setting are afforded different instructional activities and learning opportunities that were not perceived or even possible before Web-based instruction (Dabbagh & Schmitt, 1999). Accordingly, many classes will undergo pedagogical reengineering as the process of learning over the Internet is examined more closely (Dabbagh & Schmitt, 1999). Because of such Web features as synchronous and asynchronous communication, searchability, global accessibility, and interactivity (Dabbagh & Schmitt, 1999), it can be argued that a movement toward a more Constructivist approach can easily be facilitated. Constructivism recognizes that learning is an active process in which learners construct their own concepts rather than acquire knowledge directly from an instructor (Duffy & Cunningham, cited in Dabbagh & Schmitt, 1999). According to this perspective, the on-line course should create an atmosphere that recognizes the needs of the learner rather than those of the instructor (Berg, 1999).

Without a well-developed design process, the on-line curriculum becomes little more than a replication of traditional Instructivist-based curriculum. Accordingly, tools and strategies such as videoconferencing, file exchange, electronic libraries, virtual cafés, whiteboards, role-taking activities, and student dialogues should be integrated to encourage and support tele-apprenticeship (Bonk & Cunningham, 1998). But integrating these technologies within the framework of a well-designed instructional program can be difficult even for the most

experienced faculty member. Accordingly, a systematic process is necessary to ensure a focus on all of the elements of Internet-based instruction. There are concerns about whether or not a systematic design approach can be used to develop classes that rely on more Constructivist pedagogy. However, it can be argued that Constructivist values such as collaboration, personal autonomy, reflectivity, active engagement, personal relevance, and pluralism are objectives often overlooked by instructional designers (Lebow, 1993). In essence, Constructivism is often treated as a method when in fact it is really a philosophy, and instructional systems design is seen as a philosophy when it really is a method (Lebow, 1993). Therefore, the principles of instructional design based on Constructivism emphasize the affective domain, make instruction relevant to the learner, support self-regulation, and promote autonomy. In reality, instructional design under the context of the Constructivist philosophy includes a concern for the motivational aspects that are not often considered within the traditional approach.

The Design Team at the University of Houston-Clear Lake has created a process to guide their work in consulting with faculty members developing on-line courses for the first time. This ensures a focus on a course design that will provoke intelligent responses to the learning materials, context, and environment (Berge, 1995). Considerations for graphics, media, immersive technology, and effective text must all be embedded within the process to ensure that students will be equipped with the resources and motivational elements they need in order to achieve success. The most important challenge of the Design Team is to support faculty members in developing collaborative assignments, facilitating active on-line communication, and promoting the development of critical thinking and research skills (Palloff & Pratt, 1999).

The Design Team

Members of the Team

The Design Team at the University of Houston-Clear Lake consists of skilled professionals with expertise in a variety of areas. Accordingly, it was important initially to establish clear roles and responsibilities in order facilitate a systematic development. Otherwise, it is difficult for people to have clear expectations of what is required of fellow team members. The Graphic Designer assists in evaluating content to determine the need for visual information and immersive technology and creates images, interface elements, and animations using a number of graphic, 3D, and multimedia software applications. The Instructional Designer serves as the team leader for the project, performs the needs analysis, task analysis and instructional analysis with the Subject Matter Expert, and reviews and helps to revise course content. The Instructional Programmer evaluates content to determine the need for CGI programming, database integration, and forms; and writes code to integrate programs into Web pages. The Multimedia Specialist assists in evaluating content to determine the need for creation of multimedia and immersive technology and creates video, graphics, animation, audio and other multimedia elements. The Subject Matter Expert identifies the course's needs, establishes the goals, objectives, instructional events, and readings, writes course content, writes tests and/or quizzes if applicable, develops criteria for student evaluation, reviews and approves all products developed by the design team, and signs off on all completed components. The Web Developer creates the interface, navigation, and theme for project Web sites; evaluates content to determine the need for HTML, CGI programming, database integration, and forms; develops HTML pages for the course Web site; and conducts training sessions for the Subject Matter Expert.

Process Management

The process of creating Web based instruction involves a team of developers from many disciplines. In the development environment, some of the team players may not be able to attend all scheduled meetings for a variety of reasons. The response to this dilemma was to create an Internet-based resource, known as a Project Support Site or PSS. Team members can coordinate and exchange information using this site. The features that are included in the PSS help team members to successfully telecommute while working on a project with a deadline. In order to ensure its effectiveness, team members were asked to verify the features needed to simplify work tasks with the Internet serving as an intermediary. The announcements feature allows team members to receive news and announcements that affect everyone involved. The file exchange allows members to share files, graphics, and documents and is accessible to all project team members. A simple list of email addresses, phone or fax numbers, room numbers, and work hours is listed on the site to help team members maintain contact; password

protection is necessary for this feature. A chat room is also available when other means of communication are not feasible, and each team member also has quick access to the home page for the current project. Calendars and timelines are maintained on the Web site to serve as a reference to deadlines and delivery dates, which helps to keep all interested parties informed of the progress. The maintenance of a PSS for the duration of a project results in an archived source of information that is used to evaluate the process. This captured information serves as a reference system for designing and building future Internet projects. The PSS can be pictured as a common thread that runs through the length of the development process.

The Design Process

The process of developing an effective on-line course is an extensive, lengthy procedure, because it requires a paradigm shift from a traditional methodology. Even the best educators must reevaluate their instruction to ensure its capacity to be integrated into a Web-based format. Considerations for graphics, media, immersive technology, and compelling text must all be part of the process to equip students with all of the resources they will need in order to be successful. Since not all approaches are appropriate for Web-based instruction, some examination of teaching techniques must be incorporated into the development process. This may appear to be an arduous task, initially, but through a systematic procedure, the process is isolated into concise steps concluding with distinct end products. As each step is finished, there is an opportunity for readjustment and change to ensure the best possible outcome at the completion of the process. Within this context the Design Team adopted a modified Dick and Carey (1996) model to ensure that the procedures for developing Web-based classes are unified and systematic. This process incorporates three distinct stages, Pre-Production, Production, and Post-Production.

Pre-Production

During the Pre-Production stage, the design team for the project forms, and an initial meeting is held with the Subject Matter Expert to conduct the course analysis. This helps the team understand some basic information about how the class has been taught in the traditional setting, gain insight into the faculty member's personal strategies, and learn about the student population. From this point, the team splits into two groups. The Instructional Designer continues to work with the Subject Matter Expert as the rest of the design team creates the basic interface and prototypes for the Web pages. The outputs of this stage include a design document, a rapid prototype of a content unit, and a horizontal prototype. The design document outlines the framework of the class, while the horizontal prototype demonstrates the metaphor, navigation, and organization of the Web site. All of these are analyzed through one-to-one conferences and expert reviews before the Subject Matter Expert is asked to sign off on the product.

The design document represents the output from the initial stages of the instructional design process. In consultation with the Subject Matter Expert, the Instructional Designer works through a systematic approach based on the model suggested by Dick and Carey (1996). The process begins with the task and goal analysis, with the purpose of determining the intended outcomes of the course from the instructor's perspective, representing both content specific and affective goals. This provides an overarching perspective of what the class should accomplish. At this point, the Subject Matter Expert attempts to break the main goals into smaller topic areas that can be covered throughout the class. Based on this information, goals and objectives can be established for each individual topic area. Depending on the nature of the class, some faculty members may have very specific goals while others may take a more open-ended approach. At the completion of the instructional analysis, there is some discussion of how students will be assessed, focusing on measures that are appropriate for Internet-based classes, such as rubric grading systems. Once these initial guidelines are conceived, instructional events are established to meet the course goals. While this process first seems to represent a very rational approach to course design, it is much more iterative in practice. Decisions made later in the process often create the to need a reexamine earlier conclusions. The purpose of this effort is to produce a design document to articulate the basic structure of the course. This includes outlining the main course goals, the goals and objectives within each smaller topic area, the instructional events, and a plan for the assessment of the learners.

Unlike many instructional design situations, the delivery medium -- the World Wide Web -- has been pre-determined for our courses. Rather than looking at whether the Web is the right medium, the task in this situation

involves finding the right blend of Web technologies and print-based activities to achieve the goals of each course. One of the first challenges is to convince the Subject Matter Expert that delivering courses via the Web takes a very different approach from the conventional classroom. It is more involved that just putting pre-existing PowerPoint slides into HTML format. The second challenge is to help the Subject Matter Experts understand capabilities of various Web technologies and to visualize how these technologies can be creatively applied to their course. There are numerous Internet technologies (text, graphics, animation, sound, interactive quizzes, video, chats, bulletin boards, email, newsgroups, video conferencing) that should be considered in putting together a Web-based course in order to ensure the content is delivered in the most appropriate manner for achieving the course goals. The third challenge is to make the development of the course content and Web site as efficient as possible. To address all of these challenges, a rapid-prototyping approach has been adopted for the Pre-Production phase of each of our Web-based course projects.

Rapid-prototyping, which is commonly used in the software development industry, involves experimenting with the design ideas and issues even while the requirements analysis (or content analysis in the case of instructional design) is being conducted. Specifically, through rapid-prototyping the design team can experiment with interface design and the incorporation of a variety of Web based technologies until the right approach for the subject matter of a given course is found. The samples that are generated help the Subject Matter Experts to visualize the capabilities of these tools and to begin seeing advantages and disadvantages of using each technology. Once the design team and the Subject Matter Expert have seen concrete examples of how technologies such as bulletin boards, chat rooms, animations, video, video conferencing, or sound can be used, they are able to think more creatively about how to apply these tools to the course objectives. Rapid-prototyping facilitates formative evaluation to ensure that the chosen techniques actually achieve the desired learning goals and objectives. Through rapid prototyping the design team is able to help Subject Matter Experts understand how Web courses are different from conventional classes. This also enables Subject Matter Experts to choose the appropriate technologies to achieve their course goals.

At the completion of the Pre-Production phase, there are three main outputs. The design document specifies the content to be developed for the course. The rapid prototype provides a framework to guide Web page development. The horizontal prototype of the Web site provides the context for how all of the elements of the course will be unified. These outputs are analyzed through one-to-one conferences and expert reviews before the Subject Matter Expert is asked to sign off on the final products of this stage.

Production

The Production phase incorporates the process of developing the actual content for the Web site. The definition of content at this point is rather loose and may include textual information, graphics, descriptions of activities or assignments, job aides, test and quizzes, and other instructional events. During production, the design team uses a step-wise development process, completing one instructional unit completely before moving on to the next, but the content does not need to be created in the sequence in which it will be used. The Subject Matter Expert with the help of Instructional Designer specifies the content for the site. Information that is not available in the course textbook (if applicable) is emphasized, or additional content is added that will help to better explain the important concepts. As the content is specified, the Subject Matter Expert and the Instructional Designer work with the rest of the team to examine ways to make the content and direct instruction meaningful and engaging to the student. This involves a consideration of options available through the HTML/script coding, the media creation, and the use of immersive technology.

As the textual content, media, and immersive technology are created, they are integrated into the Web site using the template created during Pre-Production. An important part of the process at this level is considering the use of instructional programs that can be integrated into the Web pages using server-side applications or Java coding. Essentially this means that small programs can be run from within the Web pages to perform specific actions. As the Web Developer and the Instructional Programmer examine the content, they may have suggestions for ways to make it more compelling through the use of these programs.

Media creation is the main way that the content of the site is given greater force. Images can be used to demonstrate concepts that are difficult to explain in textual terms and to reinforce ideas expressed in written form. As the content of the site is developed, the Instructional Designer and the Graphic Designer work together to identify areas where images are most appropriate. Generally, images are only used for a sound educational purpose, and the design team does not recommend adding images only for their aesthetic appeal. Other media that

may be created for the site include video, animation, and audio, depending on what is required to support the content. The Graphic Designer and the Media Specialist review the content and consult with the Subject Matter Expert to make recommendations about what media is helpful to represent some concepts.

The Multimedia Specialist and Graphic Designer provide several different types of media for inclusion in the online courses, including audio, video, animation and interactive segments. Audio and video clips are used to reinforce pertinent information or to provide relevant anecdotes to increase the effectiveness of the content presentation. Interviews with Subject Matter Experts are developed for audio or video to provide relevant information to students, therefore adding a humanizing touch to the Web site (Bonk & Cummings, 1998). These interviews are kept to approximately one minute in duration to minimize download time. Video conferencing between the instructor and students is also possible in order to provide personal feedback to the student and to foster interaction (Bonk & Cummings, 1998). Immersive technologies such as Quick Time VR and Virtual Reality Modeling Language (VRML) pull the user into a simulation of reality on the Web. Shocked Director files can create interactivity to facilitate lessons such as chemistry experiments. The use of Macromedia Flash has been examined as a way to improve download time. Since Flash is a vector-based animation and multimedia tool designed for Web output, the files are small, fast loading, and produce dramatic results. All of these technologies are considered in attempting to increase the effectiveness of the content presented through the Web.

Once all of the components for an instructional unit are integrated into the Web site, it is ready for a series of evaluations. This helps ensure that all the pieces are functioning together and provides an opportunity to judge whether or not it is likely to be effectively used by the students. Formative evaluation involves the collection of data and information during the development of instruction in order to improve effectiveness and efficiency. This determines the weaknesses so that revisions can be made as necessary. Formative evaluation provides feedback that is used for improvement of the products at all stages within the instructional design process (Seels & Glasgow, 1997). During the Production phase, following the Dick and Carey (1996) model, the formative evaluation is divided in two parts, content evaluation and learner evaluation.

In content evaluation, the designers and experts evaluate the content of the instruction. This evaluation is conducted throughout the development process, and the evaluators review the goals, objectives, environment, learner analysis, task analysis and instructional materials. The content is evaluated to determine if the goals and objectives were met and to find inadequacies and flaws. The entire team reviews and makes corrections during the Production stage until the Subject Matter Expert signs off on the product. The learner evaluation involves either one to one evaluation, or small group evaluation. The use of computer programs, immersive technology, graphics, animated sequences, or video make altering the courses at the final stage very expensive and time-consuming (Seels & Glasgow, 1997). To overcome this problem, the learners evaluate the first instructional prototype. In the one to one evaluations, students individually go through the prototype in front of the designer, and the designer takes note of each student's comments. The designer studies the notes and makes the necessary revisions after students review the instruction. In small group evaluation, a group of users will go through the instruction, and the material is presented as it would be in the true learning environment. There is little intervention during the instruction, and a questionnaire is given to the users at the end of instruction.

Before the content unit can actually be released, the faculty member reviews the final product one additional time to make sure that it is an appropriate teaching tool. When the Subject Matter Expert accepts the product, then development moves forward to the next content unit and the process repeats until all content units are complete.

Post-Production

At the beginning of the Post-Production phase, all content units should be completely developed and approved by the Subject Matter Expert. At this point, field-testing is conducted which involves the actual use of the Web site to facilitate the course in a distance setting. The purpose of this field test is to discover areas that need some additional consideration to ensure that the instruction is as effective as possible for the largest number of students over the long term. The students should be asked to provide comments and feedback to help improve the course throughout this semester

Although training is provided throughout this process, a debriefing session is held at the end of the third semester to answer any questions in order to ensure that the faculty member is ready to maintain the course independently. During these three semesters, all pertinent Web technologies are introduced and demonstrated.

Additionally, basic instruction is provided to help the Subject Matter Expert learn to create and maintain Web pages independently.

Testing and ongoing adaptation testing, which are used to evaluate the merit of a completed Web course begin with simple Likert-type survey questions. The questions examine user perceptions and experiences regarding the various elements of course. The areas of interest that are most important to examine include navigation, graphics or visual appeal, and validity or comprehension of the content. A survey is administered during the field test at the completion of the Web course. The surveys are collected and analyzed for any significant input that impacts the design of the course. If user feedback suggests the need for significant improvement to the site, changes are implemented and noted. During every semester, developers and designers receive new and regular input about each course being offered through the Web. Changes are completed as necessary and the change process begins again to facilitate ongoing data collection and analysis of the Web courses.

When the final product has been delivered with all changes and corrections, and the Subject Matter Expert is ready to maintain the site, the process is complete. The Subject Matter Expert member signs-off on the project, and the full offering of the course begins.

Conclusion

As the number of classes offered over the Internet continues to increase, it is important for educational institutions to develop and maintain effective procedures for course design and development. One way to facilitate this process is to create a division within the university whose sole purpose is to guide, instruct, and assist faculty members as they make this transition. A program such as the one described in this paper ensures through a systematic process that the courses developed for this medium will be effective and produce high quality results.

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Interactive Television: The Planning Process

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Abstract: Planning is essential to good teaching. When preparing to teach an interactive television (ITV) course, planning is critical and includes additional considerations from the traditional face-to-face course delivery. In this paper, I will share some insights based on my experiences in planning and teaching an ITV course. As we experiment with new ways of providing learning for students, there are serious considerations if we are to maintain standards and integrity.

Introduction

One of the most important roles of a teacher is that of decision maker. Therefore, informed decision making at every stage of the teaching process is the most critical aspect of effective teaching. The key word here is informed. Farr and Brown (1971) observed that "most instructional decisions are made by forfeit; that is, by not recognizing that a decision can be made or by not being aware of possible alternatives. The usual forfeit 'decision' involves continuation of a practice whether or not it is the most appropriate procedure for the situation" (p. 341). There is also strong evidence that teachers tend to teach as they were taught (Nagel & Driscoll, 1992). This is especially problematic when the teaching environment is changed as drastically as when going from face-to-face instruction to interactive television (ITV).

Planning

As with any effective teaching, ITV course delivery requires planning. While there are similarities, planning an ITV course has some special considerations. Teaching a course in the ITV environment that you have taught before is an advantage. However, because of the nature of the ITV environment, planning that begins at least one semester prior to the course delivery is desirable because of the long-term planning issues. Some of the planning considerations include:

- communicating with all other departments, colleges, offices, etc., that would be involved in planning and supporting the course
- learning the capabilities of the medium
- preparing yourself for the experience
- reformatting all visual materials
- getting permission for transmitting visual and audio materials
- rethinking the pedagogy
- planning activities and experiences that could be translated into the interactive television environment
- planning at least one visit to the remote site
- involving equally students in the transmitting classroom and students in a distant classroom

Communicating with support systems

Whereas traditional course delivery involves planning with a variety of support systems, course delivery via interactive television drastically increases the number of people involved in the planning process. Identifying all stakeholders and possible support systems should be one of the first steps in the communication process. First, the infrastructure must be in place and appropriate for the type of course to be delivered. Things we take for granted in the traditional classroom, such as all students being able to hear and be heard, to see and be seen, take significant planning in the ITV environment. Providing library access and materials for students as a remote site require advanced planning with appropriate library personnel. Developing a relationship with the technical support people is necessary to insure good communication.

Capabilities of the medium

The capabilities of the medium determine, to a significant degree, the teaching strategies that can be used. Advanced planning time getting to know the medium will provide a basis for pedagogical and curriculum decisions. Determining exactly what your role will be and the amount of type of technical support you will have will also play into the decisions about the format of the class.

Preparing yourself for the experience

In addition to learning the capabilities of the medium, you need to train yourself to use the equipment. Because you may be expected to serve, at least partially, as your own producer, use the equipment appropriately and with a degree of expertise will eliminate disruption to the learning process. Also, an aspect of ITV teaching is that for at least the students at the remote site, you are a television personality. As we often tell our students, one effective way to prepare yourself as a teacher is to video tape yourself and then critique the video.

Formatting visual materials

Visual materials must be formatted for television. PowerPoint is an effective way of formatting materials. However, the specifics for developing the PowerPoint slides are rather exacting. For example, the color of both background and text have to be compatible for television. Also, the font size must be large enough to allow for ease of reading. Materials that cannot be made into PowerPoint slides have to be redone in some other compatible format.

Permission for transmitting materials

Copyright rules governing transmission of visual and auditory materials should be reviewed and appropriate plans developed for either using the materials or substituting. For example, a video that is owned by you or your organization cannot be transmitted without written permission from the producer. This is a rather involved process as getting responses from producers can require persistence and an extended period of time. Another alternative is to have original copies purchased for each site. Again, this can be costly and time consuming.

Rethinking Pedagogy

Planning for teaching an interactive television course involves the process of re-educating the teacher. If sound pedagogical practices are to be maintained, one must thoroughly investigate the medium and its capabilities. When talking with fellow teachers and students, I often hear interactive television courses referred to as the "talking head" and/or "hairy arm" classes. If the customary practice of a teacher is lecture, she or he may approach interactive television as a continuation of this practice. In the interactive television environment, this is translated into a head shot of the teacher talking or the hairy arm of the teacher writing on the document camera or overhead. This is definitely not the stimulating environment we want to provide for our students.

If a teacher has developed an approach to teaching that involves activities, experiences, discussion, and other interactive pedagogical strategies, translating this process into the interactive television environment is a

challenge. Maintaining the integrity of appropriate pedagogical strategies was a primary concern for me when planning to teach an interactive television class.

Activities and experiences for an interactive television environment

Meaningful and relevant activities and experiences are an effective way to facilitate learning. However, as Ball (1992) has suggested, activities can be devoid of meaning unless the teacher is capable of providing students with appropriate challenges and helping the learner bring the meaning out of the activity. This challenge is compounded in the interactive television environment. In addition to the usual considerations when designing interactive teaching strategies, the medium must be taken into account. However, there are some interesting ways to design experiences that are enhanced by the medium. For example, providing opportunities for students to discover the differences in perception when one can only see objects, as opposed to being able to handle them, provides for interesting discussion and insight on the part of the participants.

Remote site visit(s)

If possible, visit the remote site and transmit the class from that location. Meeting the remote site students face to face changes the relationship dynamics significantly.

Involving students equally

Getting to know the students at both the transmission and remote sites is critical. Allowing the time to make sure that students know each other is also important. Because of the familiarity of having students in the face-to-face classroom, a temptation is to focus more on the students at the transmission site. Constantly monitoring yourself to make sure that you are making "eye" contact with the remote site students, including them in the discussion, and asking for feedback from them are all ways in which you can involve students equally. Forming groups or teams whose members consist of students at both the remote and transmission site is also an effective strategy to avoid the "us" and "them" mentality.

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ASSESSING THE VALUE OF IT
(AS DIFFICULT TO ASSESS AS THE VALUE OF FORMAL EDUCATION?)

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Abstract: This paper tries to establish a comparison between the problems IT people are having, at the end of this century, to evaluate the return on the investment in IT, and the difficulties faced by those who have been trying to find consistent ways of assessing the benefits of formal education since the 60's. Our objective was to check if the problems in assessing investments in the area of education were the same, or similar to those in the IT area. If that was the case, there would be room for future studies trying to determine if the Education Economics could, somehow, contribute to the development of better evaluation tools for investments in IT.

Key-words: information technology, formal education, value assessment

"Invest in education because the cost of preserving our future is nothing compared to the cost of not having one."
Joe Petterle (1991)

Introduction

Not only academic literature but also computer industry advertising, is full of impact statements like the one above. However, it's a relief to realize that such statements are not the sole property of the computer arena. The statement above relates to the educational field, though it would be well suited to our techie environment if we swapped the word *Education* with *Information Technology* and rephrased the sentence a bit to better suit corporate "ears": "*Invest in IT, because the cost of preserving the future of your enterprise is nothing compared to it not having one*". Perfect!

When we started studying the impact of Information Technology on organizations (and the subsequent value of IT), we thought it would be interesting to investigate other areas with similarly intangible benefits. If we were able to identify another area with the same characteristics and with good, established assessment procedures, we could possibly spare ourselves a lot of effort and time. We thought of an old Portuguese saying: "When the brains don't think, the body has to work twice as much". As we didn't want to "work twice as much", we started looking for studies in other fields of knowledge that could complement or bring new insights to the way people have been treating the intangibles related to the

investment in IT. It would be quite an achievement if we could shed some light onto IT research pertaining to the value of technology to organizations. The only thing researchers had been able to say so far is that IT really brings a lot of intangible benefits to those who invest on it - benefits which probably far surpass those easily quantifiable.

Curiously, the first areas that came to mind, when we started thinking about the evaluation of intangible benefits - Education, Health, Quality of Life, Tourism, etc. - are all areas related to people, rather than to machines. This only reinforces another idea that has been discussed lately: we have to pay more attention to people and their capabilities, rather than letting them be overshadowed by the *glamour* of the technology. The value of technology is not inherent to the technology itself, but is directly related to its capacity to make people more efficient and productive, individually or in their teamwork.

This paper tries to establish a comparison between the problems IT people are having, at the end of this century, to evaluate the return on the investment in IT, and the difficulties faced by those who have been trying to find consistent ways of assessing the benefits of formal education since the 60's. Our objective is to check if the problems in assessing investments in the area of education are the same, or similar to those in the IT area. If that is the case, there is room for future studies trying to determine if the *Education Economics* can, somehow, contribute to the development of better evaluation tools for investments in IT. To quote another popular saying, "we wouldn't need to reinvent the wheel", and our efforts could be focused on "improving other parts of the car".

Coincidences and similarities between the benefits from IT and the benefits from Formal Education

IT and Formal Education are power decentralization and opportunity democratization factors:

In 1963, Schultz (apud CARNOY, 1995a), identified in Education the capacity to change salary structure and payment for work, altering the value relationship between capital and work, favoring work. This could represent a conflict of interests, as the owners of capital could be little interested in having part of their power redistributed among other people.

As IT makes the access and use of information easier to a larger number of people, it also affects the power relations within organizations, requiring special attention to be paid to managing conflicting interests.

Education and IT promise to act as power and income dissipators (which can provide an important social benefit), but this can also be a source of resistance by those who feel to be disadvantaged by it.

IT and Education allow/happen in less hierarchical environments:

Another interesting feature of the educational process and the new activities supported by the use of computers is that, in schools and "information era" organizations, there is no strict hierarchical structure, like the one that predominates in "industrial era" enterprises. Teachers and professors are not usually supervised in their activities. There isn't even a formal contract specifying the results expected from the "processing" of the student by the school. Teachers are assigned responsibility and it is expected that they put their best

efforts into conveying their knowledge to their pupils. The "information era" organizations also tend to be hierarchically less strict than those production-line companies of the "industrial era", assigning more responsibility and expecting, on the other hand, more dedication, creativity and initiative from their employees. SAS's Jan Carlzon once said: "A person without information can't assume responsibility. With information, he can't avoid it" (NAISBITT, 1990).

IT and Education are important flexibility factors:

The world is changing faster than ever. Schultz (apud CARNOY, 1995a) wrote in 1975, that one of the benefits of formal education was that it improved the ability to adjust to changes and adopt new forms of doing things. For CARNOY (1996), there has been a major swing in the purpose of education: in the past, the educational process focused on conveying certain skills, necessary for the execution of specific tasks; today, people have to be prepared quickly, and with great flexibility for tasks that are not very clear and which will undoubtedly change more often and more quickly than ever before. Reusable skills should be developed - particularly those skills that facilitate adjusting to change, interacting and problem solving. In the case of education, flexibility seems to mean give people a relatively high level of cognitive knowledge, which makes learning other tasks easier. In the case of IT, organizations expect their investment in technology to make them more able to adapt to the fast and radical changes in their business environment. Such flexibility should contribute to ever smaller production batches and lead times. Ultimately, IT should provide the industry with the main feature, lost since the time of handicraftsmen: exclusive/customized production (only possible by the close and intense interaction with customers). In times of radical change, flexibility is the key to the success, or even the survival, of organizations, it being the product of well educated people, capable of adapting to and generating change, or of the creation of a new technological model, free from the paradigm of serial production in large quantities and focused on satisfying the individual needs of each customer.

Difficulties involving the investment in IT and Formal Education

Depending on the industry, the impact of the investment may vary greatly:

One major difficulty related to the evaluation of investment in education, as well as in IT, is the fact that the impact of investment is also a function of the environment in which it occurs. CARNOY (1995b) states that the relationship between education and productivity varies significantly from one industry to another.

The intensity of the need for IT also varies widely from sector to sector depending, to some extent, on the level of competitiveness within the particular industry, but also on the productivity gain technology can provide companies with. A good example of this is the banking industry, which is highly dependent on the electronic management of information, and the construction industry, in which the impact of IT is much smaller.

Difficulty in isolating the benefits directly related to the investment in education or in IT from those caused by other factors:

Another problem is that, unfortunately, there is no practical way of segregating the benefits caused by formal education from those caused by other factors, such as the influence of the family (schooling level, social status, etc) among others, which are highly interconnected. The differences among people with different schooling profiles cannot be uniquely assigned to their educational experience. This makes it difficult to come to any conclusion about the impact of schooling. SOLMON (1995) argues that, regardless of what happens in the ideal world of research in the social sciences and education, it is impossible to study two identical groups, one exposed to formal education and the other not. For him, attempting to use statistical control in studying the issue is problematic in that one will never be sure one is taking all important factors into account, as many of them may be impossible to measure or even to imagine.

The same kind of difficulty happens when we try separating the influence of IT from that of other factors that are simultaneously acting on organizations. This makes it impossible to assign the majority of benefits related to the investment on IT exclusively to such investments. There is always a reasonable level of subjectivity involved, which allows for different interpretations, depending on the issue one is trying to prove.

Conclusions

Economists must understand the educational process, as well as the new ways of organizing work and the new technologies being introduced. In order to do this, it is necessary to create new, more complex models than those bound by the familiar paradigms of the "industrial era" which have hitherto been used to understand production line processes.

Formal education and the new ways of work organization, made possible by IT, are elaborated processes, which require special attention in their evaluation. Education and the implantation of IT are closely related to changes in attitudes and, as such, are not immediate processes. Ways of thinking as well as values cannot be quickly modified, as a consequence of scenario changes or competitive pressures. Therefore, **investment in education and investment in IT are both part of long term strategies. Consequently, any attempt to measure their results should be carried out with a long term vision.**

For CARNOY (1995c), the benefits of formal education go far beyond improving an individual's performance. Higher schooling does not only make people more productive themselves, but also allows them to help others become more productive. Thus, formal education benefits the whole community, contributing to the improvement of health conditions, decreased criminality rates, etc.

SOLMON (1995) notices that there are several beneficiaries of the educational process: the students, the community and the teachers and other workers in the education industry. All of them have to have their interests evaluated.

BENJAMIN (1993) recognizes that, as in the case of education, there are several agents benefiting (or not) from the investment in IT. They also need their interests to be well understood. He suggests that the level of commitment to the success of the investment is contingent on each one of those who have a role in the change process. Their capacity to interfere in the process, their availability, their gains from or resistance to the change should be evaluated. The identification of all stakeholders and their involvement in the change process is crucial to the chances of success of the investment in IT in achieving the expected benefits. The energy required to support the change process comes from the organization's

capacity to satisfy its needs and aspirations. Therefore, it is important that the change process is supported by a sufficient number of people committed to its success.

From what we have discussed above, it is clear that the strategic investment in IT and formal education have several things in common. The reasons for investment can be the same, especially when the focus is on achieving greater flexibility, which is probably why organizations are starting to discuss strategic IT investments, training and education and organizational culture at all. Difficulties with the intangibility of benefits and the time taken (usually long term) also seem to be similar in nature. This makes us wonder if "education economics", which has been around for much longer, couldn't help in the development of "information economics", now.

But CARNOY (1995a) reminds us that things are not going to be that simple, and that we shouldn't get too enthusiastic. He says that, up to now, there is no evidence that increased, more formal education enhances productivity. We only know that there is a strong correlation between more schooling and higher salaries. Researchers like Carnoy only believe that when school increases the student's cognitive knowledge, it makes him/her potentially more productive, as such knowledge is important for him/her to develop the special skills necessary to perform his/her work more efficiently. In other words, although they have been trying to measure the importance of education for almost four decades, by now, they are still conjecturing about the real value of education, and still have a long way to go.

If, despite all research already developed on *education economics* since the 60's, nobody can yet establish a definitive relationship between schooling and productivity, maybe we should be a little more patient, when we struggle for answers for the evaluation of strategic investment in information technology.

This shouldn't be taken as a reason for discouragement, just that we should be conscious there is still a lot of work ahead of us, before we do have a solid theoretical ground on which to step when looking for conclusive assessments of strategic IT investment. Until then, "mind and body will have to work ceaselessly", regardless of the Brazilian adage!

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Then and Now: Technology and the Changing Face of Higher Education

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Abstract: This project examines the impact of technology on the process of higher education and the impact of these advances on both students and faculty. Student demographics and academics qualities from thirty years ago are compared to those of modern students as reported by veteran and new faculty members. The impact of technology on the modern student is discussed, as are technology relevant changes in the university experience for students and faculty. The changes in the accessibility of college classes by nontraditional students due to multimedia and Internet technology is also discussed with respect to the changing nature of distance education, including emergence of teleconference courses, Internet based classes, and other alternatives to the traditional correspondence course.

Introduction

Technology has made many aspects of our lives easier, less worrisome, and much more comfortable. Not all automobiles in 1969 had radios as an option and compact disk players were not even a speculation. Modern conveniences common in 1999 were the stuff of science fiction movies at the end of the 1960's; microwave ovens, home computers, the Internet, and home satellite dish technology were not even very lucid dreams. These conveniences have become near-essentials in lives of many; the institution of higher education is no exception as it has integrated new advances and adapted to the changes these advances have made in the lives of instructor and student alike. Thirty years ago student life was very different for persons engaged in all levels of university education; technology has had a dramatic effect on every aspect of both the graduate and undergraduate experience.

It comes as no surprise that college students now, especially graduate students, rely very heavily on technology in the course of their studies. While this statement may seem obvious, the degree of difference between students, graduate or undergraduate, in 1969 and their counterparts in 1999 is staggering. We expect that the modern student would be computer savvy and accustomed to using information technology in order to produce research projects, complete assignments for class, design and deliver lectures, and to use whatever tools are available for practicum or training in the students specialty concentration. What is not as intuitive is how much the changing face of technology has altered the very nature of what is desirable in a potential doctoral, master's level, or undergraduate student. Skills, attitudes, and beliefs about their particular fields of endeavor considered preferable by admissions committees seems to have coevolved with society's technological sophistication. The very face of the student has changed as well; no longer restricted to higher socioeconomic status individuals under the age of 25, many non-traditional students are finding opportunities for study which were simply not present as little as ten years ago. Knowledge of and familiarity with technology unavailable

until relatively recently is now considered part of the minimum standards of competency in many academic and applied disciplines. Technology has not only changed what the student has to know to succeed in college, it has also dramatically increased that student's capacity for productive output.

The University Experience

The process of higher education has changed much in the last 30 years; this is not a revelation of any magnitude, but the impetus of these changes are to a degree differentially attributed by new and veteran faculty. Fourteen veteran faculty members (began instructing at the college level before 1976) and 12 new faculty members (began instructing at the college level after 1994) responded to an E-mail survey about changes in higher education. Veteran and new faculty were asked to describe their observations and opinions with respect to their first one to three years as instructors. Veteran faculty members responded that in their first few years of teaching the primary mode of lecture delivery was classroom instruction. Classes were conducted on campus, during the week, between the hours of 8-5. Night or evening classes were uncommon but when offered they were mostly prerequisites and core classes. For content courses and advanced classes students would have to come to the university/college during normal class hours. Correspondence courses were available but the topics were more limited than today's offerings. Correspondence courses generally required the student to come to campus to take exams. Most veteran faculty agreed that a degree could be completed via nontraditional courses but only if the majority of the work had been completed on campus and only if the courses offered in the evening or by correspondence would satisfy the remaining degree requirements. It should be noted that many universities then required, and many still do require, the last several courses in a student's major field of study to be completed on campus. Student's 20-30 years ago would primarily contact instructors by arriving in person at the instructor's office or by telephone. The majority of students resided on campus and a smaller percentage lived off campus near their university. Students commuting from another town, city, or nearby area was generally rare. The veteran faculty members who responded to the E-mail survey believed that social and policy changes, along with the greater availability of financial aid, had the most pronounced impact on both the student body demographics and on the university experience itself. They noted that advances in technology, specifically the advent of the home computer and the dawn of the age of the Internet, produced changes secondary to those of the changes in society itself.

New faculty agreed that the primary mode of lecture delivery was in the classroom during normal business hours, but many noted that alternatives were available for students who could not attend formal classes. Traditional correspondence courses are still offered, but the faxing or E-mailing of assignments is available as an alternative to the regular post or hand delivery. A wider variety of offerings is present today as opposed to 30 or even 15 years ago. Alternative instruction includes more than just evening/weekend classes and traditional correspondence; Distance Education departments offer Internet-based instruction, televised courses via satellite, courses on video cassette and CD-ROM, and even video-conferencing of courses to several locations at once. The new faculty noted that undergraduate degrees were easily completed by use of alternate means; such as extension campuses, internet courses and distance education. The changes in instruction on the university level are centered on information and computer technology. Veteran faculty reported that the library was the primary source of materials for undergraduate papers. New faculty note that the library is still the source of choice, but an important alternative has surfaced in the last ten years: the Internet. Many students are conducting their literature reviews and searches on the Web; the major professional publication/style manuals now recognize on-line and other web based citations. Specialized search engines and specific on-line information services such as PsychInfo, ERIC, Medline, and dozens of others provide relatively easy and rapid access to specific information. E-mail gives the more industrious student direct access to many sources of information once accessable only by the regular mail. Students now also have access to their professors via E-mail as well; personal visits and phone calls are still the modes of choice, but E-mail communication is rapidly gaining in popularity.

The advent of the computer and its accompanying advances have changed much more than just the dynamics of the higher educational process and the university/college experience, it has changed the demographics of the student itself. Veteran faculty members noted that, in their first three years of teaching, the typical student was Caucasian, upper middle or upper class, unmarried, under the age of 24, and likely to be male. Minority students were rare and female students, while not uncommon, did not make up an even proportion of the student body. New faculty members report that the majority of students are likely to be Caucasian and male, the notion here of a majority may be a misnomer. Most university campuses serve diverse populations, but even this intuitive statement does not accurately describe the population. Examining the

demographics of the modern student body can we see the major interaction between social policy change and the advances in technology. Social policy changes in the form of anti-discrimination laws and equal educational opportunity statutes greatly increased access to higher education for non-majority students. As computer and information systems technology became incorporated in the process of higher education at about the same time as many of these social changes were beginning to take effect a dramatic change in demographic nature of students can be observed, a change most likely due to the interaction between these two forces. An increasing number of non-traditional students began returning to school and their numbers rise with each successive year. Many are returning for advanced degrees to meet the needs of an increasingly competitive marketplace; for others it will be their first exposure to higher education. Some will attend traditional classes but many will take advantage of non-traditional course times and formats; for them these alternative courses may be their only opportunity to pursue a college degree. As the demands of the modern workplace change the engines which support it change as well. Advanced technology is on the forefront of these changes.

The new faculty members surveyed differed in their opinions and observations to a degree. They believed that the personal computer and the Internet were the most influential in establishing changes in the educational experience. The simple availability of these tools has dramatically altered the college experience for professors and students alike. The second most important influence noted by new faculty is the rapid increase in technological sophistication in the workplace; to be productive and competitive a worker must know how to employ and maintain the tools of their trade. Clearly, a place to learn technology competency is during the educational experience in college. While this second observation may seem intuitive, the incorporation of computer and electronic technology into all areas of American life today is extensive, likely more so than would have been projected 30 years ago. Computers are everywhere in modern society. Automobiles, cash registers, gasoline pumps, kitchen appliances, vending machines, and many other seemingly common devices now are fitted with intricate computer cores. Advanced electronics have crept into modern life with equal influence on seeming everyday conveniences. Many specific products common today were not available 30 years ago, many not even conceived as the stuff of science fiction. While the future failed to provide the citizens of 30 years ago with personal jet-packs and colonies on the Moon, it did deliver compact disc players, cable and satellite television, laser surgery, advanced optics, microwave ovens, electric and solar powered automobiles, Fax machines, voice mail, and many other advances now considered to be relatively commonplace. Operating, repairing, building, or designing these devices requires a level of skill and knowledge not available 30 years ago. The modern workplace demands a minimal level of sophistication from each and every employee, regardless of their position. In the same way that a modern architect generates a building design on a computer, a modern cashier must be able to program and operate a computerized cash register. The new faculty members did give credit to the forces of social change, but clearly in their opinions social forces were less influential than technology. It is more than likely that the change is attributable to an interaction between technology and social change, indicating that somewhere in between these relatively specific advances lies the actual agent of progress.

Technology and The Modern Student

It seems that the battle cry of faculty across disciplines heard echoing throughout college campuses in the United States is "read the textbook"! Many instructors believe their students could generate higher quality work and achieve substantially better grades if only they would study the course text and the lecture materials. Faculty of all levels of experience generally agree that students demonstrated a higher level of dedication to their studies in the past than is present now. While this argument is not often contested many critical supporting elements are often not given due consideration. The college student of the late 1960's or the early 1970's did not have access to the same technology as today's students. Yesterday's college student likely had fewer than ten channels of television, no access to a personal computer, no Internet service, no video games, no Fax machines, no E-mail, and certainly no access to courses on videotape, to name a few of the salient differences. Social conditioning was different. The technology which now expedites life simply was not in existence or did not have nearly the same impact. To learn a student needed to read a textbook, attend classes, and use a card catalog-referenced library. Some would argue that this student had more patience and determination; while this judgment is certainly face valid, it is also equally accurate to note that the students of the past simply became accustomed to waiting for the less efficient methods at their disposal to produce the desired results. Papers which had to be typed may have taken several iterations by longhand before a final draft was completed. Mistakes on a typewriter could very easily necessitate the retyping of an entire page or section; this is not a concern with modern word processing software. Completing a ten-page term paper is considerably easier with the assistance

of a personal computer or even a computerized typewriter, not to mention the added assistance of the Internet and on-line reference engines available at the university library. Subjective comparisons of quality between students then and students now are actually more confounded than they may seem on the surface when the differences in available resources and methods are taken into the equation. While both would need a degree of intellect appropriate to their field of study and the expected collection of motivational and supporting variables, the specific skills present in modern students are often technology centered. This provides both the advantage of the availability of the efficient resources of the Internet and of the personal computer and the disadvantage of the dependency on technology to be effective.

Students beginning their university careers in the early 1990's to present have received extensive social conditioning with regard to technology. The impact of this conditioning has been both direct and indirect. Students today grow up in a world of ready convenience; fast food, instant long distance telephone connections, credit cards with instant approval, Automatic Teller Machines, and many other areas that are infiltrated by technology. Stories of the past notwithstanding, modern students have little connection to life without these direct and indirect influences of technology. The vast majority of colleges and universities in the United States offer many of these and other conveniences on campus. Students are conditioned to expect more immediate results from their efforts in all aspects of daily life as compared to their predecessors. This expectancy generalizes well to their studies. Modern students can research a term paper in considerably less time using electronic indices in the university library than was possible using a card catalog. A first draft of a paper can be edited with the assistance of a word processing program, making obsolete the need for pen-and-paper outlines and drafts. The final paper then is printed with the touch of a button, a process much more rapid than typing from a hand written draft using a manual typewriter. Many textbooks now come with content-relevant CD-ROM's or floppy discs. Instructors are beginning to list supplementary sources on their syllabi in the form of web sites devoted to the topic instead of using materials on reserve at the university library. The publishers of many textbooks, in an effort to make their product more marketable to colleges and universities, now offer content-relevant web sites accessible only with a code from the student's textbook. All of these advantages, if they are to be utilized efficiently, demand that the modern student demonstrate specific prerequisite skills to access the information or use the available tools.

A student who cannot use a computer suffers a serious disadvantage in today's university setting. Word processing is more than simply knowing how to type; it requires the applicable knowledge of the software's capabilities and a familiarity with both the general lexicon of the computer age and the specific terminology to navigate the software's various utilities. Students without Internet skills literally have only a fraction of the resources available to them compared to their Internet-savvy colleagues. In many cases the lack of skill in using local area network (LAN) search engines can critically hinder a student; many college and university libraries have eliminated their card catalogs. Knowledge of word processing and the Internet, while a substantial part of the constitution of the desirable skills in a modern student, are not the only important elements. Familiarity with software for designing presentations, for example, is rapidly becoming a requirement for graduate studies in general and for many undergraduate majors as well. The ability to use E-mail for more than simply sending messages is another rapidly developing requirement. Many professional conferences accept on-line submissions, many potential employers require work samples be sent via E-mail; this may require the ability to attach pictures or graphics, convert text from one format to another, import charts and statistical diagrams from specific programs and incorporate them into the final product, and present the effort in a uniform and easily understood manner. Simply understanding the operation of a personal computer does not convey the ability to maximize its capabilities. While speculations of a paperless society by the proponents of computer technology are likely premature, the advantage of the fax-modem is not to be underestimated. Graduate and undergraduate students alike who can compose and send by fax a document without leaving their terminals possess a great advantage. Many professors allow the E-mailing and/or faxing of reports and other assignments as an increasing number of students commute to their college or university from some distance away. These skills and others allow a modern student to maximize the educational experience by utilizing available resources efficiently; students without these skills suffer a distinct disadvantage, a disadvantage that will only become more detrimental as institutions of higher learning embrace advances in technology.

Most institutions now have programs in place to meet this need. Most colleges and universities now offer a course that essentially serves as an introduction to the university itself. In such courses the student is introduced to the university's resources and receives basic instruction on their use, including the use of computer based facilities. Many universities offer clinics and other forms of instruction designed to introduce the new student to word processing, Internet and E-mail utilization, availability of services and alternate course formats, and training on discipline specific software packages. Almost every modern university now offers computer labs

and facilities staffed with personnel trained to assist students in the use of these facilities and to troubleshoot specific problems encountered in either the learning process or the application of computers and software to the student's course requirements. Many faculty members have begun requiring Internet assignments from their students as a method of ensuring that the student has at least a basic level of knowledge of how to navigate the Internet and of the operation of Internet browser software. As class presentations in both graduate and undergraduate courses of study become more and more dependent on multimedia applications, many instructors are coordinating with university departments which offer instruction in presentation software to ensure that their students have every opportunity to acquire the skills necessary to generate high quality work. A quick search of the Internet will reveal a large number of course syllabi and lecture notes or supplemental materials posted by faculty for their students and other visitors. Such postings serve as motivation for students to use the Internet for their academic careers. As students become used to acquiring information from the Internet, they will likely begin to perform searches for information related to their studies or other aspects of their future careers.

How important is the Internet and the personal computer to current students? A survey was presented to 68 students in an upper division psychology class in a mid-sized university in Louisiana. These students indicated that they believed persons with current Internet and computer skills will have a distinct advantage in the job market. On a scale of 1-10 where 10=very important and 1=not at all important, the mean response of these students to the importance of Internet and computer skills to future employment success was 7.04; 62% (44 of 68) rated this item's importance as 7 or higher. These students also indicated that computer and Internet skills will be a requirement in the future for college students. Their mean response to the question of how likely such skills were to be a requirement in the future was 6.92; 56% (38 of 68) rated the likelihood as 7 or higher. When asked how important technology would be with respect to their future careers the mean response was 6.3 on a scale of 1-10, 48% (33 of 68) rated the importance of computer technology to their future careers as 7 or higher. Of the students in this informal survey, 70% (498 of 68) reported that they owned or had access to a computer in their primary residence. 72% (49 of 68) reported that they had access to the Internet at their place of residence. 81% (55 of 68) reported that they were familiar with the basic operation of a home computer. 66% (45 of 68) reported that they used a computer for writing class assignments at home or at school. 48% (33 of 68) reported that they believe textbooks will be entirely replaced by CD-ROM's in the future.

Technology's impact is profound in the life of the traditional student, but many nontraditional students may very well owe their academic existence to computer technology. Every state in the U.S. now has at least one university or college that offers some form of distance education apart from the traditional correspondence course. The new wave of distance education is the teleconference course. Instructors in one setting, possibly hundreds or thousands of miles away, are connected in real time to students in a classroom via satellite audio/visual technology. The potential for such instruction is staggering; students unable to commute to a traditional or night/evening class now have access to university instruction. Internet based classes are developing almost as rapidly as remote conferencing; a quick search of the Internet will reveal many offerings for web-based courses, many with online exams and assignments. The Internet class is the natural evolution of the correspondence course of old; where correspondence courses could reach anyone with a mailbox and a free day to come in and take an exam. The Internet now serves as an extension campus in everyone's living room. Many universities allow remote access to their libraries' facilities via the Internet. On-line, peer reviewed journals have begun to appear in many fields, offering the modern nontraditional student access to current research and theory without having to make a trip to the university's library. The importance of these developments to the nontraditional student cannot be overemphasized; single parents, shift workers, military service members, persons unable to commute to a traditional university, and many others now have opportunities simply unavailable before the advent of computer and satellite technology.

Technology and the Modern Faculty Member

Technology has not simply impacted the lives of students; the advent of the computer and the Internet has had a profound impact on faculty members across disciplines in higher education. The same advances that have impacted the modern student have also influenced the instructional style and careers of modern faculty. Professors and graduate teaching assistants now have ready access to multimedia aids and information which was previously either difficult to acquire or simply unavailable. Once again the Internet and the personal computer appear as primary agents of this change. Faculty members can communicate with colleagues via E-mail much more easily and cost-effectively than by telephone or even by fax. Lesson plans and exams can be devised using word processing software with the same efficiency as that experienced by a student writing a term

paper. Presentation software and modern multimedia equipment have added a new element to classroom lectures. Teaching is not the sole area of influence for the computer in academia, however; computer technology has quickly established itself as indispensable in all areas of research. Professors and graduate assistants now have the potential to be considerably more productive with the aid of computers and specialized software. Statistics packages such as SPSS have literally reduced the time involved in data analysis to a fraction of that which was required to compute the figures by hand. Speed is not the only advantage of such programs; the accuracy of a computer greatly reduces the chance of human error. Many potentially valuable statistical procedures and research methods previously considered prohibitively time consuming and cumbersome to be of any utility are now in regular use due to the availability of computers and specialized software. The Meta-Analysis, for example, is an invaluable tool for outcome research in almost every applied discipline. Advanced software packages for this specific procedure have reduced the time necessary for a Meta-Analysis to a fraction of the original time required, normally many months (and in some cases, years). These advances have also allowed research-oriented faculty to essentially engage in a form of academic multitasking. The potential productivity for faculty and graduate students involved in active research is much greater now due to current technological aids, but the same prerequisites are in force for the faculty as for the students; before a computer or a software package is any utility, the professional must first know how to use it efficiently.

Conclusion

The university experience for both the graduate and undergraduate student is dramatically different now than it was 30 or even 15 years ago. While many of the same qualities are desirable in modern students as were generally present in students of the early 1970's, modern students are required to have a level of knowledge about computers and advanced technology not present in their predecessors. Modern students are technology dependent, but this is a statement that simply reflects the current state of our society. The Internet, while relatively young, has become an ingrained part of American life both on and off campus. The computer has rapidly grown from an expensive curiosity to a basic household appliance and educational tool. The modern student must be computer savvy in order to maximize the university experience and it appears that the modern student is aware of this fact. Academic life is rapidly moving forward to maximize computer and multimedia technology and the effects of this movement can already be seen in almost every institution of higher learning in the country. In comparison to thirty years ago, much has changed with respect to the college experience. Traditional student bodies are much more gender-balanced than before, campus populations are more diverse, possibly to the point of making the term "majority" a misnomer. Even within the Caucasian-male student body greater diversity exists now as opposed to thirty years ago. No longer is a college education restricted to the upper strata of American society or to a specific geographic location. Modern students have the opportunity to access more information with greater speed and efficiency. Faculty members have useful new tools available to design not only traditional courses of instruction but to take advantage of a nontraditional body of students formerly restricted from higher education due to various constraints in their lives. Internet based instruction, teleconference classes, courses on videotape, and other products of the multimedia/computer fusion have extended access to college courses beyond the campus grounds. Faculty members have seen a number of direct benefits from computer and software advances as well; research productivity and teaching efficiency have dramatically increased and likely have not yet reached their apex. As for the future, it is likely that once computer skills have become a requirement for college attendance or a faculty position we can expect to see an increase in the requirements for the successful completion of a class or for a professor's tenure. As a group becomes more productive the requirements always increase to match productivity. While this is merely speculation, it will be interesting to examine the state of theory in academia 30 years into the new millennium. Technology has dramatically impacted research, but the theoretical engine which drives academic pursuits has not been as affected; while colleagues can teleconference and discuss postulations and principles, no computer or software currently available will be able to directly influence the development and delineation of academic theory in any discipline.

Higher Level Thinking Skills and Individual Differences: Bridging Gaps with Technology

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Abstract: Pre-service and in-service teachers are expected to address individual differences in students. However, the nature of differences and the needs of individuals can slow or, at times, completely stop learning for the rest of the classroom. Teachers are also encouraged to teach higher level thinking skills, although standardized tests are often composed primarily of lower levels of questioning. By taking advantage of new technologies as they become available and combining them with old methods that are effective, teachers can accommodate individual learning differences and help develop higher thinking skills. Steps for designing effective instruction while integrating new technology are described.

Introduction

Two common instructional quandaries appear to be separate questions, but are interdependent: how best to address individual differences in students and how to correctly allocate student classroom time. Time schedules are established according to course objectives, which determine the content that is to be taught, which influences the level of required student thinking skills. Addressing individual differences, especially differences in cognitive ability, can destroy a classroom time schedule. Pre-service and in-service teachers can learn new ways to accommodate individual learning differences and effectively schedule student time through integration of appropriate technologies as they become available.

In a perfect world, instruction would always address individual differences in students. Eisner (1999) notes that ideal instruction enhances diversity. In other words, the higher quality of education, the greater the difference in student outcomes. Each student would experience challenge and would learn at the optimum rate for his ability. Individual talents would be expanded and individual interests stimulated. Differences would be addressed in formats that nurture positive outcomes for each student. In reality, the nature of those individual differences can slow or, at times, completely stop classroom learning.

The ideal is not always reality based nor is it easily attained. Teachers are encouraged to address individual differences and, at the same time, teach higher level thinking skills. If thinking and learning tasks are categorized according to the questioning levels of Bloom's taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwolh, 1956), those higher level thinking skills would be analysis, synthesis, and evaluation. In ideal learning conditions, creativity is stimulated as students develop and produce community centered projects. In the process, they use those higher level thinking skills. Student work is assessed by examination of portfolios that include many facets of the individual's work. In reality, project-based instruction takes a great deal of class time, precious time that teachers need for teaching and re-teaching the basics so that their students score well on required tests. This occurs because currently predominant assessments of teacher effectiveness and school quality are based on student achievement on standardized tests. Those tests primarily assess content acquisition at lower questioning levels: knowledge, comprehension, and application, according to Bloom's taxonomy. Accordingly, in order to satisfy that portion of teacher, school, or program evaluation that is based on student achievement scores, a great deal of classroom time must be spent on instruction and practice of the basics.

Teachers can become stressed because they are trying to address individual differences while stimulating higher level thinking skills within limited classroom time. Unless they learn new ways to plan, teachers are in a difficult situation! Pre-service and in-service teachers need skills that will allow them to make accommodations for physical, emotional, and behavioral disabilities while addressing differences in learning styles and cognitive ability. They also need new planning techniques for allocating classroom

time so that higher level thinking and learning takes place without displacing time needed to prepare for tests that assess lower level thinking skills.

Specifics

Individual differences can cause serious problems in the classroom. A typical classroom includes students with a wide range of learning styles and cognitive abilities. Inclusionary laws that require the least restrictive environment have placed students with physical, emotional, and cognitive disabilities into most classrooms. In addition, many traditional classrooms contain students with undiagnosed or unclassified but evident emotional or behavioral disorders. Teachers often give direct instruction suited to the majority in the middle of the cognitive ability range, a process that ignores the needs of those at the high and low ends. For example, if direct instruction of a concept is presented to 30 students for fifteen minutes of class time, at the end of the fifteen minutes there would be several different levels of comprehension among the students. There might be ten students who understood the concept within the first five minutes. They are now completely bored because they had to spend ten extra minutes hearing the same information presented in several ways. After five minutes these students were ready to add new information. On the other hand, five different students still don't understand. They were paying attention and trying to comprehend, but they still have little grasp of the concept. They need more time and other presentation methods. For these five students it is difficult, if not pointless, to continue the same activity. Fifteen students are now restless and may begin to disrupt the learning of the rest of the class. Least visible outcomes are one or more students who simply sit, but don't learn. The other, more visible outcome can be cessation of learning by all in the classroom due to disruption by one whose needs are not being met in positive ways.

Teachers need the means to allow each student, whatever his level and ability, to work at his optimum growth rate. They need tools that will allow their students to acquire all levels of information and thinking skills. While teachers and technology can be excellent means of student learning, student interaction with teachers or with technology is not as important as student interaction with the instruction itself. Teachers need tools that allow each student to interact as directly as possible with his instruction.

Solutions

The key to teacher survival lies in having the ability to integrate the new with the old. New technologies can complement old methods that have proven effective. New teaching tools allow technology to assist with the time-consuming lower-level tasks of instruction: individualized instruction of content at knowledge, comprehension, and application levels. The use of computer-based or web-based K-12 learning resources for acquisition and/or drill and practice of content at lower cognitive levels can free up teacher and student time for projects that encourage higher level thinking skills. These resources can also address individual differences efficiently by allowing each student to interact with content at his optimum rate.

An example of a web-based learning resource is The Digital Bridge. The prototype unit of The Digital Bridge can be can be found at http://typhoon.coedu.usf.edu/~bmoore/wits2.htm. The instructional tools at this web site include objectives, essential terms and their definitions, tutorials of several types, links to other related information, flashcards, and quizzes. The site, which allows self-paced acquisition of knowledge, comprehension, and application levels of content, is designed to address individual differences in learning style and ability. Students can use the Digital Bridge as a learning resource individually or in pairs to acquire and practice one small segment of content at a time. The prototype unit covers an introduction to the concept of motion. The Digital Bridge is appropriate for enhancement of traditional instruction, but can also be useful for students in alternative educational settings. By taking advantage of new technologies as they become available, teachers can shift lower level learning tasks to the student. Teachers can spend more class time coaching students as they work in teams on community based projects, which, in turn, stimulate higher thinking skills.

Teachers are instructional designers. Not all teachers are designers of effective instruction. Successful instructional techniques, though they may differ in format, often include similar features. Geiger (1995) pointed out that effective instruction usually includes the following:

1. The student must be capable of the task.
2. The student must be relevantly active in the learning process.
3. The student must have incentive to interact.
4. The curricular materials must be flexible (individualizable).
5. Each task should result in an identifiable product (not necessarily teacher-defined, but having met certain criteria) for two reasons:
   a) The student and teacher both know that the task is completed.
   b) The product acts as a natural reinforcer for the student.
6. The student must come to feel satisfaction about the learning over time.

Designing Effective Instruction

Processes that occur in effective instruction must be carefully planned with constant anticipation of possible consequences and monitoring of actual consequences. Following an instructional sequence, the various outcomes must be analyzed and processes revised when necessary. Haphazard planning may result in a classroom filled with students industriously on task, but poor outcomes when student portfolios and/or standardized test scores are analyzed. The following steps for designing instruction incorporate success features and offer guidance for correct allocation of classroom time:

6. Identify teaching goals and objectives.
7. Identify required student assessment(s) and the relative importance of each.
8. Identify resources, keeping objectives and assessments in mind.
9. Allocate student time according to student assessments.
10. Sort and match possible student activities to objectives.
11. Monitor student progress according to assessment.
12. Evaluate and revise.

The steps are each explained briefly below.

13. Identify Teaching Goals and Objectives.

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1 These items are available through department heads or supervisors. There should be complementary district and state level documents.

1

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14. Identify Required Student Assessment(S) and the Relative Importance of Each.

1

1 There may be district, state, or national documentation of student progress in the form of:

1 - achievement tests: standardized, benchmark, or teacher designed.

1 - portfolios containing samples of work, evidence of product or performance, etc.

1 - combination of test and portfolio.

1 Identify the relative importance of each instrument. If it is a required instrument and is used as documentation of student benchmark progress or standardized achievement, or for teacher or school evaluation by any public entity, such as the school district, or state or national government, that instrument has extreme importance in designing instruction. Examine old tests and samples of grading rubrics for portfolios and take them into account when planning student activities.

1

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15. Identify Resources Keeping Objectives and Assessments in Mind.

What activities are available to students both in and out of the classroom?
What related activities are available in the Media Center?
What activities have worked for successful teachers?
What technology is in the classroom?
What can be borrowed or signed up for?

Is there a computer lab?
What's the Technology Plan?

16. Allocate Student Time According to Student Assessments.

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1 Class time should be allocated in proportion to student assessment(s). If half of student assessment consists of product or performance evidence contained in portfolios and half comes from standardized test scores, it is reasonable to schedule half of student time on portfolio activities and half on test preparation.

1

1

17. Sort and Match Possible Student Activities to Objectives.

Test preparation and portfolio activities should coordinate. If lab reports, research, and writing assignments are to be included in their portfolios, students should have basic knowledge and comprehension of terminology before starting the portfolio project. Constructivist learning research suggests that, given an assignment, a student will construct his needed body of knowledge, including vocabulary that would be covered on tests. While incidental learning that takes place during constructivist activities may be preferable to rote memorization, the practical issue of class time demands that student time and attention be spent on acquisition of basic facts. Unless students and parents can be relied upon to see that basic facts are acquired outside of class time, it becomes necessary to schedule class time for the acquisition of content.

Students must be engaged. Students can acquire lower level concepts (knowledge, comprehension, and application) using technology. With several learning resources or tools covering the same topic, each student can acquire necessary content at his own best pace. Technology automatically adjusts to the pace of the student.

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1 - **Identify the product for the student.** The product, whether part of a portfolio or retention of certain body of knowledge, should be clearly identified to the student. If technology tools are used, they should identify small, achievable goals for the student and keep him aware of his progress.

1

1 - **Build product value for the student.** Student learning choices are made for individual reasons at any given moment. Teachers can become familiar with students' values through observation of student choices.

1

1 - **Learning should be relevant.** Portfolio and testing products should be related to students' lives. They will then become aware of the relationship of the topic to their own environment.

1

Build from student Knowledge Base. Use automated tools such as quizzes to assess student knowledge.

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Expand the Knowledge Base. Let student move through acquisition of new information at his own best pace, in his optimum learning format. Technology with varied learning tools give students options that include text, graphics, and interaction.

1

Reach for community-based problem solving. The student becomes aware that his learning affects his community and, therefore, his own environment.

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Encourage higher level thinking skills through constructivist learning sessions. Once the language and basic concepts are acquired to a degree that satisfies assessment, allow the student to reach into higher level thinking skills as his time allows. Each student will reach this point at a different time.

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18. **Monitor Student Progress According to Assessment.**
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1 Preliminary automated testing can monitor status of lower level content acquisition. Portfolio progress should be monitored often.
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19. **Evaluate the Activities Used and The Task Time Allotment.**

Are they producing desired outcomes (assessments)? If not, other activities should be considered and/or time allotment adjusted accordingly.

What Happens?

Using technology-based learning resources such as The Digital Bridge, each student can work at his own pace to acquire the vocabulary and application skills needed to plan and carry out lab experiments or community based projects. When the student knows his goals, is given the means to achieve them, and can monitor his own progress as he proceeds, he can assume responsibility for his learning.

Using on-line learning resources, students who learn quickly, completing required quizzes over assigned units ahead of the rest of the class, can move on to automated tasks that encourage higher level thinking skills. For example, The Digital Bridge prototype unit on Motion contains links to web-based lab activities that allow the student to manipulate variables via the computer, observe consequences, and make predictions about other possibilities.

After students have acquired basic information via self-paced web or computer-based instruction, they can then join other students to work on projects or actual lab experiments. Each student will be at a slightly different place in acquisition of vocabulary and basic concepts. The differences are not important, since each has acquired, at his optimum rate, as much as he is able. The alternative of group-presented direct instruction would have resulted in holding back fast learners and losing slow learners.

Should teachers worry about abandoning the direct teaching of thinking skills? Bereiter (1999) says "Forget about teaching people to think. Teach people things that are worth learning. Focus on goals and problems that really matter. Create an environment in which quality counts but where people feel safe in taking chances to achieve it. Then the thinking will take care of itself." (Bereiter, 1999, ch. 10, p. 37)

Conclusion

As technology becomes available, K-12 classroom processes are changing. Trips to the media center for research projects are being replaced by Internet research. Constructivist learning activities are replacing learning based on behaviorist and cognitive learning theories. The teacher role is shifting from dispenser of knowledge to learning coach. Student assessment is shifting from standardized tests to portfolios based on a variety of student products. But we're not there yet. None of the shifts are complete. There is wide variation in the status of procedural changes between classrooms, between schools, and between school districts. As the changes take place, neither the technology nor the theories that evolve from research can have any positive effect unless they are passed on to the people at the front line, classroom teachers.

Teacher training must address issues that are relevant to practicing teachers. Individual learning differences and correct classroom time allotment are important concerns for every educator and student. By helping teachers identify and combine effective old methods with appropriate new technologies, the gap between reality and the ideal can narrow if not disappear entirely.

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Technology for Teachers: Another Perspective of the Implementation

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Abstract: As computer technology getting more and more advanced, educators have accepted the assumption that computer has a potential to renovate education and is necessary to enhance effective teaching and learning. However, computer is a tool and the value of this tool in education does not depend solely on its qualities (Maddux, Johnson, and Willis, 1997). It is its users, teachers and students, who make the difference. Teachers' creative use of available computing tools makes the teaching and learning more meaningful. Life long and self-paced learning is the key to the effectiveness of implementation. This paper is to review pre- and in-service teachers' computing literacy training in the past decades, discuss the current trends of computing education for teachers, and explore another perspective of implementation in pre- and in-service teachers' education.

Introduction

The growth and acceptance of computer technology in education have become undeniable, and computer application is believed having an important instructional role to play in the classrooms (Lockard, Abrams, and Many, 1997). Implementing technology in education is no longer the question of "should we or not" but "we must." Since the first computer was born in 1946, computer assisted instruction has experienced mainframe plus terminals stage, individual Apple or PC computer stage, and present network plus multimedia stage. As computer technology advances rapidly, educators have accepted the assumption that computers have a potential to renovate education and is necessary to enhance effective teaching and learning. However, computer is a tool and the value of this tool in education does not depend solely on its qualities (Maddux, Johnson, and Willis, 1997).

Computer literacy training

Computer-assisted instruction in education started in the early 60s and increased in the 70s. Since 1980s, more and more computers have entered schools, computer-assisted instruction has become a booming topic, and computer literacy is becoming a sensational buzzword in education. The assumption is that as far as teachers become computer literate, they will automatically use computers in the classroom and the potential of the computer technology in education will be unquestionably achieved. Therefore, computer literacy training for teachers is increasingly recognized. However, it is always a controversy topic. Started with programming centered approach, the teacher training has experienced with other

different approaches such as computing-curriculum focused, problem solving emphasized, and productivity tools anchored approaches. Each approach has had its proponents and defenders, and all have their critics. The common thread through the criticism has been that these approaches treat the computer as the subject matter, not the implementation.

Programming centered approach was dominated in teachers' computer literacy training in the early and middle of 1980s when microcomputers entered the schools in the late 1970s. Teachers attended the training mostly on BASIC (Beginners All-purpose Symbolic Instruction Code) language, few on PASCAL or COBOL languages. Teachers learned to write programs to tell computer what he or she wanted to do. Computer literacy therefore became a synonym of programming. Computers were then used for programming instruction instead of being implemented in curriculum-related instruction. The results of this approach turned out that a few teachers, mostly from math or science area, knew how to write and interpret a computer program to communicate with computers and became capable of designing simple drill and practice courseware. On the other hand, many educators just developed technophobia for themselves because of the training (LoCkard and Abrams and Many, 1997). Programming centered training seems to turn more teachers away from using computer technology than have teachers becoming computer literate to innovate their teaching.

Gradually, the computer literacy training was shifted to computing-curriculum focused approach. The literacy definition was broadened to become units or classes at different levels. With this approach, teachers received the training first on basic computer operating skills, such as how to boot up a computer and format disks. These were considered as "survival skills" that enable teachers to work effectively on a computer. Then the training was on the computer awareness. It was believed that the knowledge of computers would help teachers better understand what a computer can do and cannot do. Therefore, teachers were required to master the survival skills and become knowledgeable of the uses or misuses of computers before moving to the next level. The next level was application. Computing-curriculum was implemented across the existing curriculum or as new courses at various grade levels. Teachers at all levels and in all different disciplines were supposed to become "computer teachers," teaching computing unit for that grade. They learned to use word processors, spreadsheets, and database-management packages. It emphasized on the packages, which were available in each institution and could assist teachers to accomplish certain desired tasks. Programming was included in this approach; however, it was more considered as a skill to enhance students' ability to function as a problem solver. Logo programming language was taught in schools for the younger children and Pascal or Cobol for older students. This approach is no doubt helpful for some teachers to work at computers; however, one study of 125 Stanford professors in the middle of 1980s showed that 80% of them used computers to prepare lectures, handouts, and exams. About one quarter of them required students to write paper or analyze a database at computers. Examining the uses of computers in the classroom, it was found that only 13 out of 125 professors had actually blended the computer into their classroom (Cuban, 2000).

By the end of 1980s, developing problem solving ability became a universally accepted objective. The problem solving emphasized approach joined the computing literacy training. It tended to seek a new way to stimulate the use of computers in classrooms. However, few software packages were designed specifically for problem solving in depth. Although LOGO firmly dedicated to the mathematics problem solving, it was frequently taught as a change of pace, as a way to create pretty patterns, and as something separated from problem-solving. A survey conducted in 1989 among 660 faculty members in humanities and sciences found that 80% of the faculty members used computers to prepare handouts, 72% to design exams, and 62% to prepare lectures. In the classroom, only 10% actually used subject-related software (Cuban, 2000). The causes might be the time, the time to locate or develop problem-solving emphasized software and the time to conduct problem solving activities at computers. Problem solving approach turned out very time consuming and at the expenses of something else. Unless a teacher is firmly convinced of the value of the problem solving activity, comfortable and skillful in presenting it, he or she is unlikely to adopt it in the classroom voluntarily. Therefore, problem solving emphasized approach usually had a sensational start and ended as a product of miscarriage.

When computer literacy training turned against programming approach, found the computer-curriculum model difficult to implement, and proved problem solving was not realistic, productivity tools anchored approach merged in. In the early 1990s, there was a trend of looking at the computer as a tool and believing its effectiveness depends on the person's skills of using this tool. Followed was a teacher preparation program renovation, in which almost every teacher preparation program in the United States included either required or elective education technology courses to satisfy NCATE review. Computing

literacy training for teachers was therefore transited to the focus of productivity tools and applications one after another. The common sequences of the training were basic operating skills, word processor, spreadsheets, database, E-mail, and finally multimedia and WWW. The courses tended to provide teachers with the knowledge and skills of using these productive tools. Yet, a faculty survey in 1994 found even worse results of using technology in the classroom. 59% of 750 professors who taught undergraduates said that they never used a computer in the classroom; 19% of them used the computers occasionally and only 8% said that they used computes often. Since 1994, even much evidence of frequent use of E-mail and Internet among faculty and students occurs, less than 10% of the Stanford faculty frequently use these new technologies increasingly. Low-tech teaching exists in high-tech schools (Cuban, 2000).

Current computing education for teachers

Computing education for teachers nowadays is facing the challenge of how to integrate appropriate technologies and strategies for maximum learning. Since 1980s, computers have flooded into schools. Compared with the academic year of 1983-1984, the ratio of students to computers in the school has changed from 125:1 to 12:1 in 1995. A research has found that never a case in the history of American education has so much money been spent with so little thought given to implementation and so little demanded in return (Lockard, Abrams, and Many, 1997). NCATE has set the integrating computer technology in education as one of its criteria for the review of teacher education programs; however, what had been expected to happen did not occur. The implementation is still in struggling, like one jumping on the buses but having no clear destination.

The arguments of computing education for teachers are focused on the question that whether it should be technology course(s) driven or technology/curriculum combination driven in teacher education programs. The former is in favor of keeping or creating computing technology courses in the teacher education program. These technology classes provide pre-service or in-service teachers with different level of computing skills and strategies. It is believed that as far as teachers master these skills and strategies, they will automatically implement technology in their classrooms. The latter prefers to embed computing skill into all courses in the teacher education program, having computing skills and strategies integrated into each specific class. It is believed that pre-service teachers or in-service teachers who have enrolled in teacher education programs will gain the computing skills and strategies bit by bit and eventually be able to use the technology in their classrooms.

Most teacher education programs with technology courses-driven are more likely to have one or two required courses dedicated to the computing education. The courses usually cover productivity tools, e-mail and Internet skills, and multimedia productions. Curriculum/technology combination-driven program requires each curricular content course to integrate one or two computing skills and has course assignments reflect these skills. Should those technology courses be considered as required components in a teacher education program or be eliminated but have each curricular content course covers one or two technological skills? To be or not to be, that is still the question.

Rapid changes in technology pose another challenge for computing education for teachers in the current. Oblinger (2000) believes that these changes are due to four major technologies that will have an impact on global education in the 21st century. The four major technologies are processing power, digitization, networks, and storage. The rapid growth in microprocessor performance doubles every 18 months. It is predicted that the clock rates will move ahead and exceed one GHz or billions of instructions per second within the next decade. Digitization makes more work shifted from physical to virtual, and more new value-added services become possible by re-shuffling pre-existing information in new forms. Increasingly developed network makes it possible to transmit close to 1.2 gigabits of information over a network with current capabilities. That is roughly to transmit 85 books or 39,000 pages of text per second. Data storage has been expended so dramatically that it allows the text of 375 average-sized novels to be stored in a single square inch of disk surface. It is estimated that a high-density CD will have the capacity to store six billion bytes of information, equivalent roughly to one million pages of text.

Because of these rapid changes, technology will become an accepted tool for almost everyone and everything. The virtual will displace the physical for many tasks. The cost of technology is going down, and the access to the technology is becoming increasingly easier. Ideally, the lower costs and improved ease-of-use will allow teachers to use computers more often and implement technology in instruction and learning more effectively. However, few of us need reminders of the rapid pace in the technology industry. It is not difficult to realize that a computer may become out-of-date almost as soon as it is purchased, and

the technology training a teacher receives is no longer applicable almost as soon as he or she goes back to teaching in the classroom. Upgrading software and hardware is taking schools and teachers enormous time, energy, and money to catch up with the current. Should we or can we take a breath to think about how to make the implementation more meaningful or keep catching up exhaustedly with increasingly advanced technology? It is the question looking for an answer.

Another perspective of implementation

Computer is a tool. The actual value of the tool does not solely depend on its quality of advances. Creative use of the tool can make the difference. Common tools, such as Microsoft office and ClarisWorks, have more potentials to help teachers and students build up their dreams. Word processor has more powerful uses than paper writing; spreadsheet is not limited in compiling grade sheets; database can definitely go beyond the student records keeping; and PowerPoint is not only a presentation tool for teachers at all. The authors believe that unless teachers and students use the tool creatively, the implementation can become meaningful. The approaches of integration and applicable strategies of implementation can only be constructed with teachers' curiosity and enthusiasm of using the common tools, and the implementation can only be meaningful when these common tools are aligned with curricular contents.

Facing the rapid changes of computing technology, life long and self-paced learning is a key to the effectiveness of implementation. Obtaining technology training once or twice or having one or two technology classes is not enough. No single teacher education program will be able to provide schools with a fully and permanent qualified professionals. Few of us can anticipate what technology will be available a few months or years from today.

Therefore, implementing technology in teacher education program needs to emphasize the creative use of common tools, such as productivity tools (word processing, spreadsheet, database, and presentation tools), Internet and WWW resources, and multimedia applications. Since these common tools are available in the majority of schools and classrooms, let us have them integrated into disciplinary curriculum and make them be meaningful in teaching and learning. Technology courses will help teachers to master the use of these tools. Alignment of these tools with curricular disciplines will enhance the technology implementation in teacher education program. Meanwhile, teacher education program should encourage pre-service and in-service teachers to work collaboratively and to be initiative to explore new technologies whenever they become available. The commitment of being a life long learner is critical for a teacher to upgrade his or her implementation skills and improve the effectiveness of teaching and learning.

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A Farewell to the Traditional Instructional Media And Technologies in the New Millennium

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Abstract: This paper will review the traditional instructional media and technologies offered in teacher training programs in the past and in some of the programs today, primarily presentation media and technologies, such as audio/video systems, overhead, slide, filmstrip, and opaque projections, and multimedia kits. New technologies in digital information storage, access and retrieval, delivery, presentation, and electronic communications as related to instruction will be examined, discussed, and compared to the traditional instructional media and technologies. Approaches to integrating new technologies into teacher training curricula and programs will also be discussed.

Introduction

Lozano (1997) depicts a vivid picture of a classroom, where traditional media and instructional technology is used, "... the cumbersome and noisy opaque projector, of armloads of slide carrousels, tape players, and handouts resting on purple-stained fingers for trying to mimeograph that elusive image, only to arrive at a new classroom in which the security, on at all times, shone just over the projection screen." Lozano is not exaggerating. This is still the picture in some classrooms or instructional environment today. Some instructors are still using such instructional technologies like films, slides, analog video and audio, overhead projectors, and so on (Lozano, 1997). Not surprisingly, some educational technology programs for pre-service and in-service teachers still have these traditional instructional technologies on their curriculum list.

Instructional media and technologies vary widely in forms and uses. According to Teague, et al. (1994) and Heinich, et al. (1999), traditional instructional media and technology involves overhead transparencies, opaque projections, multimedia kits, 35mm filmstrips, photographic slides, motion picture films, audio recordings, video recordings, display media (chalkboard, pegboards, bulletin boards, posters, etc.), and object media (objects, models, mock-ups). Overhead transparency is displayed via overhead projector. It has been one of the most commonly used tools for presentations in the classroom. Opaque projector is used to present information in a similar way an overhead projector does, but it does not project transparencies. Instead, it presents images of printed materials or real objects. The advantages of using overhead transparency and opaque projection are that one can point to or block out part of what is being shown. On a transparency, one can also add drawings or marks while displaying information. With multimedia kits, one can display several types of media at the same time, such as books, drawings, maps, video recordings, etc. With 35mm filmstrips, one can present still or animated images with a filmstrip projector. A filmstrip can normally hold 25 to 60 frames of images. Photographic slides are made from film slides, but processed by being mounted in 2x2" frames so that images can be displayed via slide projectors. Motion picture films are more vivid when they are presented in the classroom. However, the presentation

requires a 16mm film projector. Traditional audio and video recordings use magnetic tapes to record audio or video information. An audiocassette recorder/player is needed to record and playback audio content. For video, a video camera is required for shooting videos and a videocassette recorder/player and a monitor are needed for playing back the video. Today, most classrooms are equipped with a TV set and VHS VCR for video display. To edit these analog audio or video is a very tedious and time-consuming job, and additionally, professionals and professional equipment are needed for creating high-quality video materials. Display media usually refers to those non-projected visuals, which have been used in instruction for a long time, such as the chalkboard and multipurpose board.

Typically the instructional media and technologies used in schools reflect the curricula of our pre-service and in-service teacher training programs. Teacher training programs determine, to some extend, the diffusion and effective use of new technologies in schools because the trained teachers use the technologies that they were trained with back in their schools. In this sense, the technology that schools will use in the future rely much on the curricula we provide in the teacher training programs today. By examining curricula and textbook contents in some teacher training programs in instructional technology or educational technology, the above mentioned traditional media and technologies are still being taught as major instructional technologies. "Audio Visual Materials," "Print & Non-print Materials," "Television," "Film," etc. are frequently seen in teacher training curricula. Looking at schools, it is not difficult to find that teachers are still depending heavily on the traditional media and technologies listed above.

According to Villamil-Casanova and Molina (1997), we are now living in an information age. In this information age, computer-based multimedia technology has become a major tool for communicators and an effective catalyst for change in all disciplines. Not only has computer technology led to changes in our living environment, but it has also generated changes in our learning environment. Increasingly advanced computer and communication technologies are having an enormous impact on the ways in which educational materials are created, stored, acquired, and delivered to the learners (Barker, 1998). At this juncture, it is the time to create curricular materials to train a new generation of multimedia-assisted communicators (Villamil-Casanova & Molina, 1997). Several "change agents" identified by Barker (1999) are bringing about changes in many academic institutions, and they have served as a catalyst in the change of instructional media and technology. These "change agents" are ease of educational material creation, ease of information storage, ease of access to and retrieval of information, ease of fast and global information sharing, ease of electronic communication, and ease of information presentation and display.

Ease of Educational Material Creation

Traditionally, a variety of appropriate facilities, equipment, techniques, and materials are required to create desired educational materials. Transparencies have to be made and overhead projectors have to be used in order to present information to a larger audience such as in a classroom. Rolls of films have to be consumed in order to create filmstrips. No doubt, special techniques are required to shoot the filmstrips and have them developed before they can be projected with a filmstrip projector. Photographic slides have to be framed in order to be projected on a slide projector. To make photographic slides, one has to use cameras to shoot the images, and techniques to operate the camera, develop the film, and mount the slides are required. To create bulletin boards, letter-cutting device and coloring tools are needed. To create drawings, charts, graphs, posters and the like, various tools and techniques are required. In order to produce high quality sound or video materials, much more sophisticated facilities, equipment, and materials are required, and well-trained professionals are needed, which makes educational material creation very expensive and difficult.

Today, however, all the above-mentioned educational materials can be created with a single tool--computer, though some peripherals and extra compatible equipment are required depending on necessity. Software packages, such as *Microsoft Office* and *ClarisWorks* can be used easily to create charts, graphics, and drawings. Electronic bulletin boards can be created with computer and put onto the network or Internet. Digital camera or scanner can be used to capture digital images. Then using computer, we can create slide shows. Computer sound card and compatible software, such as *Sound Forge* or *Wave Studio* (for PC), or *Sound Edit* (for Macintosh) can be used to produce digital sound or music materials. For video material creation, analog video can be digitized using video capture boards, such as *Targa 2000, AV Master, Video Blaster, MiroVideo DC30 Plus*, etc. The captured digital video can also be edited with such non-linear video editing software as *Avid Xpress, Media 100, Final Cut Pro* (Macintosh only), *Premiere, Speed Razor, Trinity,*

just to name a few. More recently, a standardized digital video interface called FireWire interface (IEEE 1394) provides direct connection between a computer and a digital video camera, such as *Canon GL-1*, which has made digital video creation and editing much easier and time-saving than before.

Ease of Information Storage

Computing technology has made information storage much easier than ever before. Without computer, documents are stored primarily in printed materials. Books, magazines, newspapers are the major media for delivering stored information. Information in other formats, such as sound and video, is stored in audiocassette tapes and videotapes. To save documents, students have to either write them down in a notebook or type them out with a typewriter, or make photocopies. For audio and video, students have to have audiocassette recorder/player to store information on audiocassette tapes and VCRs to store video information. With a computer, however, one can digitize information and save it to a single storage device--the hard drive, or on a floppy disc, removable drive, or optical device with simple button clicks. Furthermore, digitized information can also be saved onto networked servers. This technology brought about the success of information sharing on the Internet. To say it is easier on storing information, not only because of saving data by simply selecting Save function from the menu bar on the, but also due to the ease of making corrections of the stored information. For traditional printed media, it is almost impossible for the writer or reader to make any changes to the original material without repeating the entire creation procedures. While in the process of writing or typing, making changes is no less a hassle practice than that on printed media, let alone making changes in the recorded audio or video information. But information stored in a computer, regardless of its format, can be modified at any time, except when the file is created read-only or burned on to a CD-ROM.

Easy of Access to and Retrieval of Information

The primary way of accessing information before this computer era was to go to a library, search the card catalog, and check out whatever was needed. The real labor was not going to the library itself and check out materials, but the tedious job of going through all the card catalog to find where the information is. The same is true with finding audio and video materials. Whereas with today's networked computers or online computers, one can easily log into a library's database to search for information regardless of the format. For some people, they can do it even without going out of their office or home. Today's Internet, especially the World Wide Web, has become almost an open library, providing information in all formats, text, graphics, images, animations, audio, and video. Many classroom teachers begin to use networked computers to access information for their students during class time. Moreover, teacher-created web pages are on the rise. These teachers put their teaching materials onto the network and/or their own web pages to allow students to access course syllabi, instructions, assignments, test materials, and the results of evaluations directly from computers at school or home. Location is no longer a boundary for accessing information. At home, one can use dialup feature to get onto the Internet through a modem. On campus, students are provided with Internet access from either computer labs or dorms. Even when traveling, one can search information on the Internet by using laptop computers that have Internet access capability. Card catalog system, though simple and inexpensive, but slow and time consuming, has given its position to the fast computer-based automated cataloging system in almost all the libraries in the United States.

Ease of Fast and Global Information Sharing

Because of the ease of creating digital media and material and the ease of storing, accessing, and retrieving information, information is now shared unprecedentedly faster and around the global. Traditionally, information is shared through local public media, such as newspaper, magazine, radio, television and even books. All these take certain time, material, and manpower for creation and then are delivered to the readers or viewers through complicated distribution channels. Educational materials are shared in the same manner. The disadvantages of traditional information sharing is the time delay between

the transformation of information into certain format, such as printed books or magazines, and the information receiver; the duplication of information resource, material, and manpower; and the high cost of distribution. A book on science would take normally over a year before it could reach its readers. A piece of information resource has to be duplicated into numerous copies in order to meet multiple users' demands. Large quantity of materials is consumed for distributing one single information resource when copies of the resource are duplicated, such as book copies or video copies. Meanwhile, matching manpower has to be involved in the duplication and distribution of the duplicated copies. However, information technology has changed fundamentally how information is shared.

Today's information sharing is moving toward on-line formality. Information is stored digitally and put into either local network for local sharing or onto the Internet for global sharing. To share information on-line, there is only minimum information resource duplication since the resource, once on-line, can be accessed without time and place restriction (unless the resource is purposely controlled in that way). Since resource duplication is minimized, materials and manpower required for the resource duplication is reduced to the minimum, too. Books, magazines, newspapers, audio and video materials have all been witnessed on the Web today. For example, a book can be saved as PDF (portable document format) file and put onto the Web. With Acrobat Reader software, one can either read it or print it out easily, or download it to the local drive and read or print it later on. Only one resource and one distribution channel, the Web, needs to be used, and it can be accessed twenty-four hours a day, seven days a week. Sharing multimedia information on the Web has become a trend, challenging the superiority of CD-ROM, one of the major media devices for multimedia distribution today.

Sharing information on-line is also changing the way we teach in schools, where computers are in use and wired to the Internet. The traditional one classroom with one TV/VCR environment is being replaced with one-computer or multiple computers plus Internet environment. Teachers therefore can share global information with students in their classrooms. They can create their own web pages easily with web authoring tools such as *Learning Space*, *TopClass*, *Quest Net Plus*, and the like, and have their web resources shared not only with their own students, but with other students and colleagues in the world.

Ease of Electronic Communication

Electronic communication has been in use for decades, but never before has it been so popular and easy to use as today, due to the availability of computers and the Internet. E-mail, used by millions of people, has become a daily activity for most of us. In recent years, voice mail, video email, and desktop video conferencing have gained popularity. Microsoft's *Net Meeting* is being used by millions of people around the world for on-line video communication. PC-to-PC calls, particularly PC-to-Phone calls such as *MediaRing Talk* and *DialPad*, are attaining prevalence. Without exception, the ease of electronic communication is affecting classroom instruction greatly. Distance education is the area where a revolution has been witnessed. "Correspondence course" and educational TV are no longer representing distance education. Instead, in its place arise communications technologies. E-mail and webboard are used to offer on-line courses. World Wide Web is employed to offer web-based courses. Two-way interactive video network, which involves computers, compressed video technology, telephone lines, and television technology, is taking the lead in distance education to deliver live courses over a great distance. A recent study found that 58% of two-year and 62% of four-year public colleges offer such kind of distance education courses (Hodgson, 1999). Furthermore, virtual universities (Barker, 1999), which hold no campuses, have been set up to offer complete degree courses on-line.

Ease of Information Presentation and Display

Traditionally, in the classroom, information is displayed by using chalkboards, multipurpose boards, pegboards, bulletin boards, or flip charts (Heinich, 1999). They are teachers' basic instructional tools. Though simple to use, instructors have to manually write things on and erase them off every time when they use chalkboards or multipurpose boards. Writing and erasing on these boards in the classroom consume plenty of valuable instruction time. To project instructional materials in the classroom, overhead projectors,

slide projectors, and the like have to be used. To display video information, TVs and VCRs have to be available.

Information technology has brought tremendous impact on classroom presentation and display today. Computers can be used to create teaching notes for classroom presentations. *PowerPoint* has been a favor of teachers and students for classroom presentations. With *PowerPoint*, presentations can be made and modified shortly before the actual presentation. The advantage of using this software for presentation also lies in its ability to incorporate images, graphics, charts, animations, even sound and video. Presentations can be saved digitally and reused at any time later on. No more tedious and labored work on preparing presentations with traditional presentation tools! No more chalk dust or the labor of writing and erasing on boards because all these jobs can be done on a computer! Another advantage of using digitized presentation is that if the presentation is saved on the network server the instructor can pull up the files and make presentations with computers in other classrooms or at other locations as long as these computers are on the same network. Or the digitized presentations can be put onto the Web and displayed with web browsers.

Of course, a projector is needed if the computer presentation is to be projected. A LCD projector such as *Infocus*, *Proxima*, and *3M* will do the job. Since images, graphics, charts, animations, sound, and video are all digitized and/or incorporated into computer software, LCD projector can project them without involving other equipment. A LCD projector is relatively expensive at this time, but it will be commonplace as we move into the new millenium since the cost is falling.

Image display has taken dramatic change from the traditional instructional technology to today's advanced computer technology. Filmstrip technology has already become an antique. Slide projectors and overhead projectors are being replaced with digital projectors. Opaque projectors have given their positions to visual presenters like *Elmo* (also called document camera). Scanner is now used to digitize film-based images. Digital camera eliminates film by digitizing images on a chip, like *Kodak DC* series or Sony's *Mavica*, which captures images directly to a floppy disk. Using software like *Photoshop*, the digitized image can be edited and incorporated into various kinds of applications for display, which are almost impossible for traditional printouts.

Traditional video display has been relying on TV and VCR. Analog video creation is expensive and complicated. Editing analog video is more expensive and complicated. It requires high-end facilities, very expensive equipment, and well-trained professionals to complete the job. Laser disc has been accompanying TV and VCR in the display for some years. The size of the laser disc is huge, and it can only hold about 30 minutes of video on one side. However, today's video creation and editing is no longer as it was in analog video, thanks to the digital technology. Digital video, as mentioned earlier, can be captured using digital video camera and transferred to computer easily by using standardized interface. Non-linear digital video editing has completely changed video editing system. After the video clip is digitized, all needed for editing is the computer and compatible software. Video clips can be cut and expended to the specific frame. Video effects can be superimposed with almost unlimited layers. Sound can be added and edited with simple clicks, drags, and drops. Tools for shooting video footage are turning into digital, too. New DV video cameras or camcorders can capture video in digital format directly on the videotape. The cost for a DV video camera has dropped drastically. Couple of years ago, a high quality DV video camera would cost between $10,000 and $20,000. Today, a Canon GL1, with the same high quality, is only around $2,000. This DV video camera has a LCD color-viewing window, and it can serve as a viewing monitor for editing. This new digital video technology makes video capturing and editing at an affordable level, even for home entertainment.

While video turns digital, presenting video on the Web is challenging for new technologies. Video files are usually very large, making it much difficult to be played back on the Web. Nevertheless, new technology has made it possible with relatively lesser problems. To solve the playback problem on the Web, video compression is used. The technology is also called streaming video. The three major web video players on today's market are Apple's *QuickTime*, Microsoft's *Window Media Player*, and RealNetwork's *RealPlayer*.

Curriculum Issue

Giving money to schools or purchasing new technology for schools is a way to insure that schools get the new technology, but it is not an effective way for integrating technology into instruction. Over the past decade, school districts have spent billions of dollars on classroom technology, yet the classroom has changed little (Yao, et al., 1999). One of the major problems that schools are encountering is the lack of

trained teachers who know how to use and diffuse the new technology. To solve this problem and help schools use new technologies, especially the new instructional media and technologies, we need to shift the training focus into the renovation of the curriculum for pre-service and in-service teacher education programs. Graduates from a teacher training program should be the leader in using and diffusing new technology in schools, but they can not take up this responsibility if they are not trained with new technology while they are in the teacher training program.

Experience tells us that appropriate curriculum change can make a big difference. Curricula designed for technology should follow the current technology trend. Courses designed for technology should follow a sequence, which introduce technology in an adaptive and logical manner and introduce current technology that are appropriate for schools. Some teacher training programs have only introductory courses on computer literacy, which focus on basic computer applications, such as word processor, spreadsheets, database, and so on, but do not have introductory course on instructional media and technology. Some may have courses on instructional technology, but those courses still hang on to the traditional technologies. This problem needs to be addressed. In addition to introductory courses on computer applications, a course, which introduces current instructional technology, should be arranged for new students in the program. Also introductory courses on instructional design, human computer interaction, and learning theories should be offered. Based on these courses, other courses offering digital audio and video, web design, multimedia production, and courses of such nature should follow. This kind of design for teacher training program can help ensure that students trained in this program will have the knowledge and techniques on using and diffusing the current instructional technology.

Conclusion

It is apparent that computer-based instructional media and technology has far more greater advantages over traditional media and instructional technology in almost all the aspects: Educational material creation, information storage, information access and retrieval, information delivery, and information presentation. Moreover, the industry is switching from the traditional technology towards the new digital media and technology. As digital media and technology advance in the new millennium, some of the traditional instructional media and technologies will remain in use, most of them will give way to the digital world. It is the time when we can say a farewell to the traditional media and technology as we walk into the new millennium.

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The Technology Facade

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Abstract: This paper reports on the design, development, and application of a Checklist intended to assist educators in recognizing strengths and weaknesses in their technology-based programs at their institutions. The Checklist sampled public and private schools to validate the existence and impact of the Technology Facade. Initial findings indicate that schools have masked the effective use of computers labs and classroom computers behind the auspices of teacher activities, student participation, and parental involvement. The study and suggests possible courses of action to address deficiencies in the use of technology, the construction of the necessary infrastructure, and the design of a viable instructional strategy.

Introduction

The Technology Facade…have you seen it? Has anyone mentioned it to you? Do you know what it is? Although a precise definition may elude us at the outset, as dedicated educators, we probably know it when we see it. Consider these scenarios….

"A state-of-the-art computer lab is filled with Macintosh or Windows personal computers. They sport the latest processor, the fastest CDROM player, the largest memory capacity, and the most sophisticated multimedia sound system. But students are not permitted in the lab after school and no one can use the machines unless the computer teacher is present."

"A school district handbook contains a Technology section lauding the expensive inventory of hardware and software recently purchased and installed courtesy of the local PTA. After nearly two years of bake sales, candy drives, and magazine campaigns, we have the most up to date computer systems available. But not a single teacher, much less any member of the staff, has been. Students know more about how to operate these tools than their teachers."

And, finally… "A technology coordinator briefs visiting dignitaries on the benefits of computers to our school. No one asks the teachers. And, of course, the technology coordinator does not have the educational vocabulary much less the classroom experience to communicate with teachers who are being pushed to integrate technology into their curriculum."

Do any – or all – of these scenarios sound familiar? If so, welcome to the Technology Facade. Much like a guided tour through the back lot of a famous movie studio, with its false fronts and hollowed out sets, the Technology Facade presents a false sense of activity and substance with respect to the uses of technology in the school. Shiny computer labs, ill-prepared and overworked technology coordinators, and last minute budget re-adjustments run counter to a technology-based curriculum that deserves to be grounded in proven pedagogy, a viable support infrastructure, and sound fiscal propriety.

For many schools (and many more students), this is the reality of technology in the classroom. This article will help you recognize the Technology Facade in your district, your school, and most importantly, in your classroom whether that be as a teacher, student, or concerned parent. The Facade can only be overcome by a steadfast refusal to be taken in by what appears on the surface. It takes a willingness to displace the facade with a robust structure to bring about real change in the classroom of the 21st century.

Defining The Technology Facade

The Technology Facade is best described as "the use of technology in a school without benefit of a necessary infrastructure to support its application as a viable instructional strategy." Key elements of this definition provide some common understanding about terminology: technology, infrastructure, and instructional strategy." The Technology Facade occurs when we fail to understand that the educational imperative of technology involves the integration of computers and software with learning strategies, developmental principles, and pedagogical ideals to solve real-world educational problems. The Technology Facade occurs when we fail to understand that technology is an on-going process that demands the time, attention, and dedication of many competent people; a significant and consistent level of financial investment; and, a commitment of resources that will necessarily be diverted from other critical school-wide obligations. And, finally, the Technology Facade occurs when we fail to equip our teachers with the necessary skills to successfully prepare, present, and evaluate instructional lessons using technology.

The Study

The Technology Facade Checklist (Tomei, 1999) was developed for application to schools and school districts. A selective sample of public and private schools was chosen to validate the Checklist and to test for the existence and impact of the Technology Facade on a variety of institutions representing a range of student populations, ethnic diversity, teacher preparation and in-service programs, financial support capability, and instructional focus. In conjunction with the Technology Facade definition, the 20 item Checklist includes questions categorized as Use of Technology, the Necessary Infrastructure, and a Viable Instructional Strategy.

Use of Technology. Questions pertaining to the Use of Technology focuses on access to computer facilities, incorporation of technology-based competencies in classroom lessons, status of hardware and software, use of computer facilities for classroom instruction, and the ratio of students to computers (in both classrooms and computer labs). They include:

1. Are the computer labs in your school used by classroom teachers or is the computer teacher the only educator who dispenses technology-related instruction? This item uncovers the practical, daily applications of technology by all teachers within the school, not only the computer teacher.
2. Are computer facilities locked or are they available to teachers and students during recess, study halls, lunch, and before and after school or when there are no classes scheduled? This item determines whether computer facilities are for "show" or provide a workplace suitable for teacher and student advancement in technology.
3. Are teachers expected to include specific learning objectives related to technology-based competencies in the Lesson Plans? Teachers should incorporate specific learning objectives dealing with technology in their lesson plans; most states already require technology-based competency standards.
4. Does the software found on computers reflect current classroom curriculum? Or, is the computer software outdated, seldom reflecting what student are doing in the classroom?
5. Do classroom teachers use computers for grades, lesson preparation, out of classroom assignments, and professional self-development? Many teachers are forced into using technology by principal, peers, or parents. This item examines four particular uses that evidence commitment on the part of teachers to model and demonstrate technology in the classroom.
6. Are major computer facilities located in the school's Library, classrooms only, or a majority of regular classrooms? Most schools are moving away from the computer lab as the single focal point for classroom technology. This item awards extra points for those schools who are integrating technology in the classroom.

Necessary Infrastructure. Items regarding the Necessary Infrastructure include related issues of teacher training, preparation, and incentives; strategic technology planning and funding; professional staffing of technology facilities; and, replacement policies for the school's technology. They include:

7. What is the extent of technology training received by teachers? Research has found that many of our teachers have received no training or initial training only in technology. Others receive in-service training on technology or are provided training classes upon demand. The very best are offered formal programs in instructional technology programs.

8. Who is participating on formal committees, teams and boards pertaining to the use and development of technology in the school? Schools tearing down the Technology Facade include teachers, administrators, parents, alumni, community leaders, and even students on their committees for technology budget preparation, curriculum technology, technology planning, and hardware and software acquisition.

9. Are technology funds provided by PTA magazine drives and bake sales and end-of-year fallout monies or is it included in the General Operating Budget as a specific, recurring line item? A critical measure of the Technology Facade is whether technology is given equal weight with other school programs and projects or funded with leftover monies at the end of the academic year.

10. For teachers who develop technology-based instructional materials, do they receive compensatory time, monetary compensation, or other specific remuneration? If not, perhaps the schools has recognizes excellence via school newsletters, bulletins, and school board reports. Regardless, the Technology Facade is greatly affected by teacher attitudes. If the school sees no merit in instructional technology – and evidences that value with tangible rewards – teachers will ignore the rhetoric to the detriment of the technology program.

11. Is there a Technology Plan for the school and is it revised on a regularly scheduled basis? A viable Technology Plan is critical to meeting the long-range goals of the school.

12. Does the school's Technology Plan contain the following: vision/mission statement; demographics; procedures for purchasing, maintenance, facilities, and security; curriculum impact; a plan for the use of technology for lifelong learning, special needs learners, and exceptional learners; and, an evaluation plan? Many plans are in "name only." A viable Technology Plan includes most, if not all, of the items mentioned in this Checklist question.

13. Does your school provide a computer teacher, computer technician, and/or a technology coordinator? Most schools in the grasp of the Technology Facade place all of these responsibilities in the hands of a single individual – sometimes even a teacher with a full or part time load.

14. Are the majority of computers in the school less than two years old, CDROM-capable, connected to the Internet? Some schools will declare their commitment to technology and still employ outdated systems incapable of running today's educational software packages and unable to access the wealth of materials on the World Wide Web.

Viable Instructional Strategy. Analysis of a Viable Instructional Strategy is supported by questions related to scope and sequencing of technology-based skills/competencies; use of lesson planning for technology-based learning objectives; incorporation of teacher vs. professional materials; and, student assessment of learning opportunities with regards to technology. They include:

15. For technology-based lessons, has the school developed a "scope and sequence" to include technological competencies for all students, by grade and subject area? "Scope and sequence" is a tool used by educators to design a curriculum with explicit learning objectives (scope) delivered in a precise arrangement (sequence).

16. Is there evidence of behavioral learning objectives that include the components of behavior (action to be performed), condition (tools to be used in the instruction), and criteria (assessment standards) in these lesson plans? A teacher's lesson plans should include specific learning objectives (based on a preference for the behavioral, cognitive, or humanistic teaching style) when using technology-based resources.

17. When using technology-based lessons in the classroom, do teacher prepare their own Handouts, study guides, and workbooks to guide the lesson presentation? An over-reliance on "off the shelf" instructional materials is one indication that teachers are not truly committed to learning how to use instructional technology. They should be designing some of their own materials to ensure the instruction is addressing the learning styles of their own students.

18. When classroom teachers wish to use technology resources to present a lesson, are the computer labs available for scheduling without significant delays or are they always filled with students who are "required" to receive a certain amount of lab time each week? The Technology Facade manifests

itself by computer labs occupied by students who are there only because "every students gets two hours of computers every week" whether they are addressing technology competencies or not.

19. Do students in the computer classroom/laboratory describe their experience as play time or preparing them for self-learning and future vocations? Students know when their computer time is productive. The Technology Facade Checklist actively solicits their input.

The Technology Facade Rating. The final item on the Checklist (Item 20) rates the School and compares their Composite Score against the following Standard, see [Table 1].

Total Possible Point: 200	*Your Composite Score ____*	*Your Facade Rating ____*
175 - 200 points	Outstanding Technology Program	**A Rating**
125 – 175	Satisfactory Technology Program	**B Rating**
100 – 125	Modest Phase of the Technology Facade	**C Rating**
75 – 100	Moderate Phase of the Technology Facade	**D Rating**
< 75	Severe Phase of the Technology Facade	**F Rating**

Table 1. Technology Facade Rating

Findings

See [Table 2] below. The primary component which seems to detract most from the successful implementation of technology is, not surprisingly, the Necessary Infrastructure. On average, the sampled schools lost 57.6% (58.8 out of 102) of their possible points in this category. On the positive side, the Use of Technology scored highest with 62.4% (39.3 out of 63) of the possible points. A Viable Instructional Strategy found middle ground with 59.4% (20.8 out of 35).

Item	Pts	Average Score
1	7	5.2
2	7	4.4
3	7	3.8
4	7	5.3
5	28	15.3
6	7	5.3
Ave	63	39.3
7	7	4.0
8	32	13.1
9	7	5.3
10	7	2.2

Item	Pts	Average Score
11	7	5.8
12	20	11.6
13	17	12.4
14	5	4.4
Ave	102	58.8
15	7	2.6
16	7	2.8
17	7	4.3
18	7	5.8
19	7	5.3
Ave	35	20.8
20	200	118.9

Table 2. Technology Facade Checklist Results

It is interesting to note that several questions contributed to overall low scores more than others. For example, few schools provided any incentives (Item 10) for teachers who went the extra mile to prepare technology-based materials for their classroom. Items 3, 15, and 16 contributed to an overall poor showing with regard to lesson planning and learning objectives – a trend that should demonstrate the need for school administrators to begin working more closely with their teachers with regards to curriculum redesign to integrate technology into classroom instruction.

Conclusions

In the final analysis, most schools sampled merited a solid C Rating with an average Composite Score of 118.9 points. Only one school warranted an A Rating and several received the F ranking. An interesting note: many schools had an intuition, before applying the Checklist, that their institutions would fare much better than they actually did. Several administrators were terribly disappointed in the final results; however, none questioned the validity of the checklist, the appropriateness of the points awarded, or the areas of emphasis for the purpose of assessing technology-based school programs.

The Technology Facade is all too real. Does it exist in your school? The Checklist can help you recognize problems with your school's instructional technology program. Share the results with your administrators -- along with your volunteer statement to help tear down the Technology Facade and replace it with a viable program. Good luck.

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Technology Planning and Technology Integration: A Case Study

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Abstract: The purpose of this study was to consider how the development of a school district technology plan facilitates meaningful use of technology in the classroom. One school district's experiences were the focus of the case study, from the formation of a technology planning committee to the implementation of an expanded use of technology in upper-elementary classrooms. Components of the research include document analysis of a district technology plan, interviews with technology plan committee members, fieldwork observations and interviews with teachers. The study demonstrated that effective technology planning can lead a district through establishment of a technology infrastructure, including a district-wide network, Internet access to all classrooms, and high quality staff development. Findings suggest that teachers need curriculum integration support, beyond what is often provided in the technology plan, in order to take full advantage of available technology.

School reform continues to be a focal point in education today, as it was in 1983 with the publication of the *A Nation at Risk* report (National Commission on Excellence, 1983). School improvement planning and technology integration are two areas that emerge from the reform agenda in K-12 education today (Mehlinger, 1995; President's Committee of Advisors on Science & Technology, 1997). Technology integration is offered as one of the cornerstones of the school reform effort (Collins, 1991; David, 1991; Kelly, 1990, Pearlman, 1989). However, Mehlinger makes the point that "we have scarcely begun to understand the role technology will play in schools of the future. ...Technology is not merely another reform idea, like site-based management or ungraded elementary schools; it will force a reconsideration of the very nature of schooling itself" (Mehlinger, 1995, p. 8). Schools are investing large sums of money into hardware and software, with the expectation that teachers will use instructional technology to improve student learning (Hope, 1995; Means & Olson, 1994; Office of Technology Assessment, 1995). Research shows that technology use in classroom instruction is increasing, however, meaningful integration into the curriculum remains the exception rather than the norm (Dryli & Kinnaman, 1994; O'Neil, 1995).

Researchers have identified many barriers to the use of instructional technology (Marcinkiewicz, 1994; OTA, 1995; Smith & O'Day, 1990), including lack of access to suitable hardware, poor quality software, inadequate staff development, lack of technical assistance, and teacher resistance to changing instruction. Planning guides for technology advise school districts to address these issues in their strategic plans and administrative practices (Dryli & Kinnaman, 1994; Kimball, 1996; Kimball & Sibley, 1997). However, it is difficult to sort out the factors related to the planning process from the implementation factors involving changes in instruction and learning.

The state of Iowa made efforts to help school districts make advances in use of technology through state funding initiated in 1996 (Iowa code, §295, 1996). A requirement of the funding was the development of a multi-year technology plan. The purpose of this case study was to examine whether development of the required technology plan facilitates meaningful use of technology in the classroom. The study began with the selection of one Iowa school district, Boone Community School District (Boone CSD), based on its strong technology plan document. The district's planning process of 1996/97 was examined retrospectively. The study then followed the implementation of a planned technology integration project at the upper-elementary classroom level. Each classroom, grades 3-5, received a second computer at the beginning of the 1998/99 school year, explicitly for student use. Classrooms doubled their access to technology by having available two multimedia, Internet-capable computers and the means to display the computer image on a classroom television. For teachers not yet using technology with students, this new addition to the classroom sent the message that technology should be integrated into the teaching and learning process.

Review of Literature

The President's Committee of Advisors on Science and Technology (PCAST, 1997) recently published the *Report to the President on the Use of Technology to Strengthen K-12 Education*. In the report, the promise of technology's role in school transformation is expressed.

> While a number of different approaches have been suggested for the improvement of K-12 education in the United States, one common element of many such plans has been the more extensive and more effective utilization of computer networking and other technologies in support of a broad program of systemic and curricular reform... Particular attention should be given to the potential role of technology in achieving the goals of current educational reform efforts through the use of new pedagogic methods focusing on the development of higher-order reasoning and problem-solving skills. (p. 6-7)

While Kimmel and Deek (1995) agree that technology can play a key role in the school reform effort, they warn that educational technology should not be considered a "panacea for educational reform" (p. 327). They stress that curriculum, in the hands of good teachers, should drive the use of technology. They identify active student involvement and integration of technology as two educational practices growing out of the school reform movement. Collins' (1991) survey of the literature on the role of computer technology in school reform agrees, but he adds that classroom use of technology may help to reduce the didactic style of teacher-led instruction and allow a more constructivist practice in teaching and learning (p. 36).

Although gains have been seen, the full impact of instructional technology has only been seen in a small portion of classrooms (Becker, 1994). This is due in part to administrative and organization factors at the district-level. To help with these district-level decisions, a number of guides to the technology planning process have been developed (Anderson, 1995; Kimball & Sibley, 1997; NCRTEC, 1996). In a study of technology planning in California schools, Kimball (1996) identified components of strong technology plans by reviewing available educational research and planning guides. He then confirmed the findings by surveying technology practitioners in California. This process yielded nine essential components for a strong technology plan (Kimball, 1996, p. 74). These components are (1) broad-based support in the planning process, (2) comprehensive needs assessment, (3) vision based on the school district's overall vision, (4) goals based on the vision, (5) action plans for achieving the goals, with timelines, responsibilities, and budget, (6) plan for evaluation of progress, (7) multi-year planning, (8) elaboration on the curriculum integration of technology, and (9) planning for staff development. In Kimball's examination of the plans required by California legislation, he found that only 47% of the districts submitted plans, and these were of "questionable quality and indeed, ... for the most part inadequate" (Kimball, 1996, p. 83-84). Dyrli and Kinnaman (1994) also found technology plans to be inadequate. The focus of many technology plans has been on hardware acquisition, resembling a shopping list of the latest fads, without apparent thought to integration into teaching and learning.

To remedy this situation, most planning guides recommend that the technology planning committee begin by identifying the district's vision for learning, then determine how technology can support that vision. Only then is the committee ready to begin the process of needs assessment, goal setting, and action planning.

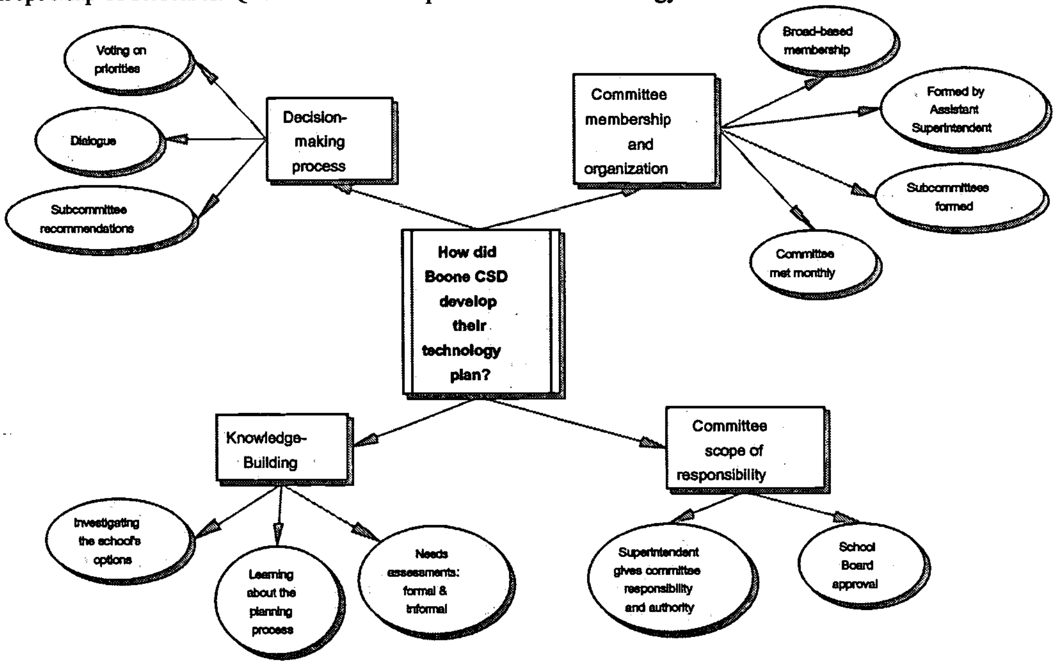
To better understand these issues, two research questions were addressed. (1) How did Boone Community School District develop their technology plan? (2) How did the district's technology planning process impact the integration of computer technology into the teaching and learning process? Descriptive, qualitative case study was selected as the primary research method for the examination of the efforts of technology integration in one school district. Components of the research included document analysis of a district technology plan, interviews of people involved in the technology plan preparation, fieldwork observations and interviews with teachers.

Findings

The Iowa School Improvement Technology Act (Iowa code, §295, 1996) required school districts to submit a board-approved technology plan to their regional Area Education Agency (AEA) by June 1, 1997. Boone Community School District began to develop their plan in September 1996. The development process was detailed during interviews with seven members of Boone's Technology Committee and through review of the completed *Educational Technology Plan* (Boone CSD, 1997).

Important components of the technology planning process that emerged from interviews include "Committee Membership and Organization," "Committee Scope of Responsibility," "Knowledge-building," and "Decision-making and Writing Process." These components are illustrated in Figure 1.

Figure 1
Concept Map of Research Question 1: Development of the Technology Plan



The formation of the Educational Technology Planning Committee was a first step in the development of the plan. Members were selected by the assistant superintendent to represent the elementary buildings, middle school, and high school. Community members and support staff were also selected. All of the district media specialists served on the committee. The committee met monthly throughout the school year under the leadership of the assistant superintendent and district media specialist. Members felt the Technology Committee represented the district well, although having twenty members made the process difficult at times.

After initial work trying to write a vision statement as a whole committee, the need for subcommittees or work groups was recognized. A vision subcommittee was formed, as well as other subcommittees to investigate hardware, software and curriculum, personnel, staff development, and staff competencies. The subcommittees met as needed to discuss options and develop recommendations to the larger committee. Subcommittees were credited with allowing leadership to emerge. One member commented,

> We had members of the committee who were very effective. When we divided up into subcommittees different people took leadership roles and really got their subcommittees going.

The district's superintendent did not directly participate on the Technology Committee but a committee member commented, "He met with our committee maybe the first meeting and said his main concern was to get more technology, especially computer technology, into the hands of the kids." The superintendent was also instrumental in authorizing the Technology Committee to allocate the budget available through state technology funds and other sources.

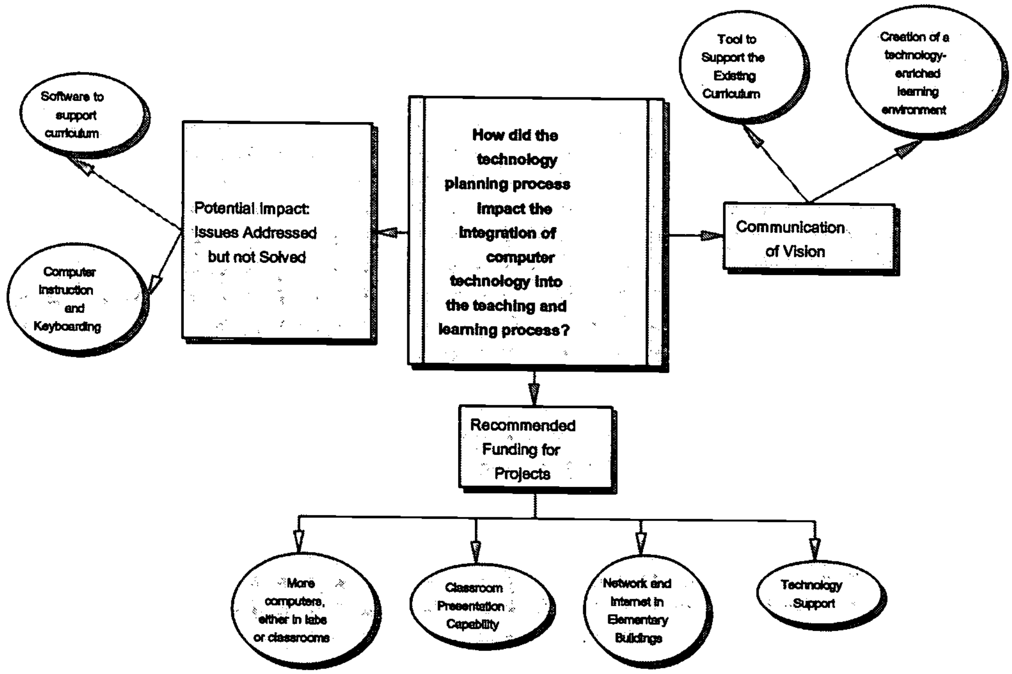
Committee members and district administrators recognized their scope of responsibility to include hardware, software, technology support personnel, staff development, and networking. Several members mentioned that the superintendent, when asked to make a decision related to technology, would suggest that the person "take it to the technology committee and see what they want to do." Looking back over the past years since the plan was written and approved by the board, one committee member expressed, "I think that our committee really worked hard that first year, but I think it has been rewarding because our plan does actually guide what we're going to do."

Committee members spoke about areas of knowledge they needed to develop in order to complete the technology plan. They needed to learn about effective planning processes, the existing situation in their schools, and the range of possibilities with instructional technology. They gained this knowledge through research, participation in an AEA Technology Planning Institute, and by conducting needs assessments.

The Technology Plan was written over a period of one school year. The process required the committee to make many decisions related to vision, goals, and priorities for action. They divided into subcommittees for some of their tasks, but they came together to vote on priorities at the end of the year. The plan was completed and presented to the school board in May, 1997. It was approved and implementation of the plan began immediately. Unlike many of the school districts in Iowa, Boone CSD did not limit itself to one year of planning. The Technology Committee continued meeting monthly during the 1997/98 school year and the 1998/99 school year, adding written updates yearly. The committee adjusted their planning by adding students to the committee and by establishing different subcommittees as needs arise. The Technology Committee's decisions continue to drive the development of technology resources within their district.

The connection between the technology plan and the resulting use of technology at the upper-elementary level in Boone CSD was examined by document analysis of the plan using Kimball's (1996) components of a strong plan and through interviews with committee members, administrators, and classroom teachers. Two areas of impact emerged from the data: "Communication of the Vision for Technology" and "Funded Projects Impacting Classroom Integration." A third area of discussion related to "Potential Impact," which includes planning decisions that have not yet been resolved by the district. See Figure 2, Technology Plan's Impact on Integration, for a diagram of the concepts that emerged relative to this research question.

Figure 2
Concept Map of Research Question 2: Technology Plan's Impact on Integration



The *Educational Technology Plan* (Boone CSD, 1997) included a strong statement of the committee's vision of the role of technology. The following statement communicates that vision clearly:

> Integrated technology is an essential element of both active learning and schools as learning communities. It is the use of a computer as a tool in the classroom, where students and teachers have immediate access when needed to pursue a specific line of inquiry, build meaning, or interact locally or globally, through the use the Internet/World Wide Web. (BCSD, 1997, p. 8)

Student use of technology is stressed, rather than instructional management uses. Technology is referred to as a tool to support the existing curriculum, rather than a subject area. The plan's stated goals include one related to improvement of student performance in the areas of reading, writing, speaking, listening, mathematics, reasoning, studying, and technological literacy. Another goal addresses the creation of "learning environments which make use of technology for problem solving, critical thinking, creating and designing" (Boone CSD,

1997, p. 5). The learning environments are to be provided early in the student's schooling and include quality facilities with flexible access and appropriate personnel to support their use.

When comparing the plan's stated vision of the role of technology with the teachers' views, we see many of the same elements. Teachers most often described the role of technology at the elementary level to be a tool to support the curriculum in areas such as writing, communicating, and research. A fifth-grade teacher expressed her belief:

> I hope that students are seeing the technology as a tool to help them with research, like when we use the various CD-ROMs. With word processing, they see that it is a tool for them to communicate their finished published product. They should be getting to the point where they work fairly independently. They're using it as a tool to get to some of those other kinds of things like research and publishing.

It is unclear whether the committee's vision about the role of technology helped influence the teachers' visions. It could be the case that the committee represented the teachers well and that the resulting vision reflected the teachers' beliefs. In any case, the plan helped to reinforce the idea that technology is a tool to support the curriculum, to enrich students' learning, and to prepare students for the technological future.

A notable way that the technology plan impacted the integration of technology in the upper-elementary classrooms was through the recommendation of project funding in the areas of networking, hardware, and technical support. Resources provided in the plan allowed more student access to technology. However, as issues moved closer to curriculum and pedagogy, the committee seemed to have more difficulty identifying options and solutions.

The technology planning process had a significant and positive impact on student use of technology in the upper-elementary classrooms. This was achieved through the committee's communication of a vision of technology-enhanced learning and through funding of technology projects such as Internet, email, computer presentation capability, and two multimedia computers in each classroom. The difficulties seem to reside in areas that are outside the Technology Committee's scope of responsibility, namely the curriculum and pedagogy at the upper-elementary level. The existing district committee structure provides a means to address those issues, but the funding does not follow the responsibility. Again, this is an area for continued collaboration and planning.

Conclusion

The qualitative case study showed that Boone CSD was successful in writing an effective technology plan to lead their district through establishment of a technology infrastructure, including a district-wide network, Internet access to all classrooms, and high quality staff development. A strong technology committee evolved whose members built expertise, made difficult decisions about complex issues, developed a plan, and managed the change process over three school years. Leadership relative to instructional use of technology emerged from the administrators, support staff, and teachers throughout the district. Teachers, students and principals were eager to establish greater integration of technology into the formal curriculum of the school district.

The technology plan helped to communicate a shared vision about the potential impact of technology on student learning and preparation for their future. The vision was multi-faceted, including technology as a tool to support the existing curriculum and creation of a powerful learning environment where students can use technology as a way to solve problems. However, there is more to making these changes than providing access to classroom computers, display capabilities, and an Internet connection. Use of technology to support learning or to solve authentic problems does not come from exposure to technology alone. Teachers need to develop expertise in curriculum, technology, and effective teaching strategies in order to make the vision attainable. Boone CSD's committee structure appeared to make this difficult because the technology expertise had been isolated from those making curriculum decisions.

This research showed that the technology plan and planning process provided the means to integrate technology, but more work remains to be done before teaching and learning change significantly. As the issues move away from infrastructure and closer to curriculum and pedagogy, the decisions move away from the technology leaders and the Technology Committee. It became increasingly apparent to the researcher and the district's educators that curriculum leadership needed to join with technology leadership in order to take the district to the next step in this process. The results reveal the district has progressed in terms of technology integration, but the results must be seen in the context of looking at only one small part of a longer journey of school improvement.

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Effective Curricular Software Selection for K–12 Educators

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Increases in the availability of technology, the range of content software, and curriculum via the Internet have placed countless options in the hands of teachers. Similarly, increasing accountability has placed added pressure on teachers to meet stated objectives and ensure student performance. How can teachers optimize available technologies and related content to support classroom efforts? Effective decisions are based on clear understanding of the challenge or challenges to be addressed, selection of software based on the identified challenge, dedicated classroom usage, and evaluation and implementation modification as required. The 4DIEM Model supports teachers as they engage in selection of technology-based content.

The last five years have increased the amount of technology available to classroom teachers. Personal computers, networked classrooms, and the Internet–in addition to televisions, VCR's, Videodisc players, video cameras, digital cameras–all provide opportunities to extend classroom resources and present informational and educational materials to students. Between 50-89% of school library media centers in the United States have Internet access; 30-79% have access via computer labs.

With hardware and an access infrastructure increasingly in place, attention moves from the technology itself to the content provided via the technology. Educators are faced with finding technology-based content that:

- is correlated to district and state standards;
- makes full use of the features and advantages of technology;
- is easily integrated into the classroom;
- provides meaningful feedback;
- and is pedagogically sound, rich, and motivational.

Our experience working with three different software vendors and schools in each of the 50 United States has provided valuable insight as we seek to provide at least a partial solution to these technology-based problems. While attention has been given to specific guidelines for *review* of a specific software program, less attention has been dedicated to the larger issue of *matching educational software to specific needs.* Our intent is to encourage simple planning and assessment, followed by evaluation, to increase the effectiveness of any type of software technology purchased and implemented in the classroom. By pre-defining needs and selecting technology interventions matched to those needs, educators can optimize their available resources and the content provided to their students.

According to Dale Mann of Teachers College, Columbia University, "The school is the last unreformed institution from the 18th century that we are about to trundle, unreformed, into the 21st. Agriculture, medicine, commerce, transportation, and communications have all transformed" (Mann, 1999). We encourage you to play a part in the transformation of education.

Content Software and Internet Resources

Diverse pedagogical approaches provide the underpinnings of most effective educational software and Internet activities. Software and Internet-based experiences can be routinely placed into one or more of the following categories with which educators should be familiar as they evaluate content options.

Tutorial
Tutorials present a new concept. They often employ text, illustrations, description, or simulations to teach a specific task, skill, or application. Most productivity software packages include a tutorial to teach the user how to use the application. Many educational software programs provide step-by-step instructions describing how to perform an objective and include examples of problems and solutions.

Drill and Practice
Drill and Practice software targets the reinforcement of skills, most often by shaping user behaviors. Mavis Beacon Typing Tutor and Math Blaster are examples of this type of software.

Simulation
Simulations put the user in the middle of the action, often creating an environment which the user manipulates with varied results. Problem solving is key to most simulations, and activities typically reinforce the discovery process through primarily constructivist learning environments. Oregon Trail and SIM City are examples of an educational simulation.

Productivity (Tools)
This type of software supports the user in accomplishing specific tasks. It seeks to relieve the user of routine tasks, allowing concentration on the content being developed. Word processors, spreadsheets, and databases are all examples of productivity tools.

Informational (Tools)
Information software is just that, information rather than instruction. It provides data for the user to access and examine. Microsoft's Encarta CD-ROM encyclopedia and Dictionary.com (www.dictionary.com) are examples of informational software.

Software Needs Assessment

Regardless of the type of software, the chance effective learning will occur is at risk when the content and approach does not match the specific need of the learner. For example, providing students with drill and practice software on the multiplication tables will likely provide benefit. However, if multiplication tables are not currently the focus of classroom instruction, and therefore not supported and reinforced through other experiences, learning is not optimized. This can be likened to what we refer to as the Sesame Street effect: children may indeed learn basic skills from Sesame Street, but the impact is greatly increased when parents reinforce the skills presented in the television program, and further still when what is presented in the program and reinforced by the parent is a current classroom topic.

Understanding the specific need, or learning objective(s), to be addressed is critical to making effective decisions regarding content and technology. In fact, a clear understanding of the need may prove that technology is *not* the best approach or medium for meeting the need. Predicated on this assumption, Table 1 details a process which emphasizes front-end assessment and follow-up evaluation.

We call this the 4DIEM method of software selection and use, with each letter of the acronym supporting a specific step in the process. The overall intent is to first identify and then remain focused on the specific objective(s) you seek to target with the software. The following pages provide further detail for each component of the 4DIEM model.

The 4DIEM Model

DESCRIBE the objective
It is critical to have a clearly defined set of finite instructional objectives before you begin a software search. Many software vendors promise to boost basic skills or enhance critical thinking, but beware of these generalized promises: You have to be able to evaluate the success of the software in your classroom, which means that you have to know what you want it to accomplish. Make a list of the specific objectives that you want to target and keep it close by throughout this process. Ask yourself if the identified objectives are appropriate for your students and whether or not attainment of the objectives can be measured.

DETERMINE the type of software
After identifying the learning objectives that you will target, you must determine if appropriate software exists. Additionally, from a budgetary position, you will want to consider what software your school already owns.

If technology-based instruction is appropriate for the identified objective, consider what type of software would best meet the identified objective(s) and the needs of your students. Do you need it to teach the steps of a rule? Do you need it to provide lots of practice? Is it teaching a real-world skill that needs simulated application? Is the software you need a tutorial, a drill and practice, a simulation? Or should it provide content knowledge or be a productivity tool?

Think about how you will use integrate the software into your classroom. You will want to ensure students receive instruction to develop their initial understanding of a particular skill. Some drill software just helps children become fluent at a skill; in these cases, teachers should use another method to help students learn the underlying concept.

DECIDE on several appropriate software titles
Here is where you will likely be influenced by the budget available. You may be looking for a CD-ROM or two for use with your class or you may be involved in a district-wide technology adoption. It really makes little difference; if you have clearly defined your need, you will be able to review the appropriate software and determine if there is a match.

If you have a small allocation, you will most likely turn to over-the-counter software. Go to catalogs of respected providers. If you are involved in a significant technology adoption, you'll likely be reviewing and considering comprehensive curriculum software products. For example, the integrated learning systems provided by Jostens Learning, Lightspan, CCC, Davidson, or Kaplan.

Tables 2, 3, and 4 detail some educator-reviewed resources that include both over-the-counter and Internet content. Additionally, there are many excellent software review services: see SuperKids Educational Software Review (http://www.superkids.com/aweb/pages/reviews/alpha2.shtml) and the Children's Software Revue (http://www.childrenssoftware.com/). In addition, the Children's Software Review links page (http://www.childrenssoftware.com/links.html) provides many other resources where reviews are shared and software is discussed.

TEST DRIVE the software
If you are in the market for a new car and you heard in an advertisement that the new Ford Focus made driving 100% safer, would you walk into a dealership and purchase the car sight unseen? Unfortunately, educators have been known to spend ten-times the amount of that car on technology-based curriculum without allowing the driver and passengers (read: teacher and students) to take it for a test drive.

Most important, next to identification of your targeted objective(s), is reviewing the software and ensuring it will meet your needs. Many software programs are purchased only to collect dust due to the omission of this step. Routinely question the marketing claims made by the vendors–after all, they are trying to sell the software. Personally review the program to see if it is easy-to-use and matches your identified objectives. Ask for evidence of effectiveness in classrooms similar to your own. Then, select a few students and have them work through the program. Solicit their experiences; have them reflect on what they learned.

Note that many software review checklists and guidelines have been published over the years. Use these resources to ensure adequate and comprehensive review. For a rich resource of evaluation guidelines, checklists, and heuristics, see http://school.discovery.com/schrockguide/eval.html.

INTEGRATE the software into lesson plans
In a survey done by Global Strategy Group, Inc. only 37% of polled educators consistently integrate instructional software into their curriculum. Do not assume simply because you have targeted objectives that the software will immediately integrate into your classroom curriculum. Technology is a relative newcomer to the classroom and must be introduced, welcomed, observed, respected, and called-on to become an integral member of the class. Textbooks have a century of historical precedent on their place in the classroom—technology needs some hand holding as we figure out how best to integrate it. EdWeek

recommends that teachers *"[m]ake sure the technology has features and functions that fit your curriculum. If a software publisher hasn't worked out how to integrate its product with the subject, you must do it–or cast it aside" (Trotter, 1998).*

EVALUATE its effectiveness regularly
Our experience has shown that once a software program is selected—be it an over-the-counter drill and practice math program or a school-wide integrated learning system—scant resources are dedicated to evaluating the effectiveness of the program. We encourage you to question your decisions and seek opportunities to prove effectiveness. This certainly does not need to be a full-scale evaluation; make use of existing assessment materials or develop specific tools. Quick checks, quizzes, and tests can be used to evaluate tutorials, informational products, and drill and practice software; consider portfolio projects and other authentic assessments to evaluate simulations and productivity tools. It should be noted that many teachers have found clever ways to use the technology itself to evaluate student learning. Regardless of the approach, seek to understand the effect technology is having on student learning in your classroom and identify ways you can continuously improve your practices.

MODIFY use as needed
Based upon the results of your evaluation, repeatedly modify your classroom use to meet the changing needs of individual students and classes. Continue to use evaluation to diagnose and assess student needs and match appropriate technology-based content.

Summary

When selecting technology-delivered content, educators must identify specific goals and objectives which the software will support. Rather than having learning be incidental, we encourage teachers to target specific learning objectives and seek out software to meet those objectives. Follow selection with effective classroom usage, evaluation, and modification of your implementation plan. Using the 4DIEM model to guide this process will help ensure attention to front-end assessment, thus enhancing the effectiveness of your technology-based content.

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Activity	Description	Considerations
DESCRIBE…	the need you wish to address, and the outcome you expect	What is it that your students need to know? Why is it not already happening in your classroom?
DETERMINE …	a) if software is available to meet your need; b) and, if so, the type of software you need: tutorial, drill and practice, simulation, informational, productivity	What type of pedagogical approach makes sense with the given objective? Consider your students and their abilities–including their technology literacy.
DECIDE…	on several appropriate software titles	What software is already available at your school? Through the district office? If funds are available, review print and online commercial and educational software catalogs.
TEST DRIVE…	the software yourself *and* with several students before you buy it	Does the software directly support the need you identified at the outset? Is this a program that can be effectively used in the classroom? From the student perspective: Can students operate the program? Do they enjoy using it? Are they learning from it?
INTEGRATE	into lesson plan in phases.	Bring the program into you lesson plan based on student needs: as individual enrichment/remediation, as a small group presentation/activity, and as a large group presentation/activity
EVALUATE …	its effectiveness regularly	Monitor student progress and learning formally and informally. Ask students questions about what they learned from the software program. Use existing assessments to understand the contribution made by the software to student learning.
MODIFY…	classroom use as needed	Use the results of your evaluation to optimize your implementation and classroom use.

Table 1: 4DIEM Model

Vendor	Title
The Learning Company	Children's Writing & Publishing Center (one of the top overall titles), Student Writing Center, Reader Rabbit (the top overall title), Super Solvers: Midnight Rescue!
Claris	ClarisWorks (one of the top overall titles)
Advantage Learning Systems	Accelerated Reader
MECC/The Learning Company	Storybook Weaver, Word Munchers, Grammar Gazette
Scholastic	WiggleWorks
Edmark	Bailey's Book House
Morgan Interactive, Inc.	Best Reading Program Ever
Computer Curriculum Corporation	Integrated Learning System
Jostens Learning	Integrated Learning System
Knowledge Adventure	Jumpstart Series
Davidson	Kid Works
Creative Wonders	Sesame Street: Let's Make a Word
SkillsBank	SkillsBank /The Learning Company
Broderbund/The Learning Company	Living Books Series
Sunburst	Easy Book

Table 2: Top Reading/Language Arts Software Providers for K-12 from *The Complete K-12 Report: Market Facts & Segment Analyses 1999*, Education Market Research and Open Book Publishing, Inc.

Vendor	Title
Davidson	Math Blaster (the top overall math title), The Cruncher, Money Town
MECC/The Learning Company	Number Munchers (one of the top overall titles), TesselMania, Geometric Golfer, Math Keys
Tom Snyder Productions	Graph Club
Scholastic	Math Shop Series
Edmark	Millie's Math House
The Learning Company	Super Solvers: Midnight Rescue!, Operation Neptune, Super Solvers: Outnumbered, Treasure Math Storm
Computer Curriculum Corporation	Integrated Learning System
Claris	Claris Works
Sunburst	Divide & Conquer, Geometric Supposer, Hot Dog Stand, Voyage of the Mimi: Ecosystems
Tenth Planet/Sunburst Communications	Geometry Investigations
Sanctuary Woods	Franklin Learns Math
Curriculum Press	Geometric Sketch Page
Jostens Learning	Integrated Learning System
Broderbund/The Learning Company	Math Workshop
Milliken	Milliken Math Sequences
Nordic Software	Turbo Math Facts
Unicorn	Fraction Action

Table 3: Top Mathematics Software Providers for K-12 from *The Complete K-12 Report: Market Facts & Segment Analyses 1999*, Education Market Research and Open Book Publishing, Inc.

Site Name	Content Area
Yahoo/Yahooligans	Reading/Language Arts (R/LA), Social Studies, Research
NASA	Research, Professional Development
Scholastic	R/LA, Math, Science, Social Studies
The Brainstation	R/LA, Science, Social Studies, Professional Development
Classroom Connect	Math, Science, R/LA, Professional Development
National Geographic	Science, Social Studies, Research
Discovery Online	Social Studies, Science, Professional Development
The White House	R/LA, Social Studies
Alta Vista	R/LA, Math, Research
PBS Online	R/LA, Science Social Studies, Professional Development
ERIC	Research, Professional Development
Kathy Schrock's Guide for Educators	Math, Research, Social Studies, Professional Development
CNN	Science, Social Studies
The Smithsonian Institution	Research, Social Studies, Research
Pitsco Inc.	R/LA, Professional Development
Weekly Reader	R/LA, Math, Science
Cochran Interactive	R/LA
The Children's Literature Web Guide	Research, R/LA
The Math Forum	Math
National Educational Service	Science, Research, Professional Development
National Science Foundation	Science
USA Today	Science, Social Studies
Science Learning Network	Science
Library of Congress	Social Studies, Research
Web Museum	R/LA, Professional Development

Table 4: Top Internet Sites for K-12, from the Top 25 Internet Sites for K-12 Instruction, Research/Reference, and Professional Development, Education Research, 1998

Concept Mapping in the Classroom with Inspiration Software

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Abstract

Concept mapping is a technique that allows one to understand the relationships of ideas by ccreating

Concept mapping is a technique that allows one to understand the relationships of ideas by creating a visual map of the connections among these ideas. It is a structured process that is focused on a topic or construct of interests. It involves input from one or more participants that produce an interpretable pictorial map or representation of the ideas produced. The pictorial view or concept map as it is called not only displays a visual product, but it also shows how the ideas or concepts depicted are interrelated. (Trochim 1999) When used with students, it allows them to see the connections between knowledge they already possess and how this knowledge connects to new knowledge. It can also be utilized to organize a myriad of ideas in a logical kind of structure. Another advantage for educators using this process is that it is the type of visual language process that encourages students to operate at all six levels of Bloom's Taxonomy of the Cognitive Domain.(Bloom 1956) (Gaines, Shaw, 1999) (Novak and Gowin 1984) Concept mapping is a useful and very powerful visual-thinking tool that transforms information into knowledge. Concept mapping is very helpful for the organization of information and development of higher level thinking skills, thus deepening knowledge and facilitating clarity of thought. (Concept Mapping Companion 1998)

Concept mapping lends itself to a variety of interesting applications and products of unique design, therefore for the purposes of this paper, a broad definition of the procedure referred to, as concept mapping will be utilized. Concept mapping will include virtually any graphic production that is constructed specifically to represent knowledge.

Concept maps illustrate the shape of the structure, the relative importance of the information and ideas, and the way that the information relates to other ideas. Concept maps can be used to summarize information from different research sources, to think through complex problems by viewing the overall structure of the subject, as a quick way to review, and to associate ideas and make connections that would be otherwise too unrelated to be linked. (Mind Tools, 1995). Another strong advantage of using concept maps is that once a student has developed a concept map, the organization and details of the map will tend to be remembered for a much longer period of time than is usually the case when trying to remember the material in text form.

Concept maps have a very wide application. They can be used in many fields to facilitate a visual representation of knowledge structures (Concept Maps 1999) but, in the field of education, it probably began with Ausubel's learning theory treatment of advanced organizers and meaningful learning which holds that in order for meaningful learning to take place, students must relate new knowledge to relevant topics that they already know, that teaching strategy in and of itself does not necessarily result in meaningful learning (Ausuble1963)

Ausable's work prompted Novak (1977) at Cornell University to develop an extensive system of concept maps, which have been applied in the evaluation of students' learning in the school system in a variety of ways. (Lambiotte, Dansereau, Cross and Reynolds, 1989) His primary purpose was to provide a framework in which learners, rather than teachers, could be the cause of learning. Novak's vision of concept mapping was to provide a locus for student-teacher interaction that would empower students to take the responsibility for their own knowledge. He believed that teachers who were freed of the responsibility of causing learning could concentrate on the achievement of shared meaning. Novak concluded that meaningful learning involved the assimilation of new concepts and propositions into existing cognitive structures. (Concept Mapping Companion 1998)

However, one drawback of developing concept maps in the past has been that they had to be hand-drawn. Today we have software that is capable of generating concept maps more easily and efficiently. There are a number of software programs and tools that are very useful in producing computer generated concept maps. Some of them are, Axon Idea Processor, by Chan Bok, Cmap 2.0 for Macintosh, Decision Explorer (formally called COPE) by

Banxia Software, Sem Research Group, maker of Sem Net, MindMan by Michael Jetter, CoCo Systems, maker of VisaMap and InfoMap (Lite), Activity Map, by Time/system int., Text Vision Tex Net, by Piet Kommers. SMART Ideas, by SMART Technologies, Egle Magic, by MindMapper, and Inspiration Software, Inc, maker of Inspiration.

While Inspiration software will be the focus of this paper, it is not the intention of this paper to evaluate or compare the various software to Inspiration software or any other software. That would beyond the scope of this paper. The purpose of this paper is point out how effectively the Inspiration software can be utilized to promote the use concept mapping in the classroom.

Inspiration Software (1999) is a software package that is specifically designed to facilitate the construction and use of concept maps. It is a powerful visual-thinking tool that helps clarify and organize ideas and information. The research supports visual learning strategy as one of the best ways to teach thinking skills. Visual learning techniques help students to think clearly, and to process, organize and prioritize new information.Visual learning techniques help students clarify thinking. Students can readily see and understand how ideas are connected and how the ideas are grouped and organized. Visual learning also reinforces understanding, since students recreate in their own words, albeit graphically. As a result they tend to assume and appreciate ownership of their own ideas. Additionally, as diagrams are updated in class students gain insights into how new knowledge is integrated and how misconceptions of knowledge are identified.

The purpose of this paper is to give an overview of the Inspiration software program and relate it to the construction of the powerful visual learning tool, the concept map without elaborating on specific techniques, which can be viewed in the Inspiration Manual.

The Basic Functions of Inspiration That Can Facilitate the Construction of Concept Maps

A. **Diagramming:** Helps you to quickly record ideas and map out concepts.
B. **Rapid fire:** Makes it easy to get your ideas down as fast as you can think of them. Inspiration can automatically

C. **Move A Symbol:** A symbol can be moved at any time and when it is moved, Inspiration automatically adjusts the link.
D. **Adding Unconnected Ideas:** Sometimes you may have an idea but are not sure how to fit them into the diagram. The program allows you to add the idea anywhere in the diagram and adjust it later.
E. **Changing Symbol Shapes:** Inspiration has a variety of built-in symbol shapes that can be assigned to the diagram at any time and changed with relative ease at anytime.
F. **Drawing a Link:** Symbols are connected with links automatically, but unconnected links can be connected manually at any time and the program will make the link precise.
G. **Adding Text to A Link:** When additional information needs to be added to a connection, as is the case in many concept maps, Inspiration does it easily.
H. **Scrolling and Magnification:** Inspiration lets you move the diagram around within the window or zoom in and out on the diagram.
I. **Formatting Symbol Text:** Text font, style and font styles can be set for the entire diagram, or selectively.
J. **Printing to Fit:** The print to fit option reduces the diagram so it will fit on one page or the number of pages specified.
K. **Switching Between Diagram and Outline Views:** You have the option of working either in the Diagram view for visual diagrams or the Outline view for your text.
L. **Importing and Installing Graphics:** Color or black and white graphics created in other applications can be imported into you Inspiration diagram or installed in the Inspiration User Symbol menu.

A thorough grounding in the techniques of concept mapping and the Inspiration software program will provide all the foundation necessary for utilizing concept mapping successfully in the classroom.

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Proving Competence: Integrative Assessment and Web-based Portfolio System in a Dynamic Curriculum

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Abstract: Since 1997 Amsterdam Faculty of Education (EFA) has been officially recognized as a center for experimental teacher education. We describe the development of an assessment system and a web-based portfolio system to help students take responsibility for their learning and their proving competence at three consecutive integrative assessments. In this paper the new concept of curriculum for educating professional teachers is discussed. A new concept can only be successful in implementation if the assessment system is correspondingly altered. We also briefly describe a web-based portfolio system that supports students in building proof of competence. A more elaborate description of that system is given in the documentation of the poster session "EFA's Digital Portfolio System".

Introduction

The Amsterdam Faculty of Education (EFA) provides for about 4000 students. Most of them study to become teacher on the elementary or the secondary level. In 1997 the Dutch minister of Education reacted to a rather provocative report of one of his advisory committees on the future of education in the Netherlands, and the way teachers should be prepared for this. After a competition between several institutes for Teacher Education, EFA got the ministerial appointment to transform into an 'Experimental Teacher Education Program'.
The basic transformation concepts are set in a constructivistic view on learning. The corresponding processes of change in the institution and in the members of Faculty should mirror the intended processes of change that should occur in students on their way to professional competence.

The advisory committee report speaks about CARE for the present situation and COURAGE to envisage what is needed for the next century. In the next decade society will have gone into the information age, whilst education seems to be organized in the ways of the industrial age. The experimental Teacher Education is one of the courage-projects. It will be an *experiment*, so we don't know where exactly we will end up. That's why we call our endeavor '*expedition*' rather than 'experiment'. This expedition is based on a few important ideas:

Capable of managing change

Teacher Education should adequately prepare students for their profession in a largely unknown future. We cannot predict what that future will be like. However, what we do know is that in the decades to come there will be an increasing demand for professionals who are *capable of managing change* and who can give form and shape to education in the information society – not only because teachers must be able to react quickly to changing circumstances in their teaching, but also because learning paths, in part due to rapid developments in information and communications technology, are becoming increasingly individualized.

Responsible

The program should offer students an environment in which they are indeed given the opportunity to shape their own learning processes. For this, students need to be given *responsibility* and they need to accept it - responsibility not only for the way in which they acquire the (constantly changing) competencies they will need in professional practice, but also for the way in which they demonstrate to the outside world that they have indeed acquired these competencies.

Freedom

In this environment, students have a considerable degree of freedom in filling in the details of their own learning processes. Our program operates in a context in which the requirements for newly qualified teachers are stipulated by law. This means that, although students should be given the opportunity to create their own learning paths toward becoming adequately qualified, we wish students to demonstrate to us, through integrative moments of assessment at three points in the program, that they have acquired the competencies they need to be admitted to the next phase.

This view runs directly counter to the view that, under the direction of the institution offering the program, the road to becoming a competent and qualified teacher consists of parts of a curriculum that have been determined in advance, and that evidence of competence is synonymous with the successful completion of those parts of the curriculum.

The central concept: Meaningful Learning

Authentic Learning in Professional Education

At as early a stage as possible, the program should create an environment for students which mirrors professional practices. Learning during the program must be linked as far as possible to useful and responsible work resembling work in the profession for which one is being trained. In professional practice, teachers have to carry out relatively complex tasks that fit in with the objectives of the school. To be able to do this useful work well, they must be able to use 'two kinds of learning'. They should not only be able to acquire on their own initiative the knowledge and skills they need to do their job well (learning of the first kind), but they should also be able to continue to learn from the experience gained and to experiment systematically with actions leading to improvement or change (learning of the second kind).

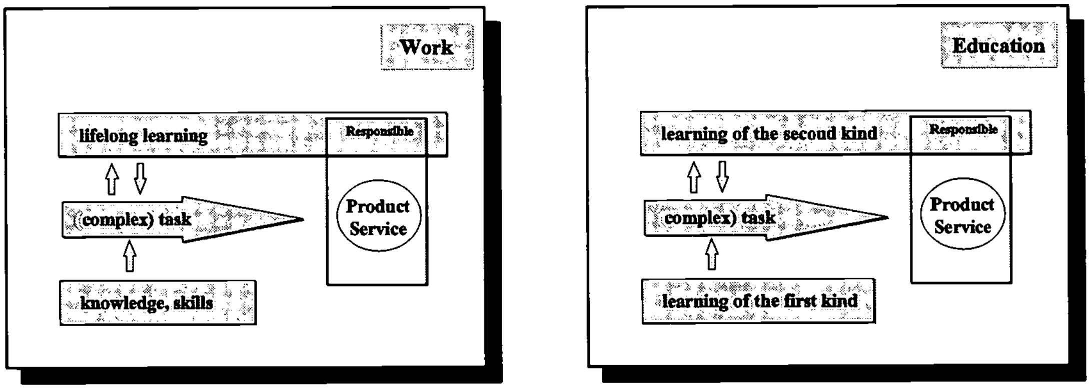

Figure 1: congruence between work and education

Both kinds of learning are important in the concept of 'lifelong learning'. Both are 'guided' by the competencies, which the competent and qualified teacher must have.
The program should offer environments in which students can (and indeed should) put these two kinds of learning into practice connected to authentic practical work, in order to acquire the skills required for the profession.

Each learning process the student goes through in that environment, consists of the phases of **orientation, planning, execution and evaluation**, and is guided by the competencies derived from the professional profile. For students this means that in their orientation with respect to the learning and working process they take the competencies they need to acquire as their point of departure. In doing so, they are aware of the fact that at a later stage, during the assessment, they will have to demonstrate that they have actually acquired the required competencies. On the basis of that orientation, they formulate concrete learning goals and activities (plans), subsequently work on useful products in a learning environment created by the program (execution), and, finally, they evaluate the degree to which those activities have contributed to the realization of their learning goals and the acquisition of competencies.

The assessment of a teacher's work is – if all is well – based on the degree to which the teacher's work has been useful in aiding the achievement of the school's objectives, and on the teacher's ability to make improvements and to manage change. This assessment is therefore not based on disconnected knowledge and skills. Since the program is intended to mirror professional practice, it includes at three points in time an *integrative assessment*. During these assessments, students must show that they are qualified to take the next step: first to be admitted to the main phase, then to enter the assistant teacher phase, and, finally, they need to show that they are competent and qualified to start a professional career. The student's admission to each phase depends on the outcome of these integrative moments of assessment, which are in that sense decisive and final.

During these integrative moments of assessment, students demonstrate individually to a small committee (consisting of people from within the institution and from outside) that they have reached a level of development

which is at least that required. They also show how their growth in acquiring competencies has progressed so far. As proof of their growth, students must compile a 'showcase' from their portfolio containing results of their work and studies, including judgements made by others. In principle, students are thus made responsible for proving their own level of competence, measured against externally specified criteria. This is also in accordance with the procedures followed in professional organizations and professional practice.

Program facilities in relation to learning processes

The program environment consists of a number of facilities which students use in taking responsibility for achieving their processes of learning and gathering evidence of competence. Below, we demonstrate in general the role and function played in the learning and/or working processes which students work through by existing facilities and facilities yet to be developed. In the next section, this is worked out for each phase separately. Although reality is always more complex and ambiguous than schemes and pictures may suggest, a simple graphic representation is given in this figure of the relation between learning and/or working processes and program facilities.

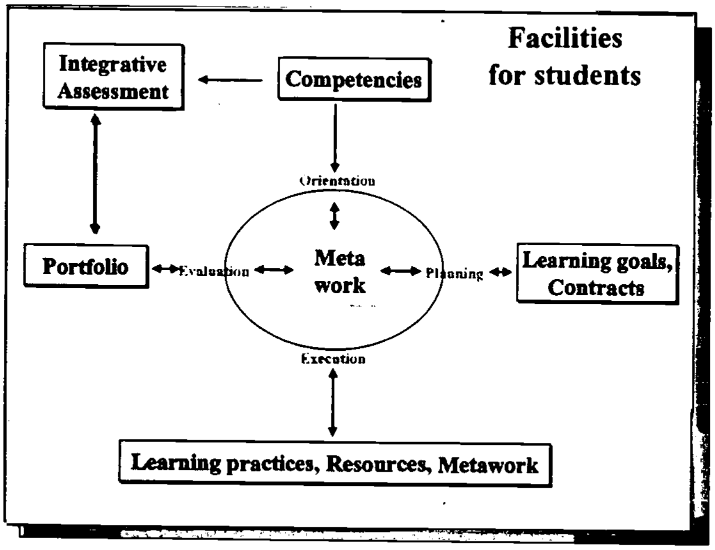

Figure 2: program facilities in relation to learning processes

Orientation

At fixed points during the program, students orient themselves with respect to the competencies they still need to acquire or improve. In this, 'metawork', in the person of the mentor and peer students, plays a supervisory, coaching role. Students and their mentor will use facilities such as the competence descriptions and (the results of) the integrative moments of assessment.

Planning

On the basis of this orientation, students translate the selected competencies into concrete learning goals they want to achieve in a learning practice and they determine which sources in the fields of knowledge, skills and information are required for this. In this phase, students enter into a learning contract and a work contract. In metawork, the mentor and peer students helps students in formulating learning goals.

Execution

In this phase, students work and learn within the frameworks agreed upon in the contract. The learning practice relates the learning process to the work to be carried out in the profession, sources support learning of the first kind, and learning of the second kind takes place by reflecting within metawork on one's own learning and working processes.

Evaluation

In this phase, students consider their growth in acquiring competencies ('internal thermometer') and work on building up part of the evidence for the integrative moments of assessment ('external thermometer'). For both aspects, the portfolio is the main tool. In this, metawork fulfils a coaching, advising function.

Program facilities in detail

Orientation: The role of competency descriptions and moments of integrative assessment

If students are to take responsibility in orienting themselves with respect to the competencies they need to acquire during the program or a particular phase of the program, a clear description must be given of the competencies they can acquire demonstrably during the program. Competence descriptions are necessary both in relation to the 'internal thermometer' (self-assessment) and in relation to the 'external thermometer' (assessment by others), and they will therefore need to be described in two ways:

1. For the internal thermometer: description in terms of long-term objectives, including functions such as becoming aware of the competence requirements, monitoring of growth and justification of choices made by students within the program facilities.
2. For the external thermometer: implementation of the above-mentioned long-term objectives in criteria to be used during the three integrative moments of assessment for admission to the following phase of the program. Presently, we assume there will be three integrative moments of assessment during the fulltime program (competent for main phase, for Assistant Teacher phase, and qualified to start a career in the teaching profession).

The integrative moments of assessment during the program are based upon the competence descriptions; for this to be possible, for each competence, criteria must have been formulated which students have to meet before they can consider themselves 'competent to undertake the main phase', 'competent to undertake the assistant teacher phase' or 'a competent and qualified teacher'. During the moment of assessment, students must demonstrate individually to a small committee (consisting of people both from within the institution and outside it) that they have developed at least to the required level and they must also show the committee how their growth process proceeded ('lines of development'). Students are also required to show that for a few competencies they exceed the minimum requirements.

The integrative assessments are being developed in a two-dimensional space (see figure 3). The parameters determine how much freedom a student will have in designing his or her own convincing way of proving competence, and which role the show-case from the portfolio plays in that proof. The sequence of three assessments will follow the positions indicated by the skew arrow.

In collecting the evidence, students make use of their portfolio to draw up a 'show-case', a kind of current curriculum vitae. They do that by making a selection of their own learning and working results, which they have compiled in their portfolio with the aim of complying with the criteria for competencies.
In addition, the committee can employ a number of standardized tools to assess students' competencies.

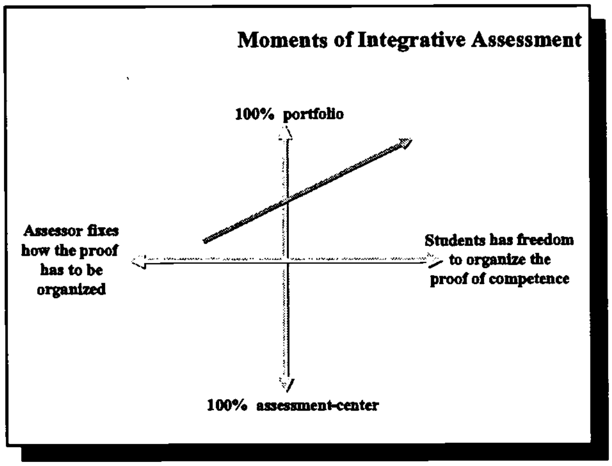

Figure 3: dimensions of moments of integrated assessment

A prerequisite for the proper functioning of the integrative moment of assessment as an external thermometer is that the institution has established clearly formulated criteria for the competencies in such a way that students still have enough freedom to formulate their learning goals themselves.

Planning: The role of contracts

In the planning phase, students have to formulate their own learning goals and the activities they plan to undertake, based on an orientation on the competencies they have to acquire. Students' learning goals must be related to the competency descriptions. Students should formulate their goals in such a way that they are related to the work they are going to do in the context of the learning practice. In doing so, students must also take into account that during the integrative moments of assessment they must be able to demonstrate the competencies they have acquired.

After students have oriented themselves, they enter into a contract with the educator responsible for the learning practice and with the commissioner. In the contract with the commissioner, the commissioner specifies the requirements the product or service must meet. In the contract with the educator, the student determines the competencies he or she is going to work on and – more specifically – which concrete (and short-term) learning goals they want to achieve and the resources (knowledge, skills and information) they feel are necessary for this purpose. Students also specify in the contract with the educator how they propose to show (or be tested) that they have indeed worked on these competencies and that they have achieved their learning goals.

In principle, the mastery op resources (knowledge and skills) are not tested as separate units. However, students may include in the contract with the educator that, given the way in which they wish to organize their evidence, certain knowledge should not be tested on the basis of the product delivered, but directly.

In order to help students on their way, descriptions of certain learning goals may be given. Subsequently, students, in consultation with their mentors, must themselves locate these descriptions in their line of development toward competencies and place them in the context of the learning practice. In addition to the learning goals provided, students may also formulate personal learning goals or choose to work with learning goals from learning practices carried out earlier.

Execution: Learning practices and the role of resources and metawork

Students work in learning practices. These practices are learning environments within which students are personally responsible for carrying out tasks that are useful to themselves and to others.

In learning practices, students deliver products or services, preferably commissioned by institutions or people who will make use of the result and who therefore have an interest in the delivery of a useful product. In the contract the student enters into during the planning phase, the responsibilities of those involved in the learning practice are described. The educator in charge of the learning practice will supervise students to help them achieve the agreed learning goals.

Resources refer to the knowledge, skills and information students feel they need in order to be able to do the work in the learning practice well. In the course of their development, students assume a greater measure of personal responsibility for determining the resources involved. Resources are therefore as far as possible offered independently of educator, place and time. In the offering, students' various learning styles are taken into account (varying from lectures to consulting experts to searching libraries and internet to instructions on CD-ROM). ICT plays an important part in making the resources more flexible. In principle, resources are demand-driven. In Year 1, this is only true to a certain extent, because students then still need to acquire basic subject knowledge and skills, which will allow them to ask for new resources.

The metawork element has two functions for students, both of which fall under 'learning of the second kind':

- It provides a tool to help students acquire the metacognitive skills they need to prove during the integrative moments of assessment. For this, use is explicitly made of students' activities and experiences during learning practices;
- It offers students supervision and/or coaching in formulating learning goals and choosing learning practices and preparing for the presentation of the proof of their competence to official bodies (both internal and external) during the integrative moments of assessment. This function provides important support during the phases of orientation, planning and evaluation.

In metawork, the link is made between the learning goals students formulate and the competencies they have to achieve. Metawork pays explicit attention to the course of students' development toward becoming competent and qualified teachers.

Evaluation: The role of the portfolio

Students keep a record of their learning processes in a digital web-based portfolio system that is currently being implemented. The portfolio system is a multi-functional evaluation tool used within the context of metawork. In principle, the portfolio has three functions:

- It is a tool to help students become aware of the competencies involved in the teaching profession: helping them evaluate their own process of development and keep a record of it;
- It is a tool to help students keep a record of their personal curriculum: students record which learning practices they have worked on, which learning goals they had intended to achieve, which products the work resulted in and the assessments they received from commissioners, teachers and/or fellow students;
- It is a tool to help students compile a showcase or curriculum vitae of material they have collected to provide evidence to the assessment committee.

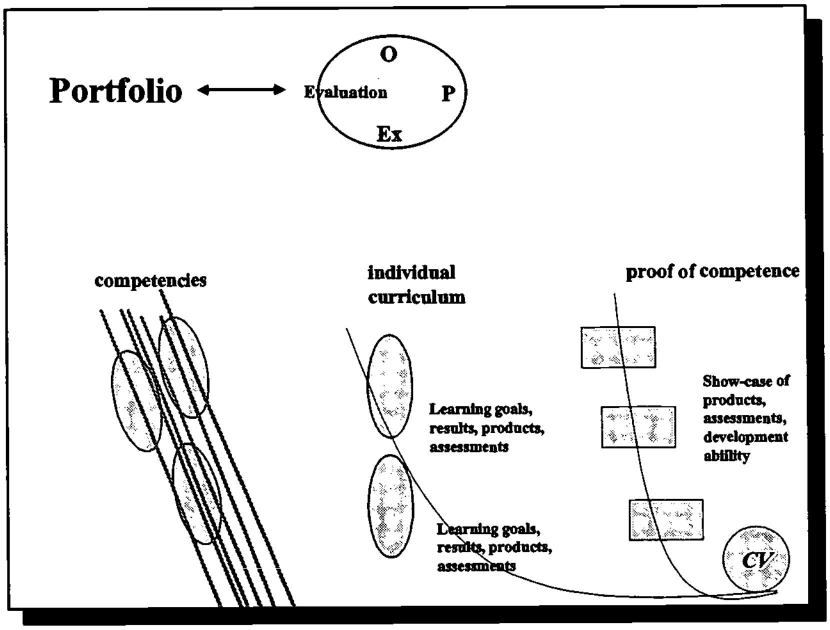

Figure 4: portfolio system

The portfolio therefore has three roles: an educational tool for the development of metacognitive skills, a navigational and recording tool for the personal curriculum, and tool to build convincing proof of competence for the three integrative moments of assessment during the program.
The portfolio plays the role of a 'student tracking system' in a dynamic curriculum.

EFA has chosen to have a digital portfolio in the form of an individual homesite for each student. There were a number of reasons leading to this decision:

- A digital portfolio makes it possible to order a great deal of material clearly and compactly.
- Through hyperlinks students can easily show the relationship between different parts of the portfolio and so demonstrate the coherence between different elements in the program.
- Experience from other institutes also indicates that many students find it motivating to present themselves on their own web-site.
- In this way the portfolio contributes to the necessary development of future teachers' ICT skills. With the latest software it is becoming progressively easier to make a web-site and also within reach of students who are not computer experts.
- Through placing the portfolio on the intranet or internet it can become a means of communication between tutors and students and among students themselves.
- Finally, students can continue to develop their portfolio after finishing their studies and can present themselves to future employers on their own homepage. In this way the portfolio becomes an instrument in 'life-long learning'.

During the paper session at SITE the results of the development of the Integrated Assessments will be shown. A more elaborate description of that system is given in the documentation of the poster session "EFA's Digital Portfolio System". That poster session will show the actual system.

DISTANCE EDUCATION

Section Editors:

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Distance education is described by McIsaac & Gunawardena (in Jonassen *Handbook of research for educational communications and technology*, 1996) as instruction offered through many media, from correspondence study to video broadcast, in settings synchronous and asynchronous. This year's research presentations focus on teaching and learning facilitated by the Internet, almost to the exclusion of other settings and media. Only one (W.E. Wessel, "Technology in the Classroom") of the accepted studies addresses studio-based distance education; the Web presides over the rest.

Readers will not be disappointed by the substantial variety of studies within the general subject of Internet planning and delivery, however. The twenty-five studies presented here deal with teacher education, course design and platform selection, program research and evaluation, and learning or communication techniques for students and instructors. Many of the studies address distance education as a medium for delivering programs, as opposed to single courses, particularly within teacher education and certification. A rich representation of international and multinational programs reflects the truly global potential of education facilitated by technology.

Strategies for teaching & learning

Critical thinking, communication among students, and collaborative learning models comprise the subject of six papers. Loving discusses Nursing Education as a model of critical thinking strategies in an "instructional strategies in nursing" course. Miltiadou & McIsaac present "Problems and practical solutions of web-based courses" related to interaction, motivation, and organization in the faculty development process. "Evaluating new ICT-based models for teacher training" presents Lysne and Tvedte's discussion of collaborative techniques for including external and campus-based students within a single teacher education course. Casual learning and the learning outcomes of chance, virtual encounters are addressed in Contreras, Llamas, Favela, & Vizcaíno, "Improving collaborative learning by supporting casual encounters..." while Tarouco & Rodrigo describe tools and techniques for automating decision-making and summarizing in "Group learning through Internet." The "Challenges of using CSCL in open distributed learning" include the faculty member's journey from teacher to learning facilitator in the Nilsen & Instefjord study.

Design and delivery platforms

Pioneering distance education offerings relied on text-based media like e-mail, Usenet news, and MUD universes. Recent multi-media and graphical environments, as well as course-management programs, extend and improve both the possibilities and appearance of Internet classes; hence, six studies explore the choices available in design and delivery platforms. Novice distance educators are helped along the path to "The convergence of power and user-friendliness" in Lan's stud; Hamza, Alhalabi, & Marcovitz describe more sophisticated applications supporting shared and virtual laboratory experiences in "Remote labs!" Serrano, Santiago, & Medina trace their institution's search for a platform suitable for "Online interactive learning" for a variety of liberal arts courses. Marsh, Price, & McFaddin present "An overview of online educational delivery applications": a review of a dozen prominent platforms for instruction with particular attention to their utility for the new distance educator.

Tarouco & Rodrigo evaluate a Sun-based Remote Procedure Protocol for forming, categorizing, and distilling "Group learning through Internet." Abramson, Cohen, Ellis & Pratt, in "Teaching and learning in an anytime/anyplace classroom," explore other uses of bulletin-board applications. Course design can also be re-conceptualized through intellectual tools, as Gomes & Bastos Gottgtroy describe in "DEP WEB: A concept mapping based on web distance education process."

Research and evaluation

Selection of media will be followed by evaluation of media and the standardization of research protocols for investigating learning through new distance education technologies. Four studies address the complex of issues arising from program evaluation and research in distance education.

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Identifying the elements of a successful distance education experience must surely occupy a preeminent place among the evaluator's priorities. "Qualitative factors that affect learning in a web-based university course" are explored by Sujo de Montes & Gonzales, who investigate the ways learners feel about themselves during the process of participating in an online course. The learner, reacting with the teacher, is the subject of Offir and Lev, "Content analysis as a tool for evaluating the effectiveness of distance learning systems." "Creating an instrument for a new course delivery mechanism" is described by Izat, McKinzie, Mize, & McCallie, in a report on the design and validation of a class and instructor evaluation instrument for Web courses. Tarouco & Hack apply Kirkpatrick's (1998) training evaluation model to investigate a suite of "New tools for assessment in distance education."

Teacher education

Teacher education forms a large part of most college's offerings, and the need to reach out to all teachers and, particularly, to extend alternative certification to non-traditional and teaching students is critical. Distance education reaches further into the network of public schools as those schools become connected and equipped, and the possibilities of collaboration among pre-service and serving teachers promises to change both distance and campus-based programs. nine studies present model programs and techniques related specifically to P-12 teacher education.

"Trickle-down technology" describes a professional development model that Parker has applied to transferring technical expertise from college faculty member to pre-service teacher education student and thence to teachers in service. Active learning and interactivity occupy the forefront of Lysne's "Evaluating new ICT-based models for teacher training." Kissock presents a core pre-service "WWW based comparative education course" as a model for undergraduate courses in many disciplines. Blending the styles and experiences of on-campus and off-campus teacher education students provides a "Shifting focus from teaching to learning" in Haugen, Ask, Breatseth, Engelsen, Lysne, & Tvedte's study of using distance education to integrate training and practice in a pre-service program.

Programs, rather than simply individual classes, occupy several investigations. Hirtle & McGrew-Zoubi explore "New horizons in distance education: Re-mapping the pedagogical terrain" in a four-course certification sequence for uncertified teachers. Teachers working in a master's degree program participate in "Three community building strategies and their impacts in an online course," which are analyzed by Egbert, Chao, & Ngeow. Wessel argues for comprehensive change to accommodate "Teacher education: Implications for teacher education."

Two studies focus on the relationship of course management to specific topics. Ask & Haugen present an online course on designing online courses in "Introducing ODL in teacher education: An online course on how to create online learning environments" for a European college consortium. Naudé describes a South African project to train and make available Computer Studies teachers in an underserved environment.

Global perspectives

The twenty-five studies, and their far-flung authors, contained in the Distance Education section remind the reader of the global reach that these technologies give to programs. Henrichsen presents "Distance education insights from eight case studies in TESOL teacher preparation" in a system designed to reach ESL teachers worldwide.

Naudé's computer studies teacher preparation meets a need for an entire nation, and Ask & Haugen describe a teacher education instructional platform designed to facilitate international collaboration. Informal interaction is worthy of study in every distance education setting; consider how remarkable it becomes in Contreras, Llamas, Favela, & Vizcaíno collaboration among Massachusetts Institute of Technology, the Pontifica Universidad Católica de Chile, and the Centro de Investigación Cientifica y de Educación Superior de Ensenada: a collaboration that is international and intercontinental.

Though no reader of this section likely needs persuading, the studies contained here will convince the skeptic, inform the searcher, and further enlighten the professional concerning powerful tool for learning and teaching, collaboration and communication, understanding and creation that Distance Education continues to become.

Role Modeling Critical Thinking in an Online Course for Nurse Educators

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Abstract: In this paper, the author describes the use of critical thinking strategies in an online master's level course entitled, "Instructional Strategies in Nursing". The course is a required specialty course for graduate students in the nursing education track. These students are preparing for careers as nurse educators. The course combines online learning activities with periodic synchronous classroom sessions. Tools used to role model critical thinking strategies include online threaded bulletin board discussion, online reflective journals, and practice questions with automated feedback. The course employs WebCT as an online course template.

Introduction

Nurse educators have traditionally delivered classroom instruction using a didactic model. Nurse educators combine this didactic classroom instruction with structured clinical learning experiences to prepare nurses for practice. In an age of accelerating knowledge obsolescence, nurse educators must examine strategies to assist their students in learning critical thinking skills. Nurses who are able to transform knowledge and who are able to apply this transformed knowledge to a variety of contexts will be well prepared for nursing practice in the new millenium.

To prepare nurses who are capable of critical and reflective thought requires graduate nursing education programs that prepare nurse educators to role model critical thinking abilities. While delivering the course, the author role models the use of critical thinking learning strategies for student nurse educators.

Critical Thinking Models

Learning to critically think is a developmental process requiring practice and feedback. Having a common language to discuss critical thinking facilitates meaningful dialogue about one's critical thinking practice in any discipline. One popular model that provides such a language is Paul's (1995) Universal Features of Thinking. Universal features of thinking include the elements of reasoning and intellectual standards.

While critical thinking is a complex construct with many definitions, one simple way to define critical thinking is thinking about one's thinking with a goal of improving that thinking (Paul, 1995). In order to think about one's thinking, one must have some way to break apart thinking in order to analyze that thinking. The elements of reasoning provide a system for breaking apart one's thinking. The reasoning elements include purpose, issues/problems, information, concepts and theories, inference, assumptions, point of view, and implications. One can question one's own thinking or the thinking of others using these elements. For example, "What are the primary issues that I must consider before deciding?" or "What assumptions am I making if I take this position?"

Additionally, if one is to assess one's own thinking or that of others, one must have some criteria by which to assess that thinking. Paul's intellectual standards provide the criteria for assessment of thinking. These standards include clarity and precision, accuracy, depth, breadth, significance, relevance, and logic. One can formulate questions using these standards. For example, to assess depth of thinking one can ask, "Am I considering all of the complexities of this issue when I formulate my decision?" Or, to assess breadth one might ask, "Are there other relevant perspectives that I haven't considered?"

The instructor can use the elements of reasoning and intellectual standards to design instruction that facilitates critical thinking. Questions are the fuel that drives critical thinking. By formulating questions using the universal features of thinking the instructor can promote students' practice at thinking critically about key course concepts. With repeated practice and feedback, hopefully the student will develop the ability to ask him/herself the critical thinking questions that the instructor has repeatedly asked. That is, the student learns to assess his/her own thinking as a matter of habit.

There are many stimulus materials about which the teacher can ask instructional critical thinking questions. Examples include written case studies, videos, and readings. Perhaps the most powerful materials, however, come from the students' own experiences in practice. Reflection on practice is an element that Kataoka-Yahiro and Saylor (1994) add to Paul's model to describe clinical nursing judgment.

Online Tools to Practice Critical Thinking

The web-based tools used to practice critical thinking strategies in this online course include: threaded bulletin board discussion, reflective journals of educational practicum experiences and the student/teacher dialogue associated with these journals, and interactive practice questions with automated feedback. Each of these online experiences is structured using instructional design principles associated with the universal features of thinking.

The author uses threaded bulletin board discussion extensively in the course. Threaded bulletin board discussion is a tool that I have described as technologically simple, yet pedagogically complex. One doesn't need much technical expertise to design this instructional activity. Yet, one must be able to ask appropriate stimulus questions to facilitate students' thinking about key course ideas. One must also be able to keep the discussion going and focused.

The teacher establishes a timeframe for the discussion. For example, "We will discuss roles of clinical instructors during the week of April 2". The teacher also includes threaded discussion participation in the course's grading structure. Unfortunately, students often need this extrinsic motivation initially. Students have reported, however, that after having become engaged in the online discussion the bulletin board proved to be one of the most useful learning activities in the course.

The instructor posts the original discussion questions to the electronic bulletin board for all to see. Students post their responses. The teacher and other students post their responses to the students' responses. And the discussion builds. Positive feedback to the students for their initial postings is of particular importance. Students report that they are initially reluctant to post their ideas on the board for all to see.

The instructor's responses to student articles posted on the bulletin board may take the form of additional probing questions using the universal features of thinking. For example, "You have addressed a very important point. I wonder what the issue looks like from the perspective of a new nursing student." Or, the instructor may periodically summarize key points included in the discussion. It may also be necessary to include key points that have not been covered by the discussion. The teacher's facilitating the online discussion provides the students with an ongoing example of how discussions are facilitated and how questions are designed to facilitate students' thinking.

Class discussions can be organized by forum. Using the forum feature of WebCT, the teacher can create private fora as a means of dividing a large class into smaller, more manageable discussion groups. Or the teacher can divide the discussions by subject fora. With large classes it is necessary for the teacher to devise a system whereby he/she does not have to respond to each student posting. Examples of such a system include the following. The instructor can randomly select students' articles for review and response. Or, the teacher may designate and orient selected students to leadership roles in discussion groups.

It is important that the teacher advise the students of parameters for the teacher's involvement. That is, the teacher should inform the students specifically how often they will check and respond to bulletin board discussion. For example, "I will check the discussion daily in the late afternoon", or "I don't access the course on the weekends." Such information provides the students with the security of knowing the instructor is a part of the learning community.

In an online, asynchronous discussion students who are otherwise reticent to spontaneously share their experiences in a classroom are able to carefully formulate thoughtful responses that can be posted online. By carefully formulating contributions to online learning activities, students are able to consistently

practice their writing skills. Faculty can then provide consistent, documented feedback to students on their writing and thinking skills.

Another tool that provides students with consistent feedback on their written work is the online journal. The instructional strategies course includes a practicum component in which students practice their teaching skills in a nursing education setting. Students then submit a journal via WebCT private e-mail. In their journals students describe and analyze practicum experiences, describe students' reactions to teaching strategies they employed, and compare their teaching experiences with theoretical and practical literature. The instructor writes the feedback directly on the students' electronic journals and then returns the feedback via electronic mail. While the bulletin board discussion is a forum for establishing discussion among all the class members, the journal creates an instructional dialogue between the teacher and the individual student. Both tools, however, are capable of producing a rich dialogue between and among the students and teacher.

With WebCT there is also the capability of programming automated feedback to students for practice questions. These self-test questions are multiple-choice items that the teacher creates and attaches to a particular unit of content. Students may independently view and answer the questions. With each answer chosen, feedback appears. This feedback provides rationale for why the answer is right or wrong. The feedback can also provide the student with the thinking process involved in arriving at that answer. Such a method is analogous to the teacher thinking aloud to role model thinking in real time.

Evaluation and Discussion

Online course evaluations collected during the first two semesters of this course reflect extremely positive student responses to the online critical thinking activities used in the course. Many of the questions contained in the online course evaluation are based on the American Council on Education (ACE) (1996) guidelines. Samples of questions from the final course evaluation and the associated mean response scores for those questions are included in Table 1. These means are based on 14 student respondents during the fall, 1998 and spring, 1999 semesters. Responses were on a five point scale as follows: (1) Strongly agree; (2) Agree; (3) Neutral; (4) Disagree; (5) Strongly Disagree.

Item	Mean
Learning Activities are appropriate for the course objectives and outcomes.	1.15
Elements of the course-content, instructional methods, technologies, and context complement each other.	1.23
Online learning experiences adequately enhance learning in the course.	1.31
Use of bulletin board discussions enhanced interactivity among course participants.	1.62
Review questions with feedback helped me use key course concepts.	1.54
Constructing a journal helped me process and assimilate new knowledge from the course.	1.38
Learning activities were sufficiently challenging and stimulating	1.00
The technology enhances instruction and improves motivation	1.46
Learning via web-based activities is a convenient way to learn.	1.23

Table 1: Mean Responses for Selected Course Evaluation Questions in an On-Line Course for Nurse Educators

The author's demonstrations of critical thinking teaching strategies provide a model for student nurse educators who will practice these strategies with their students. The developing nurse educators can use case studies, dialogue, reflection on experience, and critical thinking questions to design instruction that will provide their students with practice at these valuable thinking abilities.

While many of these same critical thinking strategies can be used in a traditional classroom, there are advantages to online critical thinking learning activities. Asynchronous, online learning activities allow

working graduate students to complete the activities at times convenient for them. Online practice questions can be structured with automated feedback for student responses. Once developed, the automated feedback can save the instructor time. Additionally, experience with online instruction will prepare these student nurse educators for using technology in their own nursing education careers.

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Problems and Practical Solutions of Web-Based Courses: Lessons Learned from Three Educational Institutions

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Abstract: The purpose of this paper is to review problems encountered in web-based courses delivered at three different educational institutions. Implications are discussed based on distance education theories of interaction. Interaction is a vital issue to the design of online courses. Further inquiry that sheds light on online students' motivational characteristics and organizational skills is vital in order to empower educators to design instructionally sound courses and students to benefit from them. Results would also aid academic administrators to predict student success with the ultimate possible purpose of lowering attrition rates.

Introduction

Historically, distance education has been defined as the delivery of instruction in which time and geographic location separate students and teachers (McIsaac & Gunawardena, 1996; Moore, 1988). Distance education courses have been an alternative for students in remote areas, or with difficult time schedules, job demands, or family responsibilities, unable to participate in traditional classroom instruction. The lack of face-to-face meetings between teachers and students in a shared classroom has led to the development of systems of delivering instruction in modalities often very different from those used in traditional teaching. Over the years different delivery systems have evolved along with the development of communication technology. In the late 1800s, traditional mail played the role of the first delivery system in correspondence studies. During the next one hundred years, radio, television, and computer multimedia were used to deliver instruction. The development of advanced technologies in the last decade has had an important impact on education. As a result, computer networks and the Internet are becoming the leading way to reach online learners and proving to be a global communication system (Harasim, 1996).

The present trend and market demand for education is indeed toward online education. This trend is highlighted in the "*The Condition of Education*" report published by the National Center for Education Statistics (NCES, 1999). According to this report, in 1995 thirty-three percent of higher education institutions offered distance education courses and another twenty-five percent indicated plans to begin courses within three years. Furthermore, Peterson's (1999) Distance Learning Guide provides information about two thousand degree and certificate programs available from nearly 900 institutions. This number can be compared to 762 institutions in 1997 and 93 institutions in 1993. Many educational institutions offer a wide variety of online courses and provide the opportunity for students to enroll in certain online courses as part of a degree. Other institutions offer complete undergraduate and graduate degrees through online distance education. Finally, the Kellogg Commission on the Future of State and Land-Grand Universities (1999) recently published a report entitled "*Returning to Our Roots: A Learning Society.*" Members of the commission included presidents of state institutions that have invested heavily in technology in recent years through statewide distance education programs. According to the report, online technology needed for universal access to education is available today.

The Three Educational Institutions

Three institutions in the metropolitan Phoenix area offer Internet courses in a wide disciplinary spectrum. The first institution is a community college that offers traditional as well as distance learning courses. The "school without walls" is one of the leading institutions in the race for online distance education and offers more than 200 courses on the World Wide Web. Online students use the FirstClass conferencing system for fulfilling course requirements and promoting interaction in the virtual environment. The Distance Learning department provides technical support to students on a twenty-four hour, seven days a week basis. Attrition rates in online courses range between twenty and forty percent at this institution.

The second institution is the second largest traditional community college in the United States. The Center for Teaching and Learning department offers about 110 Internet courses, but provides very little technical support to students who face hardware or software problems. Attrition rates in online courses were up to seventy percent at this institution.

The third institution is an urban university that offers about seventy online courses. Students use the CourseInfo conferencing system for synchronous and asynchronous interaction and to fulfill course requirements. The Distance Learning Technology department provides some technical support to students by phone or email. Attrition rates at this institution range between forty and fifty percent.

While the three institutions possess extensive hardware and software resources, attrition rates are very high. Attrition rates in distance education courses tend to be forty to fifty percent higher than the ones in traditional face-to-face classrooms (Dille & Mezack, 1991; Parker, 1994). Distance education requires students to monitor and regulate their own learning because of the geographic separation between students and instructors. One of the main factors that influence attrition rates is the concept of interaction.

Distance Education and Interaction

The use of communications technology is still a recent development in education and many online students (as well as instructors) encounter various difficulties and feel frustrated with using such technologies. Examples include students who are technologically illiterate and therefore are not able to interact with their classmates or the instructor, download instructional material from the class web site, or submit online assignments and participate in discussions.

Interaction in an online environment is one of the most important factors that influence the success or failure of a program. Keegan (1988) views interaction as a key to effective learning and information exchange, and Moore (1989) considers interaction as "vitally important" in the design of distance education (p. 6). Furthermore, Kearsley (1995) points out that a high level of interaction positively influences the effectiveness of any distance learning course.

There are four types of online interaction identified in the literature. Moore (1989) identified learner-content, learner-instructor, and learner-learner interaction. Hillman, Willis, and Gunawardena (1994) identified a fourth type of interaction, namely learner-interface interaction.

Moore (1989) defines learner-content interaction as the intellectual interaction between the learner and the topic of study. According to Moore, learner-content interaction is an important concept of online environments because it changes learners' behavior toward an educational goal. The importance of this type of interaction is also depicted by Moore and Kearsley (1996) in the statement: "it is not too difficult to present information over a distance, but getting people to participate and making learning active at a distance is much harder" (p. 133).

The second type of interaction in online environments occurs between learners and instructors or team of subject-experts who prepared the course material. In this type of interaction, instructors are responsible for stimulating and continuously maintaining learners' interest in the topic, motivating students to learn, assessing students' progress, and finally providing support and encouragement to them (Moore, 1989).

The third type of interaction occurs among the learners of an online environment with or without the real-time presence of instructors. This type of interaction represents the communication between one learner with another learner, or with a group of learners, and takes place either synchronously, via "live" discussion chats, or asynchronously, via the exchange of electronic email or posting of messages in bulletin boards.

Hillman et al. (1994) define learner-interface interaction as "a process of manipulating tools to accomplish a task" (p. 34). Learners must understand not only the procedures for working with the interface, but also the reasons why these procedures obtain results. This fourth type of interaction links the other three types of interaction together.

Learners must be able to use online technologies in order to interact and communicate with instructors, peers, and the course content. The absence of interaction can inhibit student success and may even force online students to drop out of online courses.

Enhancements of the four types of interaction in an online environment are the lessons learned from our experiences with the three educational institutions.

Lessons Learned

Based on our experiences with the three educational institutions, we classified the findings in two categories. The first category pertains to technological aspects of online education, while the second category includes instructional design and course development principles for online courses. Both categories target lowering the high attrition rates encountered in online courses.

Technological Aspects of Online Education

Students enrolled in web-based courses are often required to use technology for the daily procedures of the course. Such procedures include (a) email interaction with peers and instructors, (b) using a web browser to access class material, (c) searching for journal articles using the Internet, online databases, and the institution's libraries, (d) submitting assignments online, and (e) participating in weekly discussions. These are examples of the four online types of interaction identified before. Moore (1989) suggests that online students need to interact with the instructor, the course content, and their peers. The only way for any interaction to take place is for students to use CMC systems. Interaction is vital to distance educators because if one type of interaction is missing, or it is not well thought and planned, then online courses might not be effective and successful. For example, if there is no interaction between learners and the topic being studied (because of unspecified or unclear instructions, assignment questions, or discussion topics), then learners will not obtain the desired learning outcomes. Moreover, if learners cannot communicate with instructors in order for the latter to answer any questions or clarify unclearness in any aspect of the course, then learners may not perform as expected. In the same context, if learners do not communicate with each other to provide support to each other and discuss intellectual topics in synchronous and asynchronous modes, then instructors' expectations will not be met nor students will master the content. In addition, if both learners and instructors have difficulties using the hardware and software necessary for interaction, then all their efforts will be consumed with how to figure out how to communicate with each other and little effort will be spent on the actual class content. All four types of interaction need to be present in a distance education course in order for the course to be successful. Research in this area would help educators define the set of skills needed to enhance interaction and satisfaction among distance education students.

Enhancing social presence in an online community should also be one of the first priorities of instructors and course designers. In order to do so, instructors should require online students to participate in asynchronous discussions about various topics of the course. Instructors should also provide immediate feedback to students' questions and assignments in order to help students feel that they are not alone in the class and that if they face a problem they have somebody to turn to.

In order to ensure easy access to course information, the course Internet address (URL) as well as the URL for the distance learning department homepage should be printed out in the published schedule of classes. Also, when students register for a course, they should provide updated personal information such as their current email address, telephone number, and postal address. This will ensure that students receive a registration packet with vital information.

Students who lack computer skills face major frustration and may drop the course because they cannot deal with technology. One way to prevent students from dropping out is to organize, possibly during an orientation week, a one-day technology meeting, during which students are taught how to use an email system, the Internet, and the conferencing system used in the course. Furthermore students should also be taught on how to submit online assignments. During the technical orientation meeting, students could create and post on the Internet their personal web page that includes a photograph and a short biography. This is a great way for classmates and instructor to put a face to the name. The meeting would be also useful for students to get to know each other and the instructor of the course.

In case students are not able to visit campus during the technology orientation meeting, the educational institution should provide technical support assistance via email or a toll free number. Online tutorials detailing the

daily procedures of a course as well as describing how to use technology should also be developed. Institutions that created such a department and offer technical support twenty-four hours a day, seven days a week have lowered attrition rates that were due to technology problems. Some may argue that creating such a department will require a huge budget the university might not be willing to pay. However, funds for such a department might be available from the increased amount of students. Alternatively, institutions might charge students a small technology fee in order to overcome the cost barrier.

Providing a teaching assistant (TA) for instructors who teach web-based courses is another solution to help students stay enrolled in the course and succeed. The TA could be responsible for providing technical support to online students. Twenty students per TA is a reasonable number of students for such a task. One drawback to this solution is that the TA will not be available to provide immediate feedback twenty-four hours a day, seven days a week. Still, some technical assistance it is better than nothing.

In case none of the above is possible, course instructors should consider teaching students how to use technology during the first few weeks of the course. This might take away from the course content, but in the long run it will pay off. Students are less likely to drop the course and more likely to enjoy the content, and instructors will not be frustrated every time they receive a phone call or an email message from students who require help with technology.

Instructors should identify students who lack the ability to use online technologies in an online course and should provide early feedback. Students' perceptions of their skills with using technology can be measured using a self-efficacy questionnaire administered by the instructor at the beginning of an online course (Miltiadou, in press). The questionnaire can be posted on the Internet and students' answers could be collected either by email or using a database application. After analyzing results, instructors could warn students of their lack of skills with using technology and advise them accordingly. The provision of early feedback and remediation could result in students staying in the course. This may translate to a decrease in the high attrition rates evidenced in some online courses.

Instructional Design and Course Development Principles for Online Courses

The abundance of web-based courses that exist today does not guarantee that these courses are all instructionally sound. There are a number of design and development issues and principles that course developers need to consider in order to design high quality courses.

First, course developers need to answer some very basic questions such as (a) is the course content appropriate to be taught on the web? (Porter, 1997) (b) who is the target audience? (c) what are the course goals and objectives? (d) how will objectives be assessed? (e) what are the limitations of technology? Instructors who simply post lectures and assignments on the web are supplementing their course, but this would not usually constitute an instructionally sound course. Course developers should refer to instructional design models, procedures, and techniques and follow the necessary steps in order to ensure high quality courses (i.e. Dick & Carey, 1990; Gagne, Briggs, & Wager, 1992; Smith & Ragan, 1999). Several other good sources for advice regarding instructional design principles for distance learning include Eastmond and Ziegahn (1995), Hirumi and Bermudez (1996), Ritchie and Hoffman (1997), and Savenye (1999). Additionally Hannafin and his colleagues have developed guidelines for designing open-ended learning environments, which might form part of the distance learning course (Hannafin, Hall, Land, & Hill, 1994; Hannafin & Land, 1997).

In addition, instructional designers could follow Keller's (1987) Attention, Relevance, Confidence, and Satisfaction (ARCS) model in order to develop an intrinsically interesting course which would enhance students' motivation. Keller's (1987) ARCS model would be used to develop courses that would capture students' attention, enhance content relevance with their prior knowledge and experiences, built students' confidence, and enhance their satisfaction with instruction and content material.

Instructional designers should also make an effort to enhance the relevance of course contents with students' educational backgrounds and experiences. Incorporating case studies that approximate real life situations and match students' interests would increase students' learning goal orientation because it would capture students' attention and motivate them to learn. Instructors should not substitute the learning experience with easy assignments because students might lose interest (Locke, 1996; Locke & Latham, 1990). As a result, students' learning goal orientation might decrease, and it is learning goals that are responsible for students' mastery of the subject being taught.

Instructional designers should create well-planned and structured online courses, including syllabi that are clear and concise. Students should know exactly what is expected of them and the precise steps they need to follow

to accomplish the objectives of the course. Instructors thus would help students control their own pace for finishing assignments, posting messages to various discussion questions, and reading the required material. Johnston (1997), for instance, recommends developing an hyperlinked syllabus, providing students access to many other types of resources.

Course developers also need to either design their own interface, or use a web-course template provided by the distance learning department at their institution. Web page design is not a simple step and should not be taken lightly. The interface should be user-friendly, allowing for sufficient white space and consistent placement of text and images on each web page. A dark font size on white background should be used because often students print out web pages to be able to read the material easily. An appropriate font style and size, universal for both PC and Macintosh computers, is required for students to be able to read without difficulty. Colors should be subtle and should complement the content. Navigation should include a site map for easy access of all web pages by the students.

At the end of the design and development phases, course developers should post all necessary information on the class web page before the beginning of the semester. Such information should include the weekly schedule of readings, assignments, and discussion topics.

The issue of online exams is another major one in online courses. Often instructors feel that they do not have control over such examinations. One way to solve the problem is to have educational institutions collaborate on testing. For example, collaborating universities could provide the classroom and the exam proctors for students living in that area. Another idea is to have students submit essay-type questions, case studies, or research papers, on which it would be difficult for them to cheat.

A final instructional design consideration is the value of conducting formative evaluation and revision on the distance learning course and materials, as specified in most instructional design models. Porter (1997) in her chapter on determining whether courses are appropriate for distance delivery includes a useful checklist for evaluating distance learning courses. Another example of criteria to be considered in evaluating distance courses in schools is presented by Hawkes (1996).

Conclusion

Inquiry that sheds light on online students' motivational characteristics and organizational skills is vital in order to empower educators to design instructionally sound courses and students to benefit from them. Such research studies would aid academic administrators predict student success with the ultimate possible purpose of lowering attrition rates.

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Evaluating new ICT-based models for teacher training

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Abstract: This paper shows how we have developed new models for integration of internal and external students into the same type of courses, and made a dual mode learning environment with common courses for on-campus and external students. Based on feedback from students, we present our experiences about how these models work. In our work we focus on changing the student from being a passive listener to an active learner. We present a tool to implement interactivity in the course material presented on Internet.

Introduction

Over the past eight years we have through our R&D work been experimenting with different models for teaching ICT skills to teachers. The courses have gradually evolved from traditional lectures in the classroom, to Open and Distance Learning (ODL) courses. We have developed, implemented, tested and evaluated different models where the physical location of the student is of less importance compared to methods of presentation. We very much work towards a situation where we can call a student a student, and not focus on whether he or she is actually an internal or an external student. The focus is on what methods to use in working with the content. This means in practice that internal and distance students are participating in the same courses and working with the same material. They take part in the same electronic conferences, and participate in the same discussions. An important goal of this work is to make models for teaching which is the same for both internal and external students. By developing these new models we also try to find new ways of teaching on campus, making the internal students more responsible for their own learning, where the teachers are tutors or guides in the learning process. In our work we have used different tools to make an interactive learning environment where students take an active part.

Our work is based on cooperation with different institutions in Norway and Europe through various projects. For three years we participated in the European JITOL (Just In Time Open Learning) project, which is a European project for developing courses in an ODL environment. Towards the end of the JITOL project work continued in a similar Norwegian project NITOL (Norway-net with IT for Open Learning). Through this project four institutions have worked together to make a common course pool. The last and most comprehensive project we participate in is the Norwegian Network University (NVU). This is a joint project with seven Norwegian Universities and higher education institutions, making a common course pool for Open and Distance Learning in higher education in Norway.

Organization of the Courses

In our courses we provide the majority of learning material through Internet. In this material we include references to books and URLs, integrate video shots to illustrate actions and so on. On Internet we

present exercises and assignments as a part of the course. Internet is also used as a forum for discussion and exchange of views and experiences according to the learning material and assignments. This is building an electronic learning environment where both learning material and student work are presented and discussed.

The contact with the students is also done electronically. Student assistants and teachers are made available for net based interaction and guidance, and tools like IRC are used to create cooperating groups.

This is done both for external students and for internal students that attend the course in a more «traditional» way. All the content of the course is presented on Internet and internal students have to read and work with this material in order to prepare for the classes. The teaching in the classroom is no longer dominated by lectures from the teacher where students are passive listeners, but guidance related to the material and assignments in the course. This guidance and these discussions are also made through electronic conferences, and IRC, in order to include the external student in the discussions. Since external students take the same courses as internal students without showing up on campus, the teaching is becoming an «extra service» for the internal student, and not an absolutely necessary part of the course. Internet is gradually becoming the arena for teaching and guiding, and the problem based learning method is becoming rather dominating.

Another important factor is to make interactivity in the course material in order to force the students to take an active part in the course. In some of our courses we «open» the material, and the students can add information to the content, ask questions, show examples and present personal experience directly in the material, not in a separate newsgroup. This is done by letting the student make *annotations* to the material. This is making the curriculum a «living» learning environment, and not a static material that is made once and for all by the teacher. To make such an interactive material, we use a tool called WebOrama. The WebOrama is a tool in the SHARP project (http://www.softlab.ntua.gr/sharp/).

WebOrama is a system where video clips, sounds and texts are integrated and played or showed as sequences. The way we use WebOrama is to start a video sequence and on certain predefined points, annotations are shown or started as other video sequences, sounds or texts. Annotations are used to give additional explanations to a video clip, text, sound and so on. In this way we organize the video sequence as a hyperstructure, not as a linear sequence. Annotations can both be shown automatically, or as a consequence of user interactivity. These annotations are usually programmed by the author of the sequence, the teacher, but an important point is that new annotations also can be made by students. These new annotations will be integrated in the sequence in the same way as annotations made by the teacher. In this way we can make the course material increase by student activity and participation in the course.

A video clip in WebOrama is shown in e.g. AVI-format, ASF-format or as a GIF-animation. The buttons below the picture can be used to add different types of annotations:

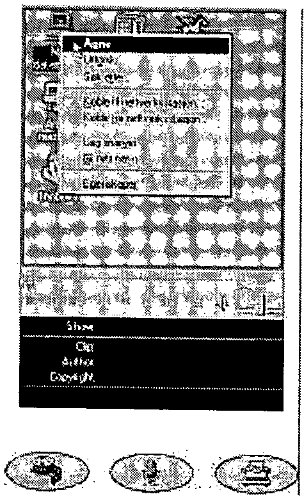

Figure 1: WebOrama with a video clip and buttons for definition of annotations.

To a video clip we can typically have a list of annotations. The user can click on these annotations to start another video clip, a sound file or a text. These annotations are defining the hyperstructure in the WebOrama sequences:

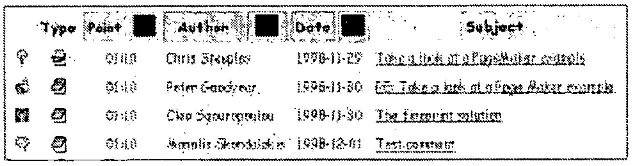

Figure 2: List of annotations in WebOrama.

The main structure is the video clip. When the video clip is shown, the time is the trigger to show the annotations. Annotations can be made to the main video sequence, but also to other annotations. This is building a hyperstructure with no limits according to levels of annotations in the sequence.

The WebOrama is one example of tools we use to increase interactivity in the course material. By using this tool, we enable the students to be active in the learning process, and to participate in developing the content of the course by making annotations. Annotations made by students are available to all other participants.

Annotations made directly to the course material, and in the material itself, will make a strong connection between the original material and the problems, questions, answers or comments to the content. The separation of the content and the place to interact with fellow students and the teacher seems to be a factor that disadvantages the use of newsgroups in this kind of interaction.

WebOrama is not implemented as a groupware, but on some points it is similar to how groupware works. In WebOrama the students and the teacher work on the same document, and all changes and additions that are done are published to all other participants. The main difference between WebOrama and «traditional» groupware is that in WebOrama the students do not work simultaneously on the same document. This prevents the student from real-time teamwork, but this system helps the students to cooperate and to work on the same content. The WebOrama system provides a simple and efficient way of publishing changes and new content in the work.

From Teaching to Learning

Maybe the most important factor and goal in our work is to change the students' attitude from being passive listeners to active learners. This has important and rather dramatic consequences both for the teacher and the student. In our courses the teacher is no longer an oracle. He is more of a guide. The teacher is no longer the most important person in the learning process because of what he teaches in the classroom, but rather because of the learning environment he makes to stimulate the students' learning.

For the students one consequence of their new role is to a much greater extent to take responsibility for their own learning and education. Much of the work in the courses requires student activity to solve different tasks. The amount of time used for *teaching* the students is reduced, and replaced with more time for the students to *learn* through their own work.

The three most important factors in our courses are *engagement*, *work* and *guidance*. Because of the integration of internal and external students in the same learning group, much of the traditional teaching has to be replaced by individual work, and work in groups of students. The course material on Internet shall not be a complete description of everything the students have to learn and to know for an exam, but rather be a trigger to the work of the students themselves. Students are guided to overcome difficulties in this part of the course. Input to students is very often based on the work done by the student, so the engagement and participation in the course plays an increasing role in how far into the curriculum the students are able to work.

Without work and engagement the students are not likely to learn. Teaching cannot replace the work done by the student. With traditional teaching to groups of low student engagement, no one but the teacher is likely to learn anything!

Findings

Through our work where we have organised the courses according to new models for teaching, we have systematically collected information about how these new models work. These data are organized in a database, and can be used to draw some conclusions about how the models function and give ideas about how they can be improved.

Even though we treat the internal and external student almost the same way, we notice some differences between traditional, internal students that work together on campus, and external students who very often are working alone and therefore have to use only electronic tools to interact with other students and the teacher.

Expectations

The majority of internal students still have expectations of getting traditional lectures as the dominating teaching method when they join a course. The content of the course is to be learned through lectures and a predefined curriculum. The attitude is still very often based on behaviouristic learning theory, and the belief that «someone can teach someone something», and that this is the best way of learning. This may be an effect of our examination system, where facts and information are asked to be recalled or reproduced. But does this actually test what is learned, and are the students in this system only motivated for using methods that make high scores in an exam? Do they really learn out of their own needs?

The traditional «delivery» of facts and science material in the classroom, or over Internet should not be confused with learning. This material should be considered as information until the students have treated it and gained some kind of knowledge. This is similar to databases. A database only stores data, and these data have to be interpreted to become information. In our courses we focus on constructivistic learning theories and do not only base the course on delivery of information to students. Our students have to work throughout the entire courses to gain their own knowledge and understanding of the content.

In the beginning our students can be a little confused, and have some problems to get started with the work. Many students need some time to adjust to the new way of working, when the courses very much are based on activity from the student in relation to the teacher as a guide, not as a lecturer. But the feedback from the students shows that after adjusting to this way of working, they find these models to be an efficient way of working and learning. They actually need some time to shift focus from listening to working.

In our courses we focus on using Internet as an interactive working arena. Internet must not be used as an excuse for presenting linear text, but as a tool to increase student activity. If knowledge is gained through work, Internet must be more than a delivery system for information. It has to be a place for working.

Results and Final Scores

The results and scores on final exams and compulsory work are the easiest factors to test and to compare with results from other courses. Over the past years we have seen that increased emphasis of active students, problem-based working methods, makes better scores on the final exam. The exam is still the same, but the results are better. This means that even though the courses do not focus as much as before on lecturing, teaching and a predefined curriculum, our experience is that the students learn more and better.

The feedback from many students reflects an attitude that they learn the curriculum out of their own needs, not with the exam as the only goal. The student finds the curriculum of the courses important to learn, and we find that this new way of working has adjusted the courses to the students' need of knowledge and skills. The methods and the content fit together.

According to how males and females score in the courses, no major differences can be spotted in the results.

In our courses we treat internal and external students the same way. The courses are actually taught over Internet, and the use of lecturing and guidance in the classroom can be considered as an «extra service» for the students that show up on campus. In this way we can say we still have some differences in teaching

internal and external students. If we look at differences in scores between these two groups of students, we can see that external students score equally or even better than internal student, both on final exams and on compulsory work. There can be many explanations to this, but we believe that when external students have to rely on the Internet based course, this inspires them to work more. And when they do not meet in the classroom, it is more obvious that the only way to learn is through their own work. We also find that many external students are older than the internal students, and therefore are more experienced learners, even though their experience may not directly be related to the content.

Transformation of a Physical Classroom to an Electronic Learning Environment

One important challenge in ODL courses is to create an electronic learning environment. How do we integrate external students into a common environment where they interact with each other and the teacher, and how are internal and external students organized into one group through electronic tools? As we often see in different courses, the interaction in a physical classroom cannot directly be transformed to an electronic learning environment. For instance the participation in electronic conferences can be limited. Feedback from many students tells us that they do not always want to ask questions in an open environment like a news conference. To help this interaction we have closed the conference for participants outside the course. Direct interaction with teacher and other students through e-mail, is more popular, because it is a closed interaction between two or a limited number of persons.

Another factor that seems to disadvantage the news groups and also to some extent the e-mail as a tool for interaction between students, is that these tools often function as a separate and not integrated system in the curriculum. The distance between the content and the arena to ask questions, make references, interact with others and so on, may in many situations be too big. The integration of curriculum and student activity, like the one in the WebOrama system, can help to overcome some of the problems related to interaction with the course material.

One of the major challenges in ODL courses, is to integrate and use electronic tools that allow and motivate the students to interact.

According to feedback from the students, we find that the search for information on Internet is efficient. Searching on Internet is a well established method for getting information, and is easy to integrate as a tool in the curriculum. In practice this means that the teacher as a resource of information can be replaced by these tools.

Groupware must also be evaluated as tools in electronic learning environments. The importance of these tools will depend on need for synchronism in student work. Our experience is that these tools function as a meeting point for chatting and for making appointments. Cooperating students often work individually, and at defined points present framework for discussion. Usually they do not work simultaneously on the same document.

Practical Aspects

Many students attend ODL courses for practical reasons. Because of work, family, physical location and so on, they are prevented from showing up on campus, and the only realistic alternative to get an education is to attend ODL courses. This is actually an important argument for making ODL courses in Norway. They are needed for practical reasons to implement lifelong learning. An important finding is that the organisation of the study as ODL courses from the students' point of view do not reflect negatively on the outcome of the courses.

Based on the given feedback and results in the courses, we see that the combination of education, work, family and so on forces the external student to be efficient. They do not have time to surf on Internet unless it is related to their work. This is a factor that we also believe has an impact on the score and results of external students. The efficiency can help them to focus on the important items and to work with them, and not sort of flounder around. This is something we see more of among internal students.

Conclusions

Our experiences are based on developing and producing courses to provide ICT skills and ICT knowledge to teachers. We use ICT to create an electronic learning environment for learning ICT. An important goal is also to implement our experiences in other topics and subjects within teacher training. The use of new models for learning and the emphasis on using ICT should not only be related to teaching ICT.

The models developed for teaching ICT skills can be used to change parts of the teaching in other topics. At least 50% of what the lecturers are teaching verbally can be presented as hyper structured interactive lessons on Internet. Instead of talking to a passive audience, the lecturers can use their time as advisors and mentors for the students. And the students should use their time working, not just listening! The teachers in teacher training must change the way they work.

To change the methods used in initial teacher training in Norway is a great job. By using methods based on ICT tools, we can rationalize the time spent on theoretical subjects, and increase the time spent on interaction with students.

Improving Collaborative Learning by Supporting Casual Encounters in Distance Learning

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Abstract: Casual encounters, in a learning environment, are very useful in reinforcing previous knowledge and acquiring new knowledge. Such encounters are very common in traditional learning environments and can be used successfully in social environments, in which students can discover and construct knowledge through a process of dialogue, negotiation or sharing. In the context of these casual encounters we developed a system that informs the user who accesses a web site of the presence of other participants and the messages they have exchanged with each other in order to interact with other people reading course-related documents within the site at the same time. The system will be used in a distance education class in collaboration between the Massachusetts Institute of Technology (MIT), the Pontificia Universidad Católica de Chile (PUC), and the Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE).

Introduction

In the last few years, we have seen an increment in online courses, video-conferencing courses, and courses that combine both technologies, offered by different universities, in which students from all over the world can receive, participate and collaborate with other students in different cities or countries.

However, most of the casual encounters and social interactions that occur in a traditional learning environment, in which students are taking coursework on a university campus, are lost in these distance education environments. In these casual encounters in which the conversation topic, duration

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and number of participants are not defined, a rich information exchange occurs between students and professors (Kraut, 1990). Some of the characteristics of these encounters are the following (Isaacs, 1997):

- Brevity: The duration of the interaction may be seconds, a couple of minutes, or 15 minutes, at the most.
- Informality: Conversations do not include formal greetings or leave-takings.
- Spontaneity: Interactions is what may be called opportunistic, not planned, although it can be planned by either party.
- Intermittence: The purposes of interpersonal interactions are seldom achieved in one interchange, so that such conversations occur over intermittent episodes (Whittaker, 1994), with participants on average interacting with each other 2.5 times per day.

Casual encounters, in a learning environment, are very useful in reinforcing previous knowledge or in acquiring new knowledge. Most researchers believe that knowledge can be acquired successfully in social environments, in which students can discover and construct knowledge through a process of dialogue, negotiation or sharing (Boekaerts, 1998), for example, when students are waiting to take an exam and are together in the room where the exam will be held (perhaps some of them have never even met before), they begin to talk with each other about doubts, and possible questions, commenting on ideas and exchanging information. In some cases, with this communication, students can understand concepts that were not completely clear to them previously and, as a result, improve their performance in the exam.

In the case of distributed collaborative learning, due to the distance and the distribution of students, casual encounters are very rare, and students cannot interact with each other as if they where in the same campus, and in general their only recourse is to attend formal meetings in order to talk about the class meetings with a definite topic and at a particular time, and they cannot talk freely about other class topics.

In the next section we discuss a distance learning course that was given through video-conference between CICESE (Centro de Investigación Científica y Educación Superior de Ensenada) and MIT (Massachusetts Institute of Technology). In section 3 we introduce brief descriptions of systems that support casual encounters in distributed environments. In section 4 we discuss the implementation of a system that supports casual encounters in a web-based environment and will be used in the distributed software engineering class and, finally, we present our conclusions and future work in the development of new courses and systems that can take advantage of the characteristics of the system implemented.

A Distance Learning Course in Distributed Software Engineering

The main objective of this course was for students to experience the software development process in a company with a project from a real client. The client was interviewed by the students to present the project that he wanted to develop and then professors assigned the roles that students would play in the software development company.

In this course we had a group of 14 students, four at CICESE (Centro de Investigación Científica y Educación de Ensenada) and ten at MIT (Massachusetts Institute of Technology). The course was taught through video-conference, with two classes per week, one theory class and a lab. Each class lasted two hours. Theoretical classes were given in alternate weeks at each site.

The Software Engineering class created a web site to publish all the documents generated during the course. It also had an e-mail list with all the participants, used to exchange information between all members of the group. We stored all the e-mail messages sent through this list in a web site.

It was possible for all members of the group to check all the information and tasks assigned to them.

All the students in this class were assigned a role as if they were part of a software development company (i.e., analyst, designer, programmer, etc.). To assign the roles all the students were asked to select two main roles they wanted to play in the class. The professor considered the selections made by the students, and the skills that each student had to best accomplish the work assigned to each role.

The short informal conversations that normally take place in the halls, which allow participants to exchange valuable information, in this case, took place through chats, via e-mail and ICQ messages. Between professors and students, such conversations took place through e-mail and video-conference but were less frequent.

The course attempted to promote interaction through group division by geographically distributing all the roles. That is, the group in each location was subdivided with two members at MIT and one at CICESE for each of the subgroups. Each group had a leader in charge of its organization and coordination. Based on this course and because of a need to find further support for casual encounters we revised several systems so that they could be utilized to improve students performance in distance learning classes.

Systems that support casual encounters

Several computer based systems have been developed to support casual interaction, but they have been used only in office environments. Some of these are the following: Piazza (Isaacs, 1996), whose approach is to use networked computers to provide opportunities to encounter others through tasks and activities accomplished on-line; Cruiser (Fish, 1989), which provides innovative mechanisms for initiating connections between users to encourage frequent, informal, and unplanned communication among a large but selected group of members of a distributed community; Ubique (http://www.ubique.com), a system that provides virtual places that allows users to see graphical representations of others browsing the same web page at the same time and to open up a text or audio chat with them, and which also offers mechanisms for navigation through Web pages together; Telenotes (Whittaker 1997), is a system designed to support lightweight interactions through conversational tracking, rapid connection, the ability to leave a message, context management, and shared real time objects. However, some of these systems require the use of special software or hardware and require, also, that people come together at a specified online "place in the network to see others (Isaacs, 1996). This approach is acceptable within a homogeneous environment where all users are using the same client-server. Only one of these systems provides mechanisms for casual encounters in web sites. With this in mind we developed a system to motivate learning produced by the interaction among people visiting the same web site. In the next section we discuss the structure and implications of this system.

The INCA system

In the context of these casual encounters we developed a system that informs the user who accesses a web site of the presence of other participants and the messages they have exchanged with each other in order to interact with other people reading course-related documents within the site at the same time. The goal of INCA is to motivate learning, produced by the interaction among people interested in similar topics. The interaction takes place when the user realizes that another person is reading the same or a related document and decides to initiate a chat or a video-conference session with him.

The main requirements to be provided by INCA were:

1. Support for informal interaction.
2. Recreate a traditional library system, in which one can meet with other people reading the same book or document.
3. Provision of audio and video resources to permit users to communicate with each other.
4. Navigation within the site that would be as natural as possible. As If there wasn't no other system, just the web browser.

The INCA system uses several servers (Web Server, Awareness Server and Collaboration Server) which delivers the different Web Pages and announces new users that connect to the web site. The server takes the real name, nickname and e-mail address from the users registration information on the main page of the site. When a user logs into the system, the web server sends the registration information to the awareness server and requests information about other users already connected and announces the new user to other users connected, then it sends to the new user all stored information about other users. Each time a user logs off the system by loading a page that is not in the site, all other users connected are notified and their user's menu is refreshed. In fig 1, we can see a typical scenario for a user connection and the interaction between the different components of the system that lead to a casual interaction through the INCA system in a web site.

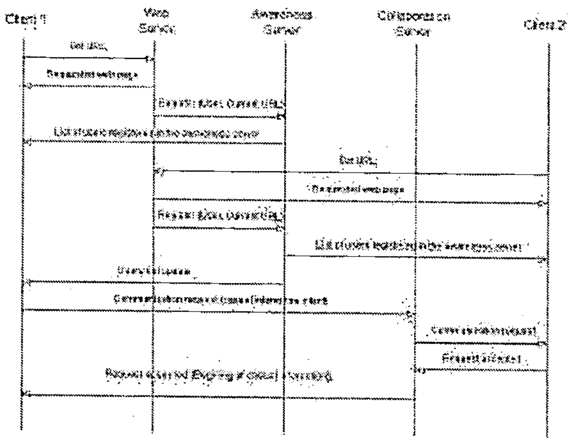

Fig. 1 A typical scenario for a user connection

In fig. 2 we can see the INCA system architecture for an interaction request and interaction acceptance for two users.

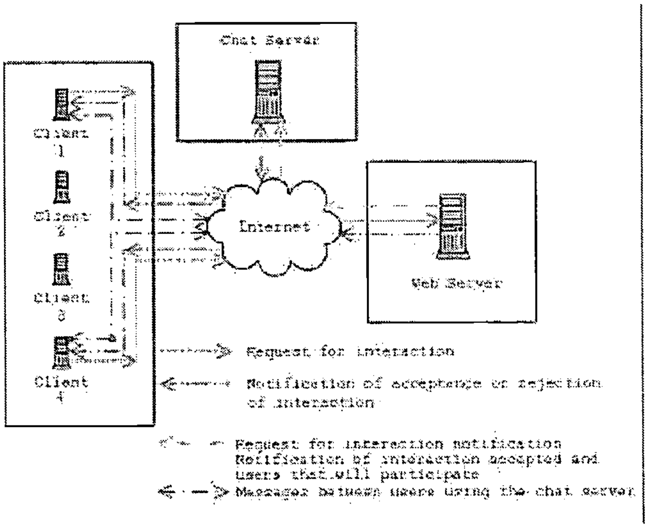

Fig. 2. An architectural view of an interaction in the INCA system.

In fig. 3 we can see the site in which the INCA system was installed to test its functionality and we can also see an interaction between 2 users using the chat. A user connected to the system can navigate normally through the web site, by clicking on a small button attached to a frame on the left side of the web browser, the user also has the option of seeing pictures of other users who are connected, by pressing a button, that opens a small window showing all the users nicknames and allows one to select a user. Once a user is selected, a window pops up showing the user information and containing three buttons that permit starting a chat conversation, establishing a video-conference or cancellation. The system presently accepts all video connections, but it will be changed so that, as in the chat request, the user may accept or reject the connection.

While users interact with each other, they have the option of synchronizing their web browsers to navigate on the web site. Then the chat or video-conferencing subsystems can be used to exchange comments about the information they are browsing. To stop interacting a user can simply close the chat or video-conferencing window or press the finish button.

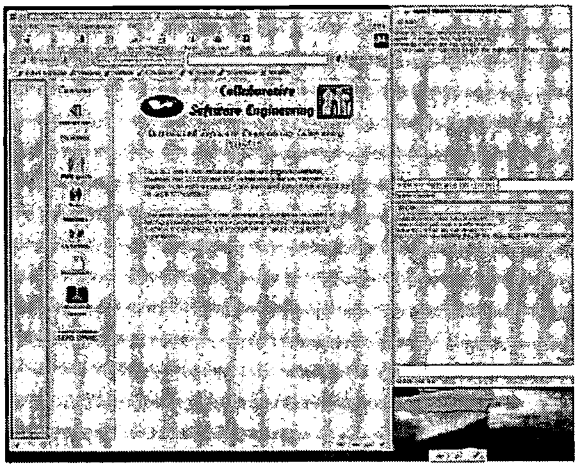

Fig. 3 Test of INCA's system functionality

In fig. 4 we can see an interaction between two users with the video-conference subsystem.

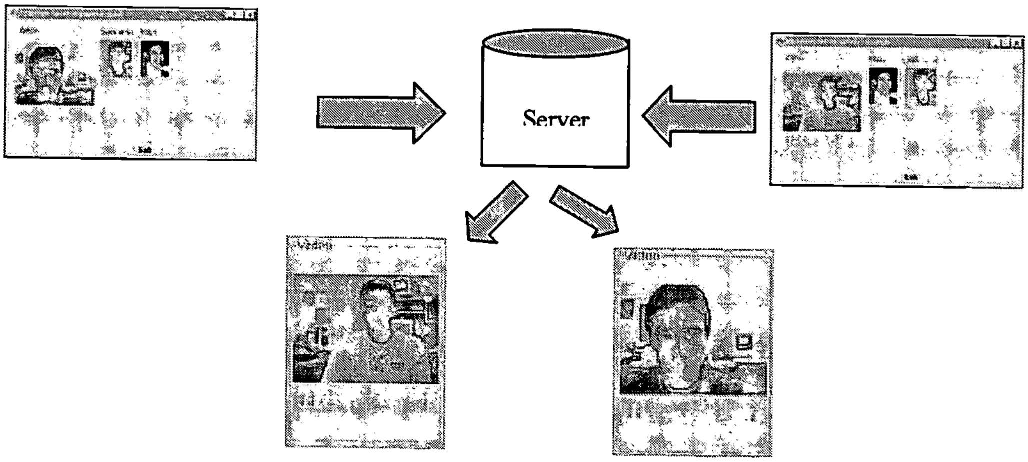

Fig. 4. Interaction between two users using the video-conference subsystem.

The INCA system will be used in the next edition of the distributed software engineering class in collaboration between the Massachusetts Institute of Technology (MIT), Pontificia Universidad Católica de Chile (PUC), and Centro de Investigación Científica y Educación Superior de Ensenada (CICESE).

Conclusions

In this paper we discussed the importance of casual encounters in a distributed learning environment since they allow a rich information exchange between students. We presented some systems that have been used only in office environments that support this type of encounters and only one of them permits the use of web-based environments. We also presented a system that permits casual encounters in web-based distance classes and informs the user of other people connected at the same time and allows them to establish an interaction among two or more users.

We think that the development of this system to support our distance learning courses will allow students to better understand the course material and as a result improve their performance in the classes because they can consult other students or professors about their doubts or solve problems in groups.

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Group learning through Internet

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Abstract: Internet is being intensively used for distance education. Normal services like email, chat and videoconference are not enough to fully support for properly handle interactions without extensive non-automated work. To support group work related to learning activities it is necessary develop applications to handle participants contributions and consolidate contributions providing summaries of the discussion. At the same time it must be integrated with group decision support tools to help students to build results from what was discussed. This paper presents a leaning environment developed to support through Internet for distance education.

1. Introduction

Computer-mediated distance learning (CMDL) is an uncommonly bright star on the horizon of higher education innovation. According to a recent study by CCA and Associates, 30 percent of colleges and universities have at least one distance learning program in place and an additional 28 percent are planning such programs. (Tucker 1998)

As Internet use in distance education grows exponential nowadays, services used at the beginning was only the ones having strong relation with ancient forms of distance education. Distance education started using post services and even those days, many courses use in wide scale Post Office distribution of printed material. Other mass communication media, as television and radio or recorded tapes with video or audio where also very usual. Some Internet services started to be used in replacement or complementing this kind of services technologies used are shown in table 1.

Ancient forms of distance education	**Internet based environment**
Printed text books	HTML pages
Exercises	Forms and CGI
TV broadcast	MBONE
VHS tapes	Real Video, MPEG
Audio tapes	Real audio
Assesment	Forms and CGI

Table 1: Distance education services

Internet utilization adds more possibilities, for news forms of interaction like is shown in figure 1.

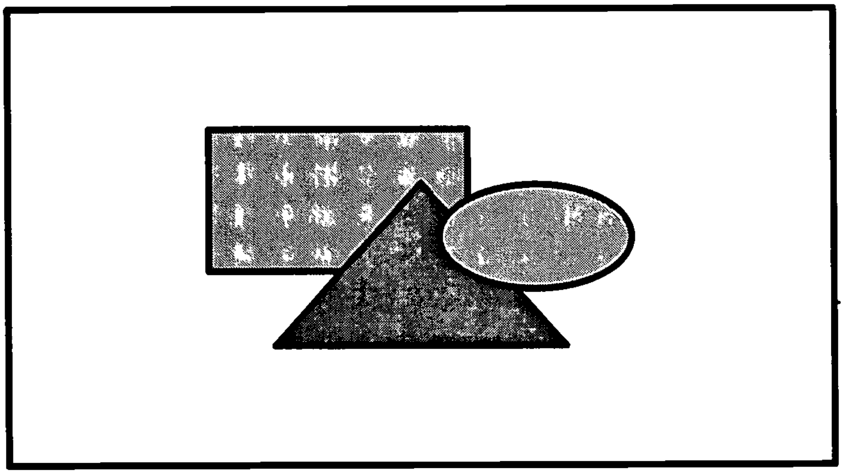

Figure 1: Interacting through Internet

The use of the Internet for distance education derived some advantages but one of the main is the support for human-to-human interaction that is as essential activity in learning. But long experience on using showed a need of a better level of automation on handling of group contribution. Huge number of contributions are some times just relegated to a historical register kept in log files. So the group activity may give opportunity for student to present contributions that some times are relegated to forgetfulness.

To support more good use of contributions derived from group work, related to learning activities, it is necessary the development of applications to handle participants contributions in such a way to provide support for group decision and utilization of contributions that came up during group activity. Collaboration strategies are requested to improve the information quality provided to support decisions. In distance education it shows up as an educational innovation.

For all the bells and whistles of groupware (Bannon 1992) , e-mail continues to be the most widely used groupware component So one can count on all the automated work provided by email or news service servers to receive, store or/and properly forward the messages. But no matter if only **email** or **news** service is used for group communication, as well as other forms of interaction, like chat combined with videoconference or with other multimedia environment (as The Palace or Virtual Reality based environments), the results from group activity are huge amounts of text derived of participants contribution. When it comes to the consolidation phase of the work, usually it is needed a lot of non-automated task to extract main ideas from the many ones presented almost randomly during the discussion. It is also needed a voting system to support group decision about the consolidated results from discussion (ordering, reordering, selecting, discarding etc).

This work describes strategies and tools designed to accomplish automatic ideas grouping (with focus on common themes) for organization of contributions resulted from steps in a group decision. A set of tools was designed and developed for to support distance education cooperative work.

2. Group tool

The work start on the supposition that group activity results on a log file containing interchanged texts (synchronous or asynchronously) during a group debate. These inputs are submitted set of routines that group ideas automatically. The system uses a WWW based interface and log files derived from the group interchange of ideas. The actual results where built from existing previous works at UFRGS.

First considered work to give a start to present project was a tool denominated "Issue Analyzer" that provides natural language recognition. It also contains an algorithm for calculation of similarity between contributions of participants from a group discussion. This prototype was implemented on Sun stations and the software used RPC (Remote Procedure Protocol) for intercommunication between a server and client applications. It provided the grouping of similar ideas generated in the phase of brainstorming and organized them according with definitions of the group.

Another previously developed work, named Eurekha, showed the importance of information retrieval techniques, to support textual information organization. It pointed the usefulness of this kind of support in an

environment with information overload like Internet. This solution uses methods for grouping textual objects. Objects are organized automatically in similar objects groups, facilitating their location, manipulation and analysis.

Both systems are directed to natural language (in written form) processing. In natural language processing, one of the more important aspects is the formal language representation. In this work it was used Discourse Representation Theory. This kind of system faces big challenges: linguistic aspects of natural language representation and handling of problems like ambiguity, references to names, pronouns, etc. So another aspect present in this solution was the grammatical classification of sentences.

The present work aimed a result in terms of group decision support system tool that is able to handle natural language input.

2.1. Proposed Model

The designed system used existing results derived from previous works, referred above. It starts with am Module I that handle log files (derived from chat sessions using software like CuSeeMe, The Palace and similar ones). Files are split up in smaller units (files with only one sentence or contribution). Those smaller units are submitted to a routine that performs similarity calculation. This module, process each sentence resulting in properly labeled version according with a Syntactic Derivation Tree (ADS). Stop words are removed from sentences because they do not add significance. It is possible to customize the system adding or removing stop words to the dictionaries. Figure 2 shows types of stop words (adverbs, pronouns, cardinals, prepositions etc)

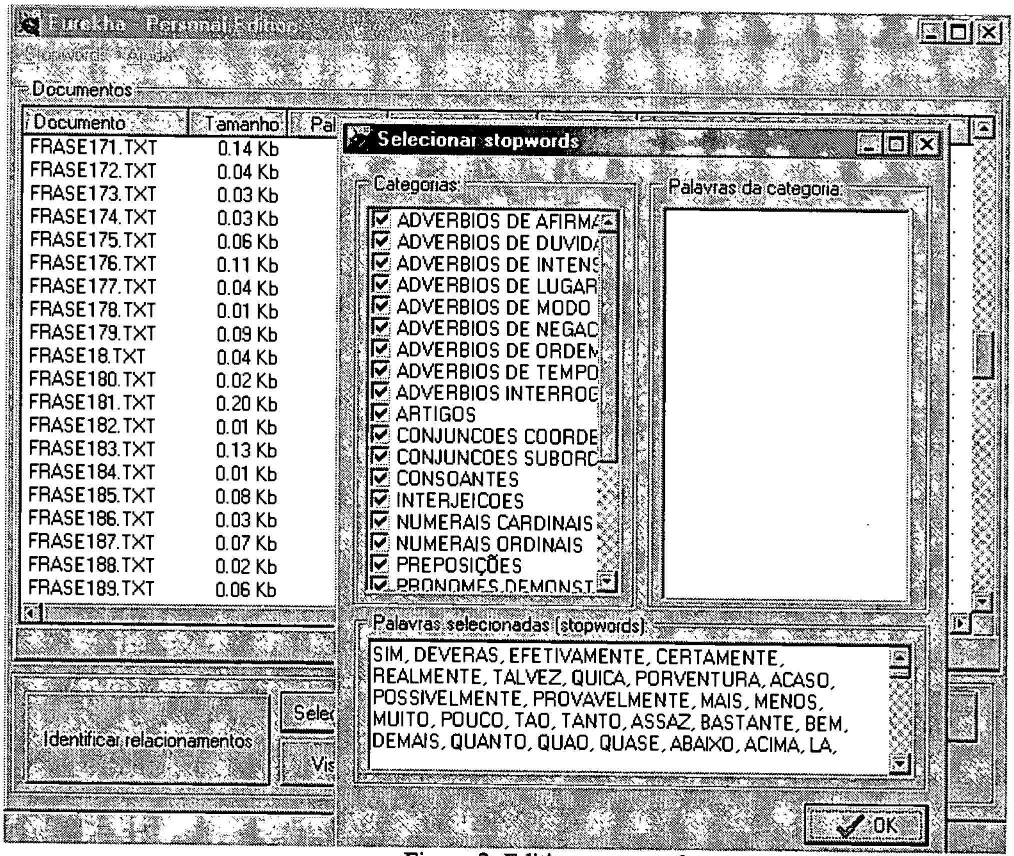

Figure 2: Editing stop words

Module II (previous work named Eurekha) handle sentences grouping them in cluster according similarity. In this step pre-processing of natural language is done. It is considered that the documents have already been corrected with the use of an orthographic checker (task also performed by the module I). Besides, is interesting that the texts have suffered some normalization of terms. However, these procedures are not conditionings Figure 3 show na example of results using Eurekha.

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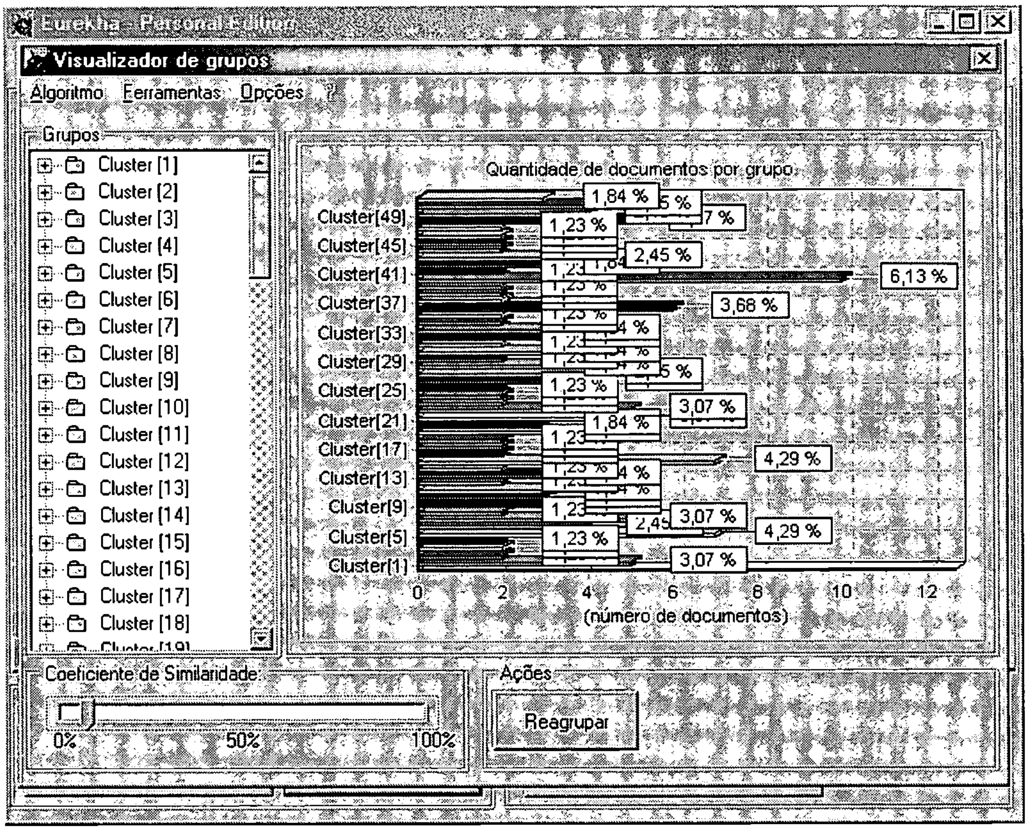

Figure 3: Output of Eurekha.

It is important to play with similarity coefficient to get better results. If one chooses a very high coefficient of similarity will result on high number of cluster with few sentences. If one choose a very low coefficient of similarity will result on few cluster but full of non related sentences. To handle files with student contributions we find out that 15% is a good number for the desired coefficient of similarity.

Other modules, built during present development of the project (Module III to V) handle the resulting cluster of sentences, identify the most frequent/relevant words that will be used to compose a set that represents each cluster. Module III performs this task.

The module IV index words and links them to original sentences for further information retrieval. So one can wants to know which sentences provided the most words resulting as representative for clusters (and of course who created that contributions.

Each group of words became an alternative in a voting process. The voting results in a hierarchy of representative ideas by the group. Module V implements this voting process. An HTML page with the results of this stage of the discussion is presented to the participants of the group to subsidize one more discussion round.

2.2 Results

A prototype version of the system is running. It provides all the funcions described above:

- clustering of sentences
- generation of consolidated idea for each cluster
- integration with a voting system to allow participant to weight and vote consolidated ideas

The results of this process can be used as starting of a new step of the group work where new discussions will use the results of previous consolidated work. This cycle can be repeated as many times as desired.

The tool will be used not only to support building conclusions from consolidated sentences but as it also

keeps the original sentences and their originators, it is possible to derive conclusion about productivity of each participant. Not only the amount of contributions can be counted but it is also possible to identify contributions that originated consolidated clusters selected by participants as more relevant and representative of the discussion conclusions. So it is possible to identify those students whose contributions are more significant, being more often included in the clusters more accepted by the group.

3. Conclusion

Tools described in this work where designed to support group activity in distance learning because it is believed that cooperation and collaboration are key components in distance education. Natural language processing was needed to handle contributions of group activity resulting in clustering of sentences and summarizing cluster to came up with representative ideas of each cluster that are submitted to a voting process and resulting ordered representative sentences are the essence of the group activity. These results may be partial being used as input for a new cycle of discussions.

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Challenges of Using CSCL in Open Distributed Learning

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Abstract: The role of the teacher is changing. The teacher is to be the one who organizes the entire learning environment. Real-time educational groupware systems allow geographically separated learners to work together in a shared virtual workspace at the same time. There has been a move from teaching to learning. As a compulsory part of the MEd in Pedagogical Information Science at the University of Bergen and Stord/Haugesund College in the Spring term of 1999, the students participated in a distributed group activity. In this paper we present some of our findings,- both challenges and decisive elements, based on our participation in this open, distributed and collaborative learning environment.

Introduction

Recent research draws attention to a change in the role of the teacher. The teacher is no longer an information-transmitter who transfers his own knowledge into the minds of the pupils. The new teacher role is instead defined more like an information organizer and adapter. The teacher is to be the one who organizes the entire learning environment. The expansion of the Internet and computers as a means of communication, have since the late 1980s opened for widespread research on different models of distributed collaborative learning. The introduction of recent technology, in particular computer-supported tools in education, has during the last 40 years gone through a number of paradigm shifts (Koschman, 1996). Tapscot (1997) describes these shifts as a change from *broadcast* to *interactive* learning. Thus, there has been a move from teaching to learning, where the roles of the actors on the learning arena have become more equal. The emerging area of theory, which several researchers are concerned with, is referred to as Computer Supported Collaborative Learning (CSCL).

Our Theoretical Framework of Computer Supported Collaborative Learning

The development within research on learning through collaboration has experienced a shift from focusing on the individual in the group (1970-80) to studying the entire group as a whole (Koschmann, 1996). Research on CSCL (Koschman, 1996) focuses on instruction as practice rather than lecturing. Focus is on the process rather than on the result. Theories are based on observed situations, and the tendency is that CSCL is based on a descriptive method, as opposed to a more experimental form of work. In addition, attention is on understanding the process from the participants' point of view. It is important to focus on the single factors, and try to understand the role of these factors in the process of collaboration, so-called process oriented focus. This, however, demands brand new tools for analysis and modeling of collaboration (Dillenbourg et al., 1996).

ICT-based collaborative learning has emerged from several theories of learning: *Social Constructivism*, focusing on the development of the individual, based on social interaction (Bauersfeld, 1995). *Soviet's Sosio-Cultural theories*, focusing on the cultural environment for understanding the actions of the individual. Furthermore it is claimed that learning rises on two different levels, first, at the inter - psychological level, and second, on the intra - psychological level (Wertsch, 1985). *Situated/distributed cognition*, emphasizing on the concrete situations and environments where learning takes place (Lave & Wenger, 1991). In addition, this theoretical framework contains a mutual understanding of language, culture, and other aspects of the social relations (Scott, Cole & Engel, 1992).

The process of learning in such an environment is based on collaborative learning. Collaborative learning can be defined in several ways. Bruffee (1993, p. 3) describes collaborative learning as "a reculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to". Roschelle and Behrend (1995, p. 70), on the other hand, define collaborative learning as "the mutual engagement of participants in a co-ordinated effort to solve [a] problem together".

In designing new information- and communication technology mediated forms of open distributed learning (ODL) environments, the expression *collaborative telelearning* (Wasson, 1998) is commonly used. Rather than explaining the expression distance only to aspects of time and space, as we know it from traditional ODL, we want the mediation of learning activities to be supported by i.e. *multimedia shared workspaces*. CSCL and collaborative telelearning use means that emphasize ICT as mediating tools in collaborative situations. Such a tool should contain mechanisms for supporting synchronization, exchange and sharing of information and documents. Access to tools and services should be as transparent as possible to avoid obstacles in the learning process. A distributed collaborative learning environment is a place that is being constructed by the participating students through individual and collaborative work. The role of the designer will be to support the students in the process of creating this environment in such a manner that the computer system becomes an integrated part of the student activity.

Our Experience

As a compulsory part of the study in Pedagogical Information Science at the University of Bergen and Stord/Haugesund College during the Spring term of 1999, the students participated in a distributed group activity. The activity, which was part of the DoCTA (1999) project, was to provide experience on distributed collaboration and use of online groupware systems. The University of Bergen, Nord-Trøndelag College, Stord/Haugesund College and Telenor Research & Development participated in the project. In practice this meant that students in each group came from different geographical places and technical environments.

The entire group collaboration process was to be mediated by information- and communication technology. The work was done on the presumption that each group member had access to his or her own computer. The groups were to collaborate through the network by means of a groupware program called TeamWave Workplace (1999). This program offers the participants a joint workspace. The workspace is defined as a room. One great advantage in Team Wave is that it is based on the *place* metaphor with its persistence, and not on a

meeting metaphor like many other groupware systems. The participants may create their own rooms, and navigate between the different rooms by using the doorways provided in the room. In each room there are a number of available tools. By means of these tools the group members can collaborate, show and exchange files and URLs, have common databases, address books and calendars, may write and draw on the same screen etc. In a room of TeamWave, participants can see who else is logged in and what room they are in. They can also observe each other's cursors and observe each other create, delete or move objects in the room.

The task of the students in this assignment was to create a room in TeamWave Workplace, which enables learning of a specific subject. The work process of the group was made up by several stages. After the group had installed and made the program work on their computers, a rehearsal stage started. In this session the students were led through a number of assignments where the underlying goal was to provide experience in using the tool and practicing interaction with the rest of the group, and simultaneously getting to know their fellow students. The main part of the activity was the design activity. The group was to design a room in TeamWave where students can learn a specific topic with theory, procedure, process etc. Throughout the collaboration, focus was directed towards the actual collaboration process within the design group. The main interest of the activity was on how students made their decisions and how they were carried out, rather than on the final contents of the learning room that was designed.

Challenges

It is a great challenge to create successful collaborative situations in a classroom. When participants in addition seek to transfer this workform to an ICT based environment in order to build what is referred to as CSCL, the task becomes even more complex. In such a situation the composition and orchestrating of the entire working environment will, according to Salomon (1992), be more important than the design of the technology. In a computer supported collaborative learning environment Salomon (1992) identifies two effects connected to the learning design. He chooses to distinguish between *effect with CSCL*; changes that take place while one is engaged in intellectual partnership with peers or with a computer tool, and *effect of CSCL;* more lasting changes that take place as a consequence of the intellectual partnership. This is the lasting cognitive result, defined as being more general than the previous. Seen from a perspective of learning the natural choice will be to emphasize and increase the *effect of CSCL*. Thus one may train for independent thinking for use in unforeseen circumstances where technology is unavailable. However, taking Vygotskys (1978) thoughts of *zone of proximal development* into consideration, and his theories of how social interaction creates cognitive changes, one should also consider the *effect with* factor.

By concentrating on the totality of the learning situation, focus will also be on the environment surrounding the pupils, the actual work process and the technical profit. Due to the fact that the student primarily manages the process of working on a PC, learning becomes more a process of active construction of knowledge than simple acquisition of facts. In order to strengthen and maintain effective CSCL, motivation and engagement from the participants are important. This is what Salomon (1992) describes *as mindful engagement*. Although the students are sincerely engaged this does not always lead to effective and adequate collaboration. To increase the quality of the collaborative process Salomon (1992) sketches a

need for *genuine and necessary context* or *genuine interdependence* between the participants. The decisive factors that this expression consists of are the need for *sharing necessary information, division of labor between the participants* and *joint thinking*, thinking in explicit terms that can be considered, adjusted and prepared by the other members. However the computer itself cannot create these effects. The development of knowledge demands a motivated engagement in a social process of acquiring opinions. This stresses that the environment is designed as a well-combined entity.

Salomon ascertains that group collaboration cannot fully function if the process consists solemnly of division of labor and individual work. He therefore stresses the fact that participants require engagement and a joint platform to base the tasks upon. In order to build this common point of departure the participants will need to share information. The fact that information is only presented in written form can clearly be seen as a weak point, considering that tone of voice and gestures disappear. It is difficult to know how much to write either by e-mail or chat modus. Being capable of producing a clear and concise message by means of only few words is a clear strength in the use of written text on the computer screen. The groupware programs which are used today for educational purposes enable students to work together, regardless of time and geography, in a common virtual room. For the present, however, the systems are not as good as face-to-face learning situations.

The success of a method of collaboration depends, as mentioned above, on the engagement of all involved parties. In an opening phase it will thus be important that the design allows and the teacher manages to motivate and activate the students. Throughout the process the role as an evaluator will also become more and more relevant. Thus it can be claimed that all these different roles are necessary for creating successful and efficient collaborative learning. In order to maintain activity and engagement among the pupils, attention is drawn to other decisive factors in addition to the evaluator function. In an early stage of the development of distributed learning using ICT, the use of e-mail has been important, especially in computer mediated communication. Internet students have sent e-mail to their supervisors and fellow students, and received response and comments on the contents of their message. Seen from a behaviourist learning perspective this form of communication may have been satisfactory.

The last few years, studies have been performed on different net based forms of collaborative work. In these studies (Koschman, 1996; Dillenbourg et al., 1995) a more socio-cultural learning paradigm is chosen as point of departure. There is emphasis of the context, environment and culture surrounding the learner. In addition there is also a tendency to increase focus on the activity of the individual as a framework for learning. Both constructivists and those who support activity-theory try to create healthy learning environments by placing the activity in the center of attention. One has focused on creating a social network around the participating students. Although students are placed at separate computers in different geographical areas, it is important to provide the students with the feeling of not being alone. This leads up to the conclusion that use of e-mail communication only, is not satisfactory. Based on this theoretical framework, Goldman (1992) has studied student behavior and divided them into three categories used as a starting point for further analysis: *social-, task- and conceptual interactions*. In a distributed learning environment the participants should build up a shared understanding and knowledge within these fields. Have the participants the same understanding of the social context? How are the connections between the participators? How is the work task interpreted and solved? How does a particular activity or piece of knowledge fit into the existing pattern of knowledge? In order to work efficiently and create an environment that encourages collaborative learning, the groupware program should contain functions providing the participants with such knowledge. In addition to these elements Gutwin et al. (1995) introduces what they refer to as *workspace awareness*. This expression embraces up-to-the-minute knowledge about the group members and the shared workspace. This expression is presented for two reasons. First, it will reduce the distance and differences in the level of knowledge between the collaborating members and enable them to act more naturally and efficiently, and second, it makes the students more capable of engaging in practices where collaborative learning may arise.

Among students in a traditional collaborative environment there are several mechanisms, which creates learning environments:

- Students frequently tempt to model their skill and knowledge to their fellow students

- Learning arises through identification and finding solutions to distinctions between crossing ideas and theories
- Peer teaching, where one student instructs and assists another where needed
- Construction of new, shared hypotheses

How can we transfer these mechanisms to a distributed ICT-mediated learning environment? The most important reason why these methods work as a means of learning in a face-to-face situation is that they enable students to take notice of and observe each other, and see with their own eyes how fellow students work. They can study each other's methods in order to copy or correct them later. In a traditional collaborative situation these factors are taken for granted. This may explain why this part so far has experienced weak support in existing GroupWare programs. Based on Gutwin et al.'s (1995) argumentation we see that it is necessary to work out knowledge about fellow students in the work field. From a visual point of view, enabling the students to observe each other's cursors and movements performed by fellow students in the workspace solves this. The use of *workspace awareness* as a starting point also makes it possible to make use of artifacts as conversing objects. This is done when the object is visible for all parties.

There are advantages with the function presented above, but you will eventually encounter the question of where to draw the line. How many details should be revealed? Will I always know everything about everybody? Could observations of what fellow students do, and incoming messages hamper and confuse my own work? Gutwin et al. (1995) propose to define two stages: task stage and work space stage. If several people are working simultaneously in the same room, it is often a great advantage to be able to observe who the other persons are. At the same time you may want to work alone without being interrupted in the task stage. How can you as a participant manage this? One of the main aspects presented by Gutwin et al. (1995) is that students should be able to peek over each others shoulder to observe what they are doing. But, as mentioned above, you may wish to work undisturbed. It is important that the program used also supports this choice, unless you plan to perform such operations in other environments. Especially when it comes to awareness concepts, but also when talking about genuine interdependence, we should be aware of the fact that the net-generation will develop a whole new attitude to virtual rooms and worlds compared to what adults ever will. This is why it may not be necessary to write or show everything about everybody, but rather leave to the students to find out on their own.

> *The written word, on the other hand, brings out images and metaphors that draws its material from the readers imagination and experiences. When we read a novel we provide the colors, sounds and movements ourselves. I believe the same form of personal supply is needed in order to understand what being digital means to ones own life* (Negroponte, 1995, p. 13)[1]

Crucial Elements Noticed

It is almost impossible to achieve full effect of CSCL without total engagement from the participants. Within several of our groups there were signs of lacking motivation among the participants. Salomon (1992) argues that we are dependent on seeing the totality of the learning session, "the curriculum, the activities that students engage in, students' perceptions of the learning goals in the classroom, their social interactions, the (p. 63). We agree that the totality of the learning situation plays a decisive role on the educational profit of the CSCL-activity. It is easier to create engagement if the task is significant. When working with learning activities in the classroom we quite often experience receiving feedback on whether the activity is good or meaningful. Usually the teacher is present and visits the group every now and then, or may be called upon to comment on the work. In a number of other educational situations one also experiences being corrected and followed up by a teacher. This can be found in professional working life as i.e. the method of

[1] Translated from the Norwegian edition.

cognitive apprenticeship (Brown et al., 1989). In connection with the expression *awareness*, together with response and facilitation from teachers and others, the students experienced a lack of feedback on their work. How can we see who has been in the room and observed our work? -When were they there and how did they appreciate our work? This could be compared to the inspiration of being peeked over the shoulder in the classroom, it does, however, assume that you know who it is and what their reactions are.

To what extent the students know each other, is also an important factor that will influence the process of collaboration. In the activity referred to in this paper, the students did not know each other. This was reflected in the method used in solving the task. The method was influenced by the fact that everybody did something, and then we discussed what we had done. The discussion was influenced by the fact that the participants did not know each other, and it takes time to get to know each other. Perhaps we were too insecure? It probably takes far more time than we had at hand to establish the necessary contact. This caused difficulties in creating an honest engagement among the participants.

Seen from our experience, *genuine interdependence* is important, perhaps even more important than *workspace awareness*. Knowing people's strengths and weak points, in addition to their being engaged, becomes important elements in the process. Nevertheless we do not neglect what an influential role *workspace awareness* serves in strengthening the engagement and the division of information that Salomon points out. Motivation and engagement regarding the work performed in such CSCL-environments will be connected to the concrete piece of work that is given. In addition, it is therefore significant that the participants experience a feeling of actually performing something of importance in order to achieve a proper result. Otherwise the actual activity will have to be inspiring enough to make the participants wish to finish the task. Based on these experiences we find it necessary to point out that the significance and functionality of a program is strongly dependent on the type of work and the task a group has been assigned with.

In the use of CSCL and telelearning it is important to look for methods for contextualizing a subject, creating more vivid descriptions and closer relations to common practice. Although the software used in our design activity has proven to contain certain weak points, we consider ICT and groupware programs like i.e. Team Wave Workplace to be a useful aid and tool for achieving this goal. The advantage of this usage is that it involves the user in constructing his or her own learning environment. In this way Tapscots (1997) wish for a shift in the learning situation from *broadcast* to *interactive learning* is getting closer to reality.

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Remote Labs!

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Abstract: The authors of this paper propose an Internet facility that will authentically provide laboratory experiments remotely. Such a facility is brought to the doors of the distance learner to help provide learning that is comparable to that offered for conventional students. This paper describes the development of a prototype remote laboratory system including software, hardware, procedures, and instructional systems. This includes surveys of existing alternatives (mainly software simulation environments), a description of the prototype remote lab environment developed by the authors, and a discussion of development issues, such as the reasons behind JAVA and RMI as the system's development tools over other popular alternatives.

Introduction

Distance learning (DL) has become a powerful educational tool to reach students at times and places that are not strictly dictated by the educational institution. New technology has made it possible to overcome many of the obstacles of distance in the educational process. Electronic mail, chat rooms, and live interactive video conferencing, for example, help to bring together the people involved in the educational process. The World Wide Web has made available many of the resources that used to be reserved for use on an educational campus (Alhalabi, Hamza, & Sudeep, 1998; Harasim, Hiltz, Teles, & Turoff, 1995; Turoff, 1994).

The success of DL, however, has been problematic for courses that require extensive use of laboratory facilities. In such courses, learning processes (i.e., problem solving and exploration) via laboratory experiments are indispensable. Thus, the distance learner has experienced a void, as no amount of theoretical explanation can be a quality surrogate for real laboratory experimentation. The challenge is to find ways to overcome the obstacle of distance and allow all students to fully participate in laboratory experiments.

In a study that investigated currently available Internet-based educational modalities (Alhalabi, Hamza, & Sudeep, 1998), the authors surveyed a large number of online courses, distance education and virtual universities, and electronic online universities that are involved and actively taking part in DL programs. None of the researched universities and publications discussed or investigated the idea or the concept of real labs via the Internet. Instead, they used primarily simulation software; i.e. virtual labs. Virtual labs, by design, place limitations on students' and teachers' abilities to experiment in real lab environments (Alhalabi, Hamza, & Sudeep, 1998; Hsu, Oge, Hamza, Alhalabi, 1999).

In contrast to the simulated laboratories, this paper provides a conceptual proposal for the implementation of an unrestricted environment where authentic laboratory experiments can take place via the Internet through remote access. Students have unrestricted freedom to apply any inputs and acquire resulting outputs as though they attend the experiment in person. Such a method can liberate students from physically attending the laboratory, and hence, engineering or science experiments can take place through distance learning facilitation software.

Thus, the authors of this paper, propose an Internet facility that will authentically provide laboratory experiments remotely. Such a facility is brought to the doors of the distance learner to help provide learning that is comparable to that offered for conventional students. This paper describes the development of a prototype remote laboratory system including software, hardware, procedures, and instructional systems. This includes a description of the prototype remote lab environment developed by the authors and a discussion of development issues, such as the reasons behind JAVA and RMI as the system's development tools over other popular alternatives.

Distributed Interface and Protocols

Java Language

Java was chosen for several reasons for the implementation of remote labs. Java allows for programs that can be embedded in Internet web pages. Currently many applications, which are written in a wide variety of languages, including C++, C, and Pascal, have fairly low level facilities like protocol handlers. As remote laboratories rely on the Internet, Java was chosen due to its Internet readiness (Ince & Freeman, 1997).

Java is a machine-independent language, which creates programs that run on a wide variety of computers using a range of operating systems. Since students will log on from a variety of computers to attend the labs, it is more efficient to choose Java, which inherently solves the problem of portability (Flanagan, 1998).

Java programs do not execute directly on the computer and hence will not interfere with the operating system or user data. Instead, they run on the Java virtual machine, solving the problems of security and unauthorized access.

Java is a language well suited for interactive web applications. Most of the applications which are built in other languages, such as CGI and HTML, give the impression of being interactive. But in reality they usually move through a series of text and visual images following pointers to other sections of text and visual images.

Java language offers the feature of multithreading. This means that there are multiple concurrent executions of code, providing a high-level implementation of concurrent processing. This allows many students to work on the same laboratory setup simultaneously (Geary & McCleallan, 1998).

Java is an Object Oriented programming language. It offers facilities to define and manipulate objects, which are self-contained entities that have states and accept messages. Therefore, Java programs can be easily modified, as reusability of code is possible (Cornell & Horstmann, 1997).

Distributed Interface Protocols

Since the virtual online laboratory will be a distributed environment, the implementation had to be in CGI, JDBC, Sockets, IDL, or RMI methodologies. RMI was chosen to build the distributed computing environment, written purely in Java. Other distributed computing environments are compared to RMI below.

The Common Gateway Interface (CGI) is a standard interface that allows web developers to execute programs on an HTTP server. This is a very crude form of client-server computing whereby an HTTP client invokes a program running on the server (usually passing it some data), and the program sends some results back to the client for display on a browser. CGI programs operate in a stateless mode, which means that there is no persistent connection maintained between the client and the server programs. Each time the CGI program gets invoked its runtime environment (memory and system variables) also gets re-established. The program being executed sends the information back to the client and the process shuts down. These recurring starts and shutdowns generate an extra overhead in the server's load and cause delay in the performance. In contrast to CGI, RMI operates in a persistent mode. In other words the network session between the client and the remote objects remains active until the client or the server closes the connection. RMI's garbage collection process automatically closes the TCP stream when the remote object is no longer referenced.

Because of its persistence, RMI is far more effective than CGI in cases where the client is running within the Java virtual machine. The extra overhead is eliminated and the performance is improved.

In some environments, JDBC calls are managed directly by the clients (Reese, 1997). A few JDBC drivers require direct interaction with native database drivers such as the Microsoft ODBC, Oracle SQL Net, etc. The security contained within most commercial browsers prohibits the execution of native code by the Java applets (Cornell & Horstmann, 1997). Other JDBC drivers remove the native calls by introducing an application server. The application server operates as a form of middleware, performing all database interactions and session management on the server. When JDBC calls are incorporated in large-scale applications, such as maintaining student records, it is extremely difficult to maintain the up-to-date database drivers on every client. Also, if either the database engines or the middleware were replaced by another product, every client application that accessed it would require modifications. The JDBC client is responsible for managing the database session and processing the Information. This might cause the network to be burdened with additional traffic as the client repeatedly communicates with the database. In contrast, RMI allows partitioning of data access and workload from the client by encapsulating the JDBC code within a remote object. This approach eliminates added maintenance of the client-side drivers. This also reduces the network utilization by placing the RMI server physically closer to the Database server on the network. In this case a single server was used both as a database and for RMI.

The actual exchange of information between the client and server is performed through the TCP sockets. Architecturally the RMI process operates in a very similar way to those written with Socket objects. Both support persistent network connections between the client and the server (Horton, 1997). In RMI information between the client and server objects is performed through object serialization. However in Sockets one must create the program logic to marshal and unmarshal the objects that are serialized. The RMI is a higher level architecture than sockets. Although the two perform similar functions, the RMI allows you to concentrate on value-added program logic and not network or object transports.

The IDL or Interface Definition Language (Baker, 1997) is a standard defined by the Object Management Group for defining object interfaces. This is intended to establish the object's interface definition regardless of the programming language and environment within which it is implemented. The IDL operates in a model that is similar to the RMI, making use of stubs and skeletons to marshal parameters between objects. RMI is useful in brokering object requests when the objects are written purely in Java.

Although there are many alternatives for building distributed applications like ours, RMI shows its strength in several areas. Since we will be writing the code in Java it is completely portable. It also facilitates application partitioning as the communication takes place across virtual machines. The JDBC package was used as an interface for executing SQL statement (Reese, 1997). We implemented it in this way because: it helps large-scale applications like ours to be written to the JDBC interface without worrying much about which database will be deployed with the application; it keeps the main application insulated from vendor specific issues, so the application can run equally well on Oracle or Microsoft-Access (see Figure 1); the JDBC is built on drivers based on other databases API's, and they are very closely and deliberately mapped to the ODBC counterparts, sharing conceptual components like Driver Manager, Connection, Result Set etc.

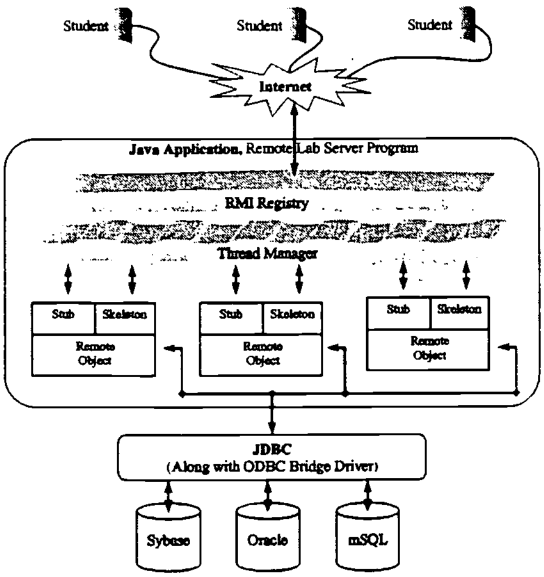

Figure 1: RMI Working Environment Model for the Remote Lab System

System Hardware and Software Model

Hardware Model

For a prototype, we have built a remote laboratory for experimentation with electronic circuits. The 6B Series product family from Analog Devices was used to build the required hardware as it provides a direct interface between the host computer and a variety of analog input, analog output and digital I/O applications. The hardware consists of analog input and output modules and the 6B50 digital I/O board. The following input modules were used in the circuit: the 6B12 Module accepts millivolt inputs from 150mV to 500mV, voltage inputs from 1V to 50V and process current inputs, returning data in engineering units; the 6B21 Module is an analog output module that provides digitally controlled, isolated current loop output to a resolution of 12 bits with an output range from either 0 to 20mA or 4 to 20mA.

System Software Model

The JDBC-ODBC bridge is included in the JDK 1.1 which enables Java applications to access data through drivers written in the ODBC standard. The driver bridge is very useful for accessing data in data sources for which no pure JDBC driver exists (see Figure 1). Through RMI a student can access any other Java object running on a separate virtual machine where the serial communication and the database accesses are performed. The Java applets, on which the students are working, invoke methods contained in remote objects, which issue the calls for serial communication and database access.

The RMI architecture shows the student (client) process and the remote object (a particular experiment) running on separate virtual machines. These two are logically linked to each other through the registry. The Java virtual laboratory application executes as a server process on Virtual Machine A. This application (the remote object), identifies itself with the RMI registry, which is another Java application whose role is to maintain active references to remote objects. A stub is a proxy for the remote object implementing its public interface. When a student object references a remote object, it does so by referencing its stub. A skeleton is

the stub's counterpart running on the remote server. Similar to the stub, it provides the mechanism for accepting students' requests, forwarding them to the remote object and sending results back to the students. Through the registry the remote objects offer their services to the students. When the student working on Virtual Machine B wishes to invoke a method contained within the remote object, he/she first communicates with the stub. The stub passes the information to the object reference, which requests the service from the registry. The registry passes the request to the remote object through the skeleton. The student talks to the remote object by accessing the RMI registry on the host where it resides, through a TCP socket connection (i.e., the Internet). Once the registry accepts the student's requests, it delivers a reference in the form of a stub back to the client.

The student now invokes a method contained within the remote object's stub. This invocation may involve exchange of additional objects as parameters to and return values from the function call. Making both the server and the student's applet code serializable makes this communication possible.

At the server end, the parameters, such as the results of the experiment performed and the grade of the student in an experiment, are forwarded to the remote object through a skeleton object. The skeleton dispatches these parameters to the remote object and invokes the appropriate methods. When this function is completed the return value is sent back through the skeleton and the stub objects and is received by the student as shown in Figure 1. The remote object and the student lie at the same level of communication i.e. any request by the student can be answered only by the remote object and vice versa. The same is true for the stub-skeleton and the RMI registry object reference. The Security Manager in RMI (Horton, 1997) also makes sure that the appropriate measures are implemented to make sure that the application is well behaved and does not violate the laboratory rules. With the help of the security manager the students will be prevented from accessing restricted information, such as grades, on the server machine.

Implementation Details

Once the student goes to the URL (http://jupiter.cse.fau.edu/directory.html) the ClientApplet gets loaded (Geary & McCleallan, 1998). The browser now halts and the RMI procedures associated with the browser start by establishing a one to one connection with the Virtual Laboratory server

When the applet runs, it automatically connects to the remote objects because the start method of the applet contains the remote objects' IP address and the remote object registry name. Once the connection has been established, RMI will get the Remote Object Proxy into the users' machine, and this proxy has the reference of the remote object. RMI has server-side skeleton and client-side stub. Once the student invokes any methods the stub interacts with the skeleton and retrieves the required remote object (see Figure 1).

The student can invoke all the methods of the server (remote objects) from the client program with the use of the stub. The server contains the skeleton of the remote objects (stubs and skeletons are generated by the RMIC compiler provided in the JDK kit). The skeleton knows the location of the remote objects in the memory of the server. When the client invokes the method, the stub sends the message to the skeleton; the skeleton calls the remote object; the remote object does the work requested by the client and replies to the server skeleton. The skeleton then replies to the client stub and the stub sends the message back to the client.

Following is an example of student registration into the virtual laboratory. To register, the student types in his/her login name and password and clicks on the register button, invoking the Register() function in the applet, which gaps the login name and password. The OpenDirectory() function will return the thread number for that student (Horton, 1997). Using this thread number the remote object's method is called with the login name and password as parameters. This calls another method for database connection using the JDBC predefined command for SQL query, which checks if any other login name in the database matches the one the user has entered. If it does, a message is sent to the ClientApplet code which asks the user to try another login name. If no duplicate login exists the login name and password are inserted into the database and a positive message will be sent to ClientApplet code which informs the user that registgration has been successful. At the end, PerformLogin() calls the CloseDirectory() function that closes the connection between the client and the remote object (Horton, 1997; Bishop, 1998).

The registered student enters his login name and password and clicks on the Login button invoking PerformLogin() in the applet. The OpenDirectory() function will return the thread number for this particular client. Using this thread number the remote object methods are called and the login name and password are

passed as parameters. This method calls another method for database connection using JDBC predefined command for SQL query. This method checks if the student's login is present in the database. After the check is made, it asks the student to perform Experiment Number 1, if not already performed, or to click on the Get Grade button to see his/her grade in the lab. Finally, PerformLogin() calls the CloseDirectory() function, which closes the connection between the client and the remote object.

If the student has not performed the experiment the student selects Experiment Number 1 from the choice menu and clicks on the Get Experiment button. This will build a new panel, which consists of the new experiment. The Get Experiment button will be enabled only if the student has not performed the experiment. Once the experiment number 1 panel is built the student enters three different values for the current. The student can now click on the Run button, which invokes PerformHardware() in the client applet. This function grabs the current values entered by the student in three different strings. OpenDirectory() will return the thread number for that particular client. The data, which the student has entered needs to be passed to the hardware connected to the serial port of the server. Since the Java Virtual Machine cannot interact with the serial port of the server directly or the operating system, the Win32Port class is developed. The values, which the student enters, are passed as parameters in the function calls to the Win32Port class. The output results are received by the function provided by the Win32Port class methods and these are then passed on to the students as outputs of the experiments. Finally, PerformHardware(), calls CloseDirectory() which will close the connection between the client and the remote object.

After the student has submitted the data to the hardware and gets back the results, the Submit For Grade button is enabled, which will invoke the performSubmission() function in the client applet. This function grabs the values of the currents, entered by the student and the voltage values and calls another method for database connection using JDBC predefined command for SQL query. This will insert all the values along with the student's name in the database. A positive message will be sent to ClientApplet code informing the user that the values have been successfully submitted. Finally, performSubmission() calls CloseDirectory(), which closes the connection between the client and the remote object.

The Hard Part: Java Native Interface (Serial Port Communication)

The last part of completing the package was to write a native interface in Java that talks to the Serial Ports. This consists of Java code (a class) that accesses data through native methods, which are typically particular to a vendor library. Like the bridge driver this class is convenient when a C data access library already exists, but it isn't always very portable.

The Win32Port class implements the access to the computer's communication ports through the Win32 API. The native methods are contained in the JWINPORT DLL, and the Win32Port class is the Java interface to them. The DLL is built using the JNI, which comes with Sun's JDK 1.1.

The standard drivers for serial ports in Windows 95/NT are limited to the ports COM1 through COM4. The compiled DLL adopts this limitation and provides space to handle the four ports. However, the multi-port interface card with a Windows driver makes additional ports visible for the operating system like the standard ports. In this case the DLL has to be recompiled for the number of ports needed.

The port number is passed to each of the methods as parameter rather than having it as a field of the Win32Port class. This is because to access an object field from the C code, a symbolic look up must be made. The port number parameter on the other hand gets passed as a plain integer and works faster.

Conclusion

The authors are successfully progressing through the design and the implementation of the Virtual Lab process over the Internet. Unlike time-shift instruction (experiencing instruction following the live lesson, i.e., videotape, or a software simulation), real labs or real-time instruction (experiencing instruction at some point during the live lesson or experiment) provides students the ability to receive instructions without the teacher's direct presence. Students in Real Lab environments have the freedom to analyze their experiments at a distance. By no means is the student thinking limited but instead his or her complex thinking processes

(basic thinking, creative thinking, critical thinking) are stirred at a distance with out any technical limitation of any kind. A student is still able to conduct an experiment, collect needed information, categorize the information, synthesize the information, and create his or her own conclusions based on data collected, from input and output, without physically attending a lab.

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Online Interactive Learning: An Innovative Project of the Inter American University, Bayamón Campus, Developed with the Integration of Students, Faculty and Administrative Staff

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Abstract: A group of professional leaders are in the process of developing an active and continuous virtual learning space based on the Educational Objectives which promote the technological advances in all the academic community of the Inter American University of Puerto Rico, Bayamón Campus. After evaluating different technical tools and choosing "Learning Space" as the platform, the Professors at the Bayamón Campus have developed the OIL (Online Interactive Learning) Project. The members of the team include a coordinator, a group of professors, a technical team composed of students, administrative personnel and the technical advise of a specialist in curricular design. This group has developed several online courses. Their dnty was to begin the first stage, which was to create eleven online courses in Spanish, which inclnde the areas of Biology, Chemistry, Marketing, Spanish, English, Accounting, History and Computer Science. The second stage of the project consists of testing these courses, and the creation of new courses by other professors. A permanent structure called Faculty Support Center was created to support this stage of the project including future development of other courses by other faculty. The implementation and third stage will start on January 2000.

Introduction

The Inter American University is the largest private university in Puerto Rico with 11 campuses throughout the island and a total of 42,000 students. The development of the online course project, called Online Interactive Learning (OIL), responds to the institutional long-term educational objectives identified as Vision 2012. These educational objectives present the Inter American University as a vanguard institution: a leader in information technology. The OIL project also responds to the educational objectives of the Bayamón Campus, which promotes a technological culture through the development of innovative projects within the university community.

The development of this virtual learning space required the creation of the Faculty Support Center (FSC) and the training of technical personnel, faculty and several students. This Center is composed by a technician and students majoring in computer sciences who provide technical support and assistance to the faculty in the

development of the online courses. The mission of this center is to develop and promote innovative educational projects that can transform the teacher-learning process according to the new educational vision of the Bayamón Campus. The goals and objectives of the Center are to train professors in new technologies related to the teacher-learning setting and to stimulate interdisciplinary teamwork. In August 1999 the Faculty Support Center was established to offer technical support and advise to professors in the production of online courses.

To fulfill the expected outcomes, the OIL project was divided into stages. The first stage consisted of the training of faculty members; the second was the creation of the course in the LearningSpace platform. The third stage is the course validation by groups of students and finally, the last stage will be the implementation of the courses in a semester through the Internet.

Materials and Methods

The human resources used were professors, administrators, technicians and computer science students. The project was done exclusively with our campus personnel. In June 1999, the twelve participating professors received training from a specialist in curricular design. At the same time they were developing the educational materials to be used in the online courses. The Director of Computer and Telecommunication Center trained six computer science students, who are completing their degree, in the use of Lotus Notes, LearningSpace and Publisher. A faculty member was the director of the project.

LearningSpace was the platform chosen for the creation of the online courses. This tool permits the use of technology in teaching and learning and can also be combined with traditional face to face training. LearningSpace enables the instructor to teach the course content in 3 different ways. These are: synchronous training that permits on line training sessions in which the instructors and the learners work together through the Intranet or Internet; asynchronous training which enables learners to work at their convenience and it also allows them to collaborate with others students in the course; and a self-paced training that allows students to work alone when they are ready. Other applications used were: Word, Power Point and electronic mail.

Results

The first group of professors created eleven online courses in 7 different disciplines (Tab. 1).

Courses	*Discipline*
BIOL 2104 General Botany	Biology
BIOL 2103 General Zoology	Biology
CHEM 2001 General Chemistry	Chemistry
ENGL 0010 Basic Elements of English	English
ECSG 1201 Intermediate Communications Skills in English I	English
SPAN 0010 Basics Skills in Spanish	Spanish
SCSG 2203 Writing and Composition	Spanish
COMP 4200 Teleprocessing and Networks	Computer Sciences
CRSG 2010 Introduction to Computers	Computer Sciences
ACCT 1151 Introduction to Accounting I	Accounting
MKTG 1210 Introduction to Marketing	Marketing

Table 1: Online Courses Created by the First Group of Participant Professors of the Inter American University, Bayamón Campus in the OIL Project.

The first group of professors is validating the courses. The implementation will be in January 2000. Meanwhile the second group will start the creation of the new courses by January 2000. Some of the courses to be created by the second group of professors are General Microbiology, General Chemistry II, Virology, Introduction

to Toxicology, Precalculus, Historical Process of the Western World, Intermediate Communication in English I and II and Basic Communication Skills in English III.

Table 2 shows the schedule in the creation of the online courses in the Bayamón Campus.

Group	*June 1999*	*July 1999*	*August to December 1999*	*January to May 2000*	*Summer 2000*	*August to December 2000*
First	Training	Course Creation	Validation	Implementation		
Second			Training	Course creation	Validation	Implementation
Third						Training

Table 2: Schedule for the creation of the Online Courses in the Bayamón Campus of the Inter American University.

Conclusions

The creation of the virtual learning space integrates the knowledge and the talent of a group of computer science students, professors from diverse disciplines and technical personnel. This project promotes collaborative work and increases the productivity in the different academic areas.

For all the individuals that were involved in the OIL Project, it constitutes a doubly enriching learning experience. It offers the faculty members a challenging experience that requires them to surpass the traditional educational methods and visions. In addition, it offers the faculty the opportunity to reflect on the teaching-learning process.

However, the planning and implementation of this project has allowed us to become aware of the following problems: some faculty members are resistant to the use of new technology in this process, and there is a need to create new regulations to facilitate and establish the project administratively and academically. In conclusion, this project has been the biggest challenge we have faced in the past months, and it has become an enriching experience, which has promoted massive changes.

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An Overview of Online Educational Delivery Applications

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Abstract: This paper is a report on the types of online delivery applications used in institutions of higher education to develop and implement web-based courses. Many institutions of higher education (IHE) are grappling with ways to implement and manage online instruction by using local personnel and resources, purchasing some components of management, or outsourcing distance education entirely. While each institution will make decisions that meets its unique needs, it is important to know about the range of possibilities available to university administrators today. The major problems confronting IHE's are twofold: (1) the lack of technical skill among faculty members to convert their courses into online formats, and (2) the need to support and manage distance education. This paper provides an overview of the most popular online educational delivery applications.

Introduction

Web-based instruction (WBI) is a comprehensive set ofÊ instructionalÊ materials available through a browser over the Internet, an intranet, or extranet.Ê WBI can provide content in hypertext, audio, video files, and other multimedia formats, and include such resources as chat, threaded discussion, e-mail, and hyperlinks.ÊÊ Many institutions of higher education (IHE) choose expensive distance education options rather than WBI, although WBI is much less expensive and equally effective.Ê Most educators adopt technology with the following progression:

- Phase 1:Ê An instructor achieves some level of basic computer literacy.
- Phase 2:Ê The instructor uses computers for personal productivity.
- Phase 3:Ê Venturing into instruction, the instructor uses technology to enhance lecture presentation.
- Phase 4:Ê E-mail is used more widely to interact with colleagues and students, along with Internet searches.
- Phase 5:Ê The instructor decides to re-purpose a course as an imitation of the conventional class requiring live, real-time interaction.

The typical faculty member re-purposes an existing course only after first experimenting with technology in the traditional classroom.Ê Instructional

technology in the college classroom is used almost exclusively to augment the classroom lecture.Ê The first instructional application attempted by a professor is usually a PowerPoint presentation, a progression that is almost routine.

Synchronous and Asynchronous Delivery Systems

Synchronous Delivery.Ê The technologies used in synchronous delivery include two-way interactive video telecourses, one-way video with two-way audio, audioconferencing, and audiographic conferencing, and may include electronic white boards, radio, television, IITS, closed-circuit, satellite.Ê Not only are the production systems more complex and expensive, but the number of potential students is limited by the real-time requirement for class attendance. In effect, this is a variation of traditional classroom instruction rather than a replacement.ÊÊ In most respects, the classroom structure and routines are similar to a conventional classroom, with the instructor treating persons at remote sites as if they are members of a large class in a lecture hall. In fact, other than using presentation graphics, instructors do not act much differently than in a conventional classroom. Students on-site or at a remote site are expected to listen, take notes, and answer questions.

Asynchronous Delivery.Ê In the asynchronous method of distance education, the instructor and students are not required to have real-time contact on a regular basis. It is not time and location dependent.Ê In some cases students are mailed videotapes or CD-ROMs, when the content could be put on the web, and this drives up costs due to production and post-production costs, personnel to handle the mailing of products, and other expenses. However, the WBI course that avoids videotape and CD-ROM development enables students access to any remote resource at the students' convenience, or on demand.Ê There is no need to have full-motion video for an entire class, especially if computer software and learning activities are designed for students to preclude the need for lecture.Ê Asynchronous WBI is much less expensive and equally effective as the more expensive synchronous models and traditional classroom instruction.

To determine a break-even point an administrator can calculate development costs and plot the projected income necessary to recover costs (i.e., **cost** - the sum of ***fixed*** and ***variable*** expenses, and **price** (per unit/enrollment).ÊÊ A general formula for calculating break-even

Fixed CostsÊ **1 - (Variable cost per unit/Selling Price per unit)**	**=ÊÊ Revenue to Break-Even**

IHEs often do not account for many fixed items in a budget on a daily or hourly basis, such as office equipment, utilities, office space, and so forth.Ê Variable costs are often easier to track because they may be hourly wages paid to specialists, contracting for online delivery, new software or equipment for production, and so forth.Ê Factors that contribute to variable costs can be identified in this table (rented and/or owned):

Some costs, particularly for faculty time, can be considered a redistribution rather than additional costs.Ê Changing a faculty member's role temporarily to develop courses for WBI may raise costs for the short-term, because of the need for someone else to teach certain existing

courses in the faculty member's absence, but these costs can be recovered in the long-term as the income per professor increases.

If development costs for a web-based course are less than a synchronous course, and if student outcomes are essentially the same, the IHE administrator needs to consider developing web-based courses and avoid more expensive synchronous endeavors.Ê However, the one factor that can drive up such expenses are online delivery systems for WBI.Ê Some IHE's provide their own management systems with varying degrees of comprehensiveness.Ê Examples of efforts by institutions without significant commercial vendor support include the University of Virginia, Iowa State University, Florida State University, and Penn State University.ÊÊÊ

Commercial Comprehensive Delivery Applications

The following commercial vendors are in alphabetical order, either by name of the product or service or by the name of the company, whichever is most prominent in the literature.Ê Some of the vendors provide aids to develop courses, others offer various tools for synchronous courses, and some offer comprehensive services including management for the IHE.Ê Costs are not discussed because it is almost impossible to determine due to the menu of services and different costs associated with scalability and number of users.ÊÊ Furthermore, there is no intention to evaluate these products or to suggest that one product is better than another, a determination best made by potential clients.Ê Finally, some products were excluded from consideration because they are specifically designed for corporate training or do not appear to have the necessary components to circumvent the greatest obstacle, namely the inability of instructors to create web content.

Blackboard. (http://www.blackboard.com/) Blackboard Inc. provides Blackboard, "CourseInfo" and "Campus" for hosting their own courses for individual courses, multiple course sites, and academic intranets, respectively.Ê Blackboard allows instructors to point and click to incorporate learning materials from word processing, audio and video, and presentation files. At the high end, with "Campus," the services include a comprehensive management system and the software becomes a campus portal for all distance courses and a variety of related services: business and strategic planning, content conversion and course migration , instructional design , systems integration and project management, application integration, training and education, web hosting, and maintenance and support.

Collegis. (http://www.collegis.com/) Services can range from implementing web-based courses into the curriculum through support services to incorporating campus-wide "Administrative Technology Services" such as new student, finance, to providing comprehensive Network Infrastructure Services such as planning and developing technology migration strategies.Ê Collegis advertises its product by stating that personnel will be assigned to the campus to work with faculty in the development of course content and other aspects of development, delivery, and maintenance of a distance education system.

Complete On-Line Teaching System or COLTS.Ê (http://www.corgisoft.com/public/colts/index.html) COLTS uses form-based tools to create classroom homepages.Ê An instructor can input text or paste from word processing then convert the text to HTML code.Ê The instructor can create or edit seminars, quizzes, and exams through a library structure.Ê Also included is a "Student Journal Module" to allow an instructor and student to work together on a document.

Convene. (http://www.convene.com/) Convene develops partnerships with IHE's and provides a six-week training program for instructors.Ê Convene also offers a host server and network, technical support, and other services.

Creator. (http://www.melbourneit.com.au/creator) Universities, schools and corporate trainers can use "Creator" to create online learning environments with interactive elements including video/audio-conferencing, newsgroups and chat sessions.

eCollegeÊ (http://www.ecollege.com/student/index.html) eCollege is a recent project created by Real Audio/Real Video to offer partnerships with IHE's to build online courses.Ê In the Premium program the IHE receives course development, instructional design, student orientation, virtual campus development, hardware and software as a complete "turn-key solution" for distance education.Ê The eCollege page is prominent on the IHE home page and serves as the portal for distance education connection.

e-Education. (http://www.e-education.com/software.html) Instructors can use a set of tools to create courses or in the full service plan.Ê An IHE may simply provide course content in an electronic format and e-education will create a course.Ê In the "self-service option" the instructor creates the course content.Ê Course elements include a course builder, announcements, roster, TestMaker, and forum administration.

Embanet. (http://www.embanet.com/) Courses can be created with an online wizard, including tests and other features.Ê The company claims that courses can be operational in two months if instructors develop the content, or in a matter of days if the company makes the course.Ê The best known courses of Embanet are those operated through the UCLA extension service.

MadDuck Technologies (http://www.madduck.com/) This company provides three major products: Web Course in a Box, Web Campus in a Box, and Web CourseBuilder ToolBox.Ê "Web Course in a Box" provides for development of a syllabus, calendar and/or scheduler, announcements, personal web pages, forums, lessons, tests, a whiteboard, and chat.Ê The "Campus" tool supports building lists of instructors, students, announcements, active courses, inactive and archived courses and home pages for instructors and students.Ê The "Faculty" tool supports home page, forum development, and campus lists of courses.

SocratEase. (http://www.SocratEase.com/school.htm) Primarily for corporate training but also used by universities, SocratEase incorporates a course management, testing and test tracking, built-in e-mail communication for discussion and questions, and a course authoring tool.

WBT Systems. (http://www.west.ie/) The company provides "TopClass," which is a comprehensive system including course development, quizzes, discussion, and other features of web-based courses. Sections from one course can be imported into other courses. "TopClass Assistants" enables Microsoft Office 97 documents to be converted automatically into courses.Ê "TopClass Creator" instructors "authorized by TopClass Server" have access to web tools for assembling complete courses from any "web-compatible" content.Ê Other tools can render presentations or documents into courses.

WebCT (http://www.webct.com) Tools include a conferencing system, chat, student progress tracking, group project organization, student self-evaluation, grade maintenance and distribution, access control, navigation tools, auto-marked quizzes, electronic mail, automatic index generation, course calendar, student homepages, course content searches and much more.

Evaluation of Online Delivery Applications

Comparisons or evaluations may be found at ZDNet (http://cma.zdnet.com/) and The British Columbia Standing Committee (http://www.ctt.bc.ca/landonline/choices.html) conducts its own evaluations and also includes links to reviews online.Ê Comparisons are difficult because of the differences in features and the variety of services available.Ê Products can be evaluated in terms of technical aspects, support, training, cost, and many other features that can be of variable importance to different IHE's.Ê For institutions that outsource everything, only cost and services are important.Ê For those interested in providing a mechanism forÊ inexperienced instructors to develop course content, the nature of the development tools and continued support or management features may be more important.Ê Some programs emphasize tests and test management, which may be unimportant to some and critical for others.Ê In general, the following areas are used in developing evaluation criteria:
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- Circumvention of HTML to develop course material
- Password and username security
- Desktop based file management
- Flexibility for instructors to revise and manage course content
- Test banks (development, randomization, timed, scoring, reporting, feedback options, etc.)
- Feedback on tutorial questions
- Progress tracking for instructor and student
- Electronic Mail
- Bulletin board

- Chat facility
- Logged chat
- Application sharing
- Asynchronous sharing
- Synchronous sharing
- File exchange
- Newsgroups
- Whiteboard
- Virtual space
- Videoconferencing
- E-commerce (registration, fee payments, enrollment, and so forth)
- Technical issues (numerous and often unique to each site)

Conclusion

As many IHE's consider the need to develop distance education because of student demand and competition, outsourcing or contracting with a private vendor is an option many consider.Ê As indicated in this article, there are several options. Whether or not an IHE develops its own system or contracts for the services, the more difficult issues are resistance by segments of the faculty to distance education, faculty intellectual property fights, workload, training and technical support, faculty support, and job security.Ê These are important concerns for any administrator or faculty.Ê The WWW threatens to widen the gap between rich and poor, between North and South, and perhaps between IHE's that thrive and those that go out of business. While the paper does not permit room for comparative data, anyone requesting information from the authors will receive information promptly.
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Teaching and Learning in an Anytime/Anyplace Classroom

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Overview of Session

The explosion of the World Wide Web has changed the way we live, work, shop and learn. Increasingly, colleges and universities are offering graduate and undergraduate courses that are delivered fully or partially over the Internet. One category of computer-based tools that is increasingly being used as a classroom in cyberspace is the forum or electronic bulletin board. An interactive forum presents a unique opportunity for everyone with a web browser and permission to access the site to be part of on-going dialogues on a variety of pertinent topics.

At the School of Computer and Information Sciences at Nova Southeastern University, we conduct fully online and partially online classes using a variety of electronic technologies in the learning process. These include e-mail (for group and private messages), the Electronic Student Electronic Teacher (for uploading, downloading, and responding to homework assignments), and a custom-modified Allaire Forum that serves as an anytime/anyplace forum. Essentially, electronic tools are programs whose uses need to be mastered. Functionally, the uses of the three tools named above have very short learning curves for people who are computer and reading literate. Devising procedures for best practices to meet cognitive and emotional needs of remote learners is a much greater challenge.

This session will focus on the forum as the meeting place of the class in cyberspace. Since it is asynchronous, it does not matter where a participant happens to be or what time it is in any given place. The people on the panel are all experienced educators with many years of face-to-face teaching that preceded the distance learning experience.

We will begin with a short demonstration of different forums (pending Y2K availability) so that the audience clearly understands the subject under discussion. The precise content of the panel and greater group discussion will target the interests of the audience. Discussion will focus on, but not be limited to, questions to which answers have been prepared in advance by members of the panel. Again, the objective of this session is to share best practices taking into account the wants and needs of faculty and students. We have determined to limit discussion to post-secondary learning environments and, whenever possible, to focus attention upon professional development for teachers.

Questions for Discussion

What aspects of the physical classroom should be carried over into the forum?

What do you do to prepare your forum for optimal learning before the first day of classes?

How do you organize and maintain your forum to accommodate a range of learning styles?

What are students expected to do in the specific contexts?

What constitutes acceptable participation?

How do you use the forum to reduce isolation for the remote learners?

How is in-depth discussion stimulated?

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How do you use the forums to promote the ancient concept of a liberal education?

How do you use the forum to meet learning needs in an era of rapid change?

What are the rules of participation that you provide to students?

How do you deal with improper postings?

How much teacher-intervention is optimal?

How do you move away from the hub-spokes model of teacher-student participation?

What are the demands on the teacher in terms of preparation and mentoring?

How does your institution accommodate these demands?

Wearing the graduate student hat, compare the cyberclassroom to the physical one.

Wearing the graduate student hat, compare your peer relationships with traditional ones.

Wearing the graduate student hat, describe your level of frustration/satisfaction with the distance program.

Wearing the graduate student hat, what advice would you have for newcomers to the program?

Members of the Panel

Moderator: Trudy Abramson, Professor of Computing Technology in Education (CTE) at NSU/SCIS teaches partially online doctoral courses and mentors dissertations.

Member: Maxine Cohen, Associate Professor, CTE and Information Systems, NSU/SCIS teaches online master and partially online doctoral courses and mentors dissertations.

Member: Tim Ellis, Assistant Professor, CTE, NSU/SCIS teaches online masters and partially online doctoral courses. Tim is one of our recent graduates and has used the forums extensively as a graduate student. His dissertation focused on distant learning at the community college level.

Member: Cordelia Twomey, Associate Professor and Program Coordinator of the Masters degree in educational technology, NJCU, teaches on-campus and on-line teacher education courses and adjuncts in the CTE doctoral program at NSU/SCIS.

Member: Mitchell Pratt is lead trainer for the Alpine School District, UT and teaches in an online program for Connected University of Pepperdine University. Mitch recently completed his dissertation through the CTE program at NSU/SCIS.

DEP WEB: A concept mapping based on web distance education process

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Abstract: This paper relates the development of a concept mapping based on web distance education process, pointing out the concepts and relations that integrates teaching-learning process, so this can be used to understand the technology and terminology used in the context of computer and distance education, and conduct, for example, the construction of virtual courses, the specification of methodologies, educational tools and etc.

Introduction:

Nowadays, the most important school challenges are related with how to use different media and technologies, as well as, lead and guide students for all the variety of informations available in our lives.

Internet appearance and invasion, without knowing why and how computers can be used in an efficient manner, almost imposed the beginning of learning process by this way. As result, not prepared teachers and other professional, involved in this process, became resistant and threatened by the ignorance of the potential of this tool (Mercado, L, 1998;1996) (Lollini, 1985). As a matter of fact, we realize that this resistance is not only by the use of computers, but of technology, in general. Some people do not know, however, technology is not going to "renovate" teaching-learning process in an effective one. It depends on its use. Let's see, for example, the invasion of a pencil (it is a technology), it is used for both writing something very important and kill somebody (Souza, R., 1999). It happens with technique aspects of technology like TV, radio, computer and etc: depending on how it is used, it can revolutionize or perpetuate existing learning structures.

Minimized the faze of resistance, we began searching knowledge of computer science as an educational tool. In practice, some schools are using this technology, in their context, without appropriated knowledge of its features, deficiencies and virtues. Professionals form different areas began to lead and interfere in education, for example, developing educational software and on line courses, without the guarantee of its quality in terms of education. On the other hand, education professionals are tied up with this technology, in a certain way, away from their usual tools and its necessary some time to know, evaluate, develop methods and use it in an efficient manner, as a complementary instrument of formal teaching, as an instrument of distance education.

Distance Education

Many discussions are concerned with distance education. Among other facts, it is attempting to search another ways of learning. Certainly, the evolution of technology is a very important element in its process of maturing. From alternative it is considered, in many cases, as a kind of regular teaching (Leite, L, 1999).

In attempting to become part of the context in distance education, many courses have transposed the *local teaching* model to the environment provided by the Internet. The local teaching model has its advantages, since this model provide the social development of its students, but from the moment that teachers

do not know educational ways to your students reach the objectives proposed for their education, this is an inefficient model. The use of Internet, for example, we realize that when a course is published as a distance teaching course it can not be, simply, composed of *home pages* referring transpositions of local courses classes. In fact, it would be a pure and simple transposition of a bad education model, according to education history. In an environment like this, students are, in a basic way, seen as contents receivers, which task is to assimilate and reproduce, but almost never discuss, analyze, reflect. According to this model, from what propose does the technology contribute in this case?

Searching some ways to give solutions referring the use of different technologies, in special, the computer, we conclude that technology ally to many interpretations of their use, in a local teaching or distance education, reinforce the need of two actions (Gomes, A, 1999): a) an education systematization, in a general way, as a "gear" for process of knowledge generator, that allow professionals reconsider educational processes existent and the opportunity to consider about school social function and b) a model conception that glimpse the understanding in the knowledge generation and in the elements involved manipulations. By the way we ca not use the tools provided by the appearance of new technologies, in special the use of computer, if we do not discuss models that can be computed.

The Conceptual Model

We believe that becoming the knowledge silted up, by now, available in education and computer science, as well as the relations of its basic principles need to be discussed for the real teaching-learning process. The objective of this paper is generate a mapping referring the systematization of distance education process so it can be discussed, evaluated and used for professionals interested in providing teachers an efficient tool, as among of training, tools constructions, softwares, virtual environments and many others, pointing fails and feasible solutions to teaching-learning process, enlarging knowledge about distance education and the use of technologies, providing conclusions about the model mapped or it can be used to create new teaching models.

The development of this model is based on constructivist approach from meaningful learning proposed by Ausubel (Ausubel, D, 1978) and concept mapping principles which was first developed by J. D. Novak (Novak, J. , 1977) to map the concepts and the relations among education, distance education and other concepts related to them to establish more understanding, questioning the actual educational paradigm. Which learning theory does exist? What are the methods and teaching techniques and how are they related in teaching process? What are society role in education? What is teaching and how do it interfere in the teaching-learning process execution? What are the objectives of education? Do these objectives interfere in the way the process is executed? What is distance education? What are the principles of distance education? These are some of the questions that have been mapping, see figure 1. But we bear in mind the most important result of this mapping, beyond the others quoted above, is not the model obtained, but mainly the mapping process, in other words the appreciation and experience that can be obtained searching articulation, organization and criticisms evaluation of the model during its development, answering and/or pointing questions as shown along this paper.

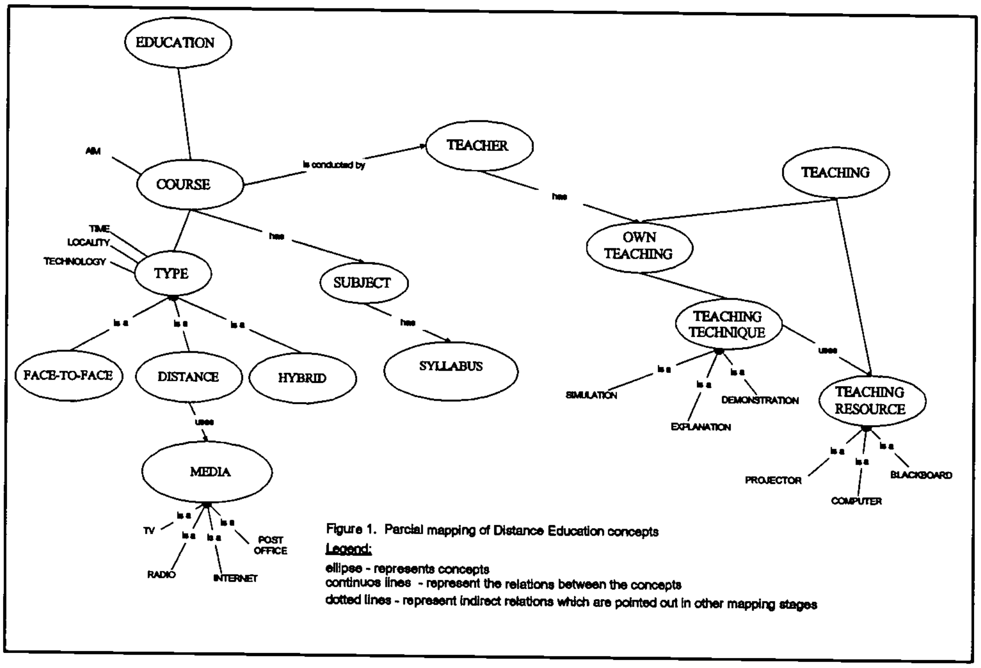

Figure 1. Parcial mapping of Distance Education concepts
Legend:
ellipse - represents concepts
continuos lines - represent the relations between the concepts
dotted lines - represent indirect relations which are pointed out in other mapping stages

Expecting Results

The systematization, the model construction process and the resulting model, as a final product of this research will have large contributions for teachers, computer professionals, educators and anyone interested in propitiate an effective environment of meaningful teaching-learning process.

We are certain, however, that the most important result is not only the conceptual model, but mainly the concept modeling, the experience obtained, discussed and presented by this process.

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More than Having a Connection: Qualitative Factors that Affect Learning in a Web-based University Course

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Abstract:
Web-based courses are becoming more common. Although several studies have been conducted to research the effectiveness of those courses, few investigations have focused on the human aspect of an online course. This paper proposes that for an online learner, the way she or he feels during the course itself is as important as the course content. In addition, the professor's abilities to lead an online course are crucial for the success or failure of the course.

Introduction

Technology in the Communications Age impacts learning and education by providing numerous sources of information and communication. The new electronic technologies present teachers, administrators, and policymakers with both unprecedented opportunities and unprecedented challenges. The Communications Age promises the delivery of information and education "anywhere, anytime." Technology is changing the landscape of education and creating a new set of possibilities for attending college.

Due to the diversity of today's learners, it is necessary to offer many diverse forms of education (Office of Technology Assessment, 1993). In support to this, Secretary of Education Riley (1997) stated, "Technologies also are important for providing opportunities in higher education at a time when college is becoming more crucial ... making courses available at convenient locations; reducing time constraints for course-taking; making educational opportunities more affordable; and increasing the institutions' access to new audiences."

Owston (1997), in an analysis of teaching and learning on the World Wide Web (WWW), concluded that a promising case exists for the Web in three vital areas: access, improved learning, and cost effectiveness. Institutions of higher education will need to understand how to utilize these new media while maintaining instructional quality and meeting an increasing demand for continuous professional development of the knowledge workforce.

Many factors, including tradition, funding, credit units, semester schedules, and other academic structures, constrain institutions to geographic boundaries and on-campus classes. However, as Olcott (1999) pints out, "preserving historical traditions and embracing new innovations can occur together."

The rate of Internet use is constantly increasing. In 1994, three million people were connected to the Internet. By the end of 1997, more than100 million people were using the Internet, and its traffic has been doubling every 100 days (U.S. Department of Commerce, 1998). Distance learning programs that use communication technology, especially the Internet, have been growing. These programs cater to students who share the following characteristics: (1) they have families and jobs, (2) they come to school after work and before going home, (3) a large number of them already have a college degree, (4) they are returning to school for retraining, to learn new skills, or to obtain an additional degree or certification for professional achievement, and (5) they

have high expectations for products, goods, and services, and many of their expectations have been created in technology-mediated environments (Fulkerth, 1998).

Purpose

Traditionally, studies have focused on the quantitative effectiveness of distance education as compared with a face-to-face setting (Miller, McKenna, and Ramsey, 1993; Souder, 1993, to mention some). However, an important aspect of the learning process is sometimes left out: the perspectives of the distance education students. The purpose of this paper is to report the perceptions of inservice teachers participating in a web-based university course.

Additionally, the researchers wanted to analyze and study the pedagogical soundness of distance education courses that model constructivist learning theory and that are available to learners at times and places convenient to them. Online teaching is a relatively new development, but recent research has shown it to have as much rigor and educational merit as is found in face-to-face courses (Sujo de Montes, 1999). Frank Odasz states, "the promise of online teaching is both the teacher and learner can be anywhere, participating at any time, through any type of microcomputer with modem. If online instruction can demonstrate economies of delivery of distance learning, it opens the door to ongoing learning for all potential learners" (Odasz, 1994). Christopher Dede (1996) says that technology can help transform schools but only if it is used to support new models of teaching and learning. Interactive distance learning (distributed learning) is a use of technology which supports constructivist pedagogy and school reform. It provides opportunities for faculty and students to communicate in and out of the classroom, become members of learning communities, utilize information from voice, text, graphic and television-video sources, develop technology competencies, and construct and apply knowledge.

Theoretical Framework

Constructivism and adult learning theories framed the present study. Constructivism views the learner as an active living being who internally creates interpretations of the world based upon his or her experiences and interactions with the environment, which are socially and culturally mediated (Cunningham, 1992; Fosnot 1996; Perkins, 1992). Constructivism also endorses the idea of the teacher as a facilitator, a senior partner whose function is to help the learner develop the skills to construct and reconstruct plans to respond to everyday life's diverse demands and opportunities (Cunningham, 1992; Duffy & Jonassen, 1992).

The word "constructivist" is defined as both a theory of learning and a strategy for education which involves having students work on complex projects, often in groups, and synthesize information to construct their own understanding of a content area. In this model, students learn technology skills and concepts in the context of using them to solve a real-world problem; for example, they might create a product they can use in their classroom. These projects follow from a theory of learning that suggests that subject matter becomes meaningful, and therefore understandable, when it is used in context-rich activities (Fosnot, 1996). The courses will be designed to emphasize the students' own responsibility for learning, for figuring out their own methods of solving problems, and for assessing their own work. Teachers who learn in this way will be better able to provide such environments for their own students.

On the other hand, adult learning theories emphasize the importance of participation, choice, experience, critical reflection, and critical thinking (Froman, 1994). Andragogy, the art and science of helping adults to learn, first pioneered by Malcolm Knowles in 1968, is a conceptual framework useful in organizing the way we look at learning with adults. Andragogy is based on humanistic assumptions about the adult as a learner, characterized by an independent self-concept, a depth and breadth of prior life experiences that can be used in learning, internal motivation, and the acquisition of new skills learned by an individual who is actively engaged in the learning process. Knowles' (1980) theory of andragogy is an attempt to differentiate the way adults learn from the way children learn. Andragogy assumes that learners learn what they need to know, moving towards autonomous self-direction and drawing from the rich resources of their prior experiences. In other words, adults

learn more efficiently by doing or experiencing. Unless what is learned can be applied to actual work of life situations, the learning will not be as effective or long lasting.

Methods and Data Sources

Different methods from the qualitative paradigm were used to collect data. These methods included (1) an open-ended questionnaire (The Middle and End of the Semester Course Analysis), (2) electronic journals, and (3) in-depth interviews. They will be briefly discussed below.

Middle and End of the Semester Course Analysis

This email delivered, open-ended questionnaire was administered at the times indicated in its title. It asked the students' perceptions about their own technology learning and the ability to integrate it into their daily practice. The survey also asked the students' opinion about how beneficial their mentoring relationship with the course professor was. Two other questions addressed how students felt about the class and about using technology. The responses to the questionnaire were sent to the researcher and were treated as confidential data.

Electronic Journals

Online journals were kept by the participants and sent weekly to the instructor and the researcher. In these journals, students discussed their accomplishments and/or problems with the assignments. Journals were also a channel through which the participants vented their frustrations with technology, with timing of the projects, and with group work. However, they were also an avenue to keep the communication open between the students and the course professor, providing a sense of participating in a class, even when there were no walls and times that delimited such a class.

In-Depth Interviews

Four participants were asked to participate in a series of three interviews, each of which lasted approximately 90 minutes. Following Guba and Lincoln (1989), the researcher selected a purposeful sample. Interview participants included an elementary teacher, two high school teachers (one first-year teacher and one veteran teacher), and a technology coordinator. Each of the interviews were conducted utilizing a chat room. The times and dates were selected by the participants, and ranged from 6:30 a.m. on a Sunday morning, to 5:00 p.m. on a weekday. Transcripts of the interviews were obtained from the software environment that was utilized to deliver the course. In other words, the researcher did not need to transcribe the interviews because they were automatically recorded as they happened. The content was retrieved and the files were immediately erased to avoid any confidentiality issues.

Results and Conclusions

Content analysis and analysis of emerging themes were used to analyze the data collected from the open-ended questionnaire and the electronic journals. Analyses of emerging themes were used to examine data collected in the in-depth interviews. The data collected from each source will be briefly discussed below.

Middle and End of the Semester Course Analysis

The emerging themes from this open-ended questionnaire were grouped into four categories: (1) class perceptions, (2) technology, (3) self, and (4) professor. In the *class perception* category, the major theme that emerged was group work. As might be expected, some responses complained about groups that did not work

well together. However, most of the responses were positive about how supportive it was to create the class projects in a group environment.

In the *technology* category, the salient theme was the improvement of technical skills. Responses abounded about how useful this class was to sharpen the participants' technical skills. The researched class was almost considered as "in-time professional development" since it allowed participant teachers to apply their newly acquired skills to extend their own classroom activities that already utilized technology, and/or plan and try new activities.

The third category, *self*, was an interesting one. Although the most mentioned topic was "problem solving," the theme "frustration" was very much mentioned. Frustration usually came from having technical difficulties with the software and/or hardware, as well as with having server problems.

The main themes of the fourth category, *professor*, expressed the importance of the role that the course professor plays in the success or failure of an online course. The two main themes, "professor support," and "professor as a mentor," discussed the participants' positive feelings of knowing that there is somebody "at the other end of the line" who gives them feedback and encourages them in their learning endeavor. At the same time, the class participants perceived having a good mentoring relationship with the course professor. Undoubtedly, the professor's efforts to have constant communication with the participants through the journals and separate email messages contributed to the development a good mentoring relationship.

Electronic Journals

This data source provided a greatest insight into the students' perceptions. Journals were also analyzed using content analysis and analysis of emerging themes. The themes that emerged from the journals were divided into three categories: (1) class, (2) problems, and (3) feelings.

In the first category, the main theme was again "group work" which was mentioned in almost every journal entry. For groups whose members lived geographically apart, they discussed their adventures on trying to synchronize and meet in one of the chat rooms to discuss the assignments. For groups whose members lived in the same location, their journals discussed how important it was for them to meet face-to-face and receive support from each other. As discussed above, journal entries on this theme also discussed their frustrations when groups did not click together and completing an assignment was a monumental task.

In the second category, *problems*, two themes emerged and were mentioned in the journals the same number of times: technical problems and self-organization. The "technical problems" theme was already discussed in the section where the open-ended questionnaire results were presented. The other theme, "self-organization," discussed the problems that the class participants experienced to meet their job and family commitments and simultaneously keeping up with the pace of the class. For some of the participants, the convenience of taking a class at any time at home turned into an inconvenience. For them, constant interruptions from their families made working at home a stressful and difficult situation. For others, being able to take a class from a higher education institution without having to travel was a blessing.

Finally, in the last category, *feelings*, two themes that emerged and were mentioned nearly the same number of times were "frustration" and "reflection." "Frustration" was already discussed above. In the "reflection" theme, participants wrote about their ideas and thoughts on how to improve their daily practice based on what they were learning through experience and self-monitoring of improvements while participating in the investigated class. As Froman (1994) noted, reflection is the result of climates that support open communication, beneficial debate, and critical evaluation of untried assumptions and values. The online class was a conducive environment for thoughtful participation and personal growth.

Many other themes emerged from each category, but only the major ones were discussed. By doing a content analysis, the researchers discovered that the number of times the different themes in the *class* category were mentioned tallied almost the same number of times the themes in the *feelings* category were discussed. This is

an important result because it suggests that for an online student, meeting the class requirements, deadlines, and completing the class projects are as important as they way s/he feels during the learning experience.

In-Depth Interviews

This data source did not provide a major insight into the way a student feels while taking an online course. However, it revealed that students come to class with a set of ideas and assumptions that situate them more or less in the constructivist paradigm or in the traditional paradigm. Of the four interviewees, three were situated in the constructivist paradigm and the fourth was more in the traditional paradigm. This result needs to be further analyzed and looked for connections between online students' teaching paradigms and the degree of technology proficiency and risk-taking ability that students exhibited during the class.

In summary, qualitative data provided an excellent avenue for gaining an insiders' view of the learning experience from the students' perspective. An important result of this research was to understand that for a distance education learner, the way she or he felt during the course itself was as important as the course content and assignments. In addition, it is important to recognize that the professor's abilities to lead a web-based course are crucial for the success or failure of the course. Of utmost importance is the class atmosphere that the course professor creates through the degree of communication that s/he maintains with the students.

Educational Importance of the Study

After several years of investigating the effectiveness of distance learning, researchers need to focus on the human aspect of such interactions. Even when the Internet has become ubiquitous, more research is necessary to understand what happens after the web-based course participants get efficient hardware and a good Internet connection. Although the results of this study are not conclusive, they provide an insight into the complex interactions that occur in a web-based distance education course.

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Content Analysis as a Tool for Evaluating the Effectiveness of Distance Learning Systems

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Abstract: Knowledge is a necessary condition for any kind of progress in our society, and the teacher is an important factor in transferring knowledge. Distance learning enables the transfer of knowledge from one place to another. There are different methods of operating DL (videoconference, internet, satellite), each with its advantages and disadvantages. DL is accepted as an innovation in the field of education and instruction. However, any change in education is only as effective as the ability of the teachers to successfully accommodate the change. This study evaluates the level and quality of the teacher-learner interaction and included three phases: a) Defining the circumstances and situations where the research can be performed; b) Constructing research tools and proving their reliability and validity; c) Operating the research - collecting information on the teacher-learner interaction. During the past three years our research team worked on the first two phases of the research.

Introduction

The challenges facing schools today are in the realm of teaching development so that with the assistance of teachers, the learners will be able to deal more effectively with the problems posed by the world in which they live by becoming independent learners and mastering basic skills. Each individual learner needs a unique set of circumstances in order to learn to the best of his ability. The fulfillment of the learner's potential is one of the better methods of enabling learners to cope with social demands. The contribution of the teacher to the process of learning is very significant. The teacher-learner interaction is an important condition for any kind of learning and for acquiring knowledge. The personal relation between the teacher and the learner is crucial for developing the learner's ability, curiosity and level of thinking. However, in many countries there is lack of good teachers, and a lack of financial resources for coping with educational needs. In widely scattered placed it is difficult to have good teachers, compared to main cities. This has increased the need for using distance learning. Distance learning (DL) is a teaching method in which the teacher and the learners are separated from each other by place and/or time. It enables the transfer of knowledge from one place to another (Holmberg 1986) and the rapid development of computers and electronics has contributed to the increase in the effectiveness of DL (Dede 1990, Feasly 1983, Pain 1989). The interaction between a teacher and a learner, or among the teachers themselves, can be performed with the aid of computers, videoconference, radio, satellite, internet, fax, telephone, television or in mailing some learning materials. Each communications technology has its advantages and disadvantages. We should learn the characteristics of the different communications technologies and media and how they have been used in distance education. All communication technologies are accepted by teachers as being an innovation in the field of education and instruction. When they are introduced into the classroom, the teacher must make some changes in his instructional and teaching methods so as to accommodate the communication technology's efficiency in the instructional process. However, any institutional curriculum or instructional change is only as effective as the ability of the teaching staff to accommodate the change successfully.

The effectiveness of any staff development policy can only be considered in the light of how the teachers themselves respond to such a policy. The understanding of teachers' behaviors and attitudes is a prerequisite for the initiation of any kind of reform in teaching and instructional methods. The connection between change and personality variables is well known in society in general and in education in particular. When society feels that a fundamental change is necessary it calls upon innovative leaders to initiate the necessary changes. This is also true for education (Duke 1987). DL is a fairly new instructional aid and only those teachers whose personalities feel comfortable with novel and innovative teaching methods will react

positively to DL and make a firm decision to use DL in the classroom. Research aimed at evaluating the teacher-learner interaction should be operated under circumstances where the teacher reacts naturally and does not feel frightened. Only in such an isolated situation will the data on the different interactions and their effects be accurate. The first phase of this research is to define such isolated circumstances. Different communications technologies are used in our project: a) Two-way videoconferencing (via cable, ISDN, 384K). This allows the learners and the instructor to interact face to face and is the closest match to traditional classroom instruction. b) Computer conferencing which allows the learners and instructors to interact via a computer network. They can send messages to each other (by electronic mail) as well as transfer data files. c) Two-way videoconferencing (one way via satellite with the learner responding via email). The learner can see the lecturer on the computer screen and can ask questions by email or by microphone. DL can alleviate the teacher's task of transferring information, so that he/she are free to deal with the learner as an individual and the teacher becomes more of an educator and less of a source of information. In our research various variables were collected, defined, isolated and analyzed by a variety of research tools, including observations, interviews and questionnaire. The lessons were also recorded on a video tape. The information collected helped us define the duty of the teacher in the process of teaching, which communications media are best for a given course and how the media should be combined for maximal effectiveness.

The Study

Teacher personality and innovation in education

The aim of the first phase of this research was to examine the connection between the teacher's willingness to adopt innovations and the personality trait of risk-taking. The research sample was made up of 80 fully qualified teachers (Offir & Katz 1990). Two questionnaires were specially designed for use in this study: 1. Risk-taking questionnaire; 2. Attitude towards innovation (computer) in education questionnaire. The subjects were divided into three levels of risk-taking according to their responses to the risk-taking questionnaire. Analysis of variance (ANOVA) was then performed for risk-taking by attitude to innovation variables ($F=17.21$; $DF=2$; $p<0.000$). This test indicated significant differences between groups with different risk-taking levels. A *post-hoc* Scheffe test, designed to examine the significance of inter-group differences emanating from the significant ANOVA main effects was then performed. The results of the Scheffes test indicate that high-level risk-takers have a significantly more positive attitude to computers than medium-level risk-takers who have a significantly more positive attitude to innovation than low-level risk-takers. The risk-taking trait is apparently necessary for adopting a new and innovative instructional and teaching method and augurs well for the successful accommodation of novelty in the classroom situation. On the other hand, low-level risk-taking seems to indicate traditionalism in the teachers' perceptions of teaching and instruction, and as such, impairs the low-level risk-taker's ability to come to terms with novel classroom methods. These results confirm the findings of Katz (1984), that certain personality traits are required for successful adjustment in novel situations. When the use of a new method in the classroom situation is universally perceived to be totally successful, all teachers will agree to accommodate it in all their instructional activities. However, if the innovation is perceived to be only 50% successful in the classroom the low-level risk-takers will agree to incorporate it in only 20% of their teaching activities. Medium-level risk-takers will use the new method in 50% of their instruction and high-level risk-takers will agree to use it in 80% of their teaching activities. Therefore, only those teachers who feel comfortable with novel and innovative teaching methods will react positively to DL and will make a firm decision to use DL in the classroom and if a school wants to succeed in operating DL, the personalities of the teachers must be taken into consideration. A history of failure in operating DL can contribute to the teacher's negative attitude towards it. After a period of accommodation, during which DL can be shown to be a useful teaching and instructional instrument, DL can be introduced into the classroom of medium and low-level risk-takers who will be more inclined to accept DL as a new but not threatening teaching method. On the basis of these results it was concluded that evaluating the teacher-learner interaction in DL should be performed under natural circumstances where there is no proven failure in operating DL or where the personality of the teacher influences him or her to relate positively to innovation. Under such circumstances the teacher-learner interactions can be evaluated, since interference by other factors

will be minimal. The conclusions from the first phase of the research helped us choose the conditions for constructing the research aid for evaluating teacher-learner interactions.

Aid for evaluating teacher-learner interactions

Biggs (1982), presents a model of three P's, according to which learning is divided into three phases: presage, process and product. The first phase, "presage", includes the learner's abilities and information on the method and structure of program learning. The second phase is related to the "process" of learning and emphasizes different elements in the interaction between learners, subject matter, method of learning and teacher contribution. The third phase, "product", is related to the learner's achievement.
defines the importance of the teacher-learner interaction and its contribution to the process of analyzing the content of a message during a lesson. The interactivity of a lesson is an active process enabling the learner to adapt the lesson to his or her level and ability (Weller 1988). Interaction is a dominant and important factor in teaching. The interaction can lead the learner to take an active part in the learning process and encourages him to make decisions and analyze the knowledge transferred. Analysis of the interaction can help in drawing conclusions on the efficiency of the lesson (Hueyching & Reeve 1992, Jones & Vesilind 1992, Flanders 1970, Mcloughlin & Oliver 1995, Murry & Zuzovsky 1994, Hogelucht 1996, Brophy & Good 1969, Ruberg et al. 1996). Based on the information obtained, Henri (1992) developed an analytical model that can be used by educators for a better understanding of the learning process. This analytical model was developed to emphasize five dimensions of the learning process exteriorized in the message: participation, interaction, social, cognitive and metacognitive dimensions. Henri's content analysis model provides information on the participants as learners, and on their ways of dealing with a given topic. Thus informed, the educator can fulfill his main role of offering support to the individual and the collective learning process. Henri, in his article "Computer conferencing and content analysis" (1992), expressed his conclusion "We do not yet possess a body of knowledge concerning the pedagogical characteristics of the content of computer conferences, the scenarios of how the learning occurs, or the elements which give rise to learning. Only when we have a better understanding of computer-mediated learning will we be in a position to say that we are making the best use of the computer conferencing and content analysis - using its full potential. We believe that this understanding can come only from a finer-grained content analysis." Henri's analytical model has been evaluated. It was found that real and very accurate information about most of the "categories" can be supplied by this model. However, when dealing with the "interactivity" category, the results collected by different judges was not significant. The judges did not recognize the same "interactivity" categories. The same conclusion was reached by Oliver and Mcloughlin (1996). Based on these results, Oliver and Macloughlin suggested some changes in Henri's analytical model. They recognized five different kinds of interactions: social, procedural, expository, explanatory and cognitive.

We have used Oliver and Macloughlin's model for analyzing the different kinds of "interactions" in distance learning and in traditional teaching. It was found that the interactions most commonly used in distance learning are the procedural and expository interactions, whereas the most commonly used interactions in traditional teaching are the cognition, social and explanatory interactions (Offir & Lev 1999). In our research 50 hours of lessons were fully video taped, where twenty five hours recorded traditional teaching and 25 hours recorded distance learning. The traditional and the distance learning lessons were given by the same lecturers (n=5). Each lecturer was video taped for five hours and the video cassettes were analyzed and evaluated. The results of the video analysis led us to the following three conclusions: 1. There is no clear agreement between the analyzers as to the definition of each "interaction", since there is no list of behaviors which can help classify the different interactions; 2. The concept of "cognitive interactions" is not clear, since the other interactions (explanatory and expository) can sometimes be "cognitive interactions"; 3. The different interactions are not defined operationally. The results of our evaluation led us to make some changes in Oliver and Mcloughlin's analytical model.

In the process of constructing our model for analyzing the content of a distance learning lesson (M.A.C.L.), the five interactions were divided into two categories: interactions which supply an encouraging environment for studying (social and procedural interactions) and content-related interactions (explanatory, expository and cognitive interactions). Interactions that support learning (social and procedural) do not deal with the subject matter, nor with the content. The purpose of the social interaction is to create a personal

connection between the teacher and the learner and to afford a relaxed environment, emotional support and encouragement for the learner, when necessary. The purpose of the procedural interaction is to deal with administrative problems arising during the lesson. These two interactions have the same goal, of helping create a supportive atmosphere for the learner.

Cookson and Chang (1995) make a distinction between a "positive emotional interaction" and a "negative emotional interaction". A positive emotional interaction is concerned with encouragement, decreasing tension and creating an informal atmosphere. With a negative emotional interaction the teachers behave formally and do not help and are not involved in the student's work, correct and react negatively towards the student, prevent help, etc. Our model divided the "social interaction" into two parts, negative and positive. Cookson and Chang (1995) helped us define the "procedural interaction". In our model the procedural interaction included administrative behaviors related to the students.

It was found that an element of "cognition interaction" is contained within the "explanatory" and "expository" interactions. Since these three interactions are cognitive in nature, the cognitive processes to be analyzed and how they can be recognized should be clearly defined. Furthermore, a clear distinction should be made between these three interactions. We are interested in analyzing "the way the student learns". Henri (1992) used the taxonomy developed by Ennis (1986). This taxonomy contains twelve different abilities. Henri reduced them to five abilities. This taxonomy can help define cognition skills.

The destination among the "explanatory", "expository" and "cognition" interactions can be based on Henri recognized different analysis levels in the cognitive domain. He mentioned the processing level: "surface processing" and "in-depth processing". Schmeck (1983) defined in-depth processing. Entwise and Waterston (1988) also made a distinction between "surface processing" and "in-depth processing", which enabled us to define the three content-related interactions: "explanatory" and "expository" interactions related to "surface processing and "cognitive interaction" related to "in-depth processing". Based on approach, the different interactions can be defined as: 1. Expository interaction: Teacher or learner present knowledge or ability; 2. Explanatory interaction: Teacher uses learner's reaction for explaining information; 3. Cognitive interaction: Behavior which presents ability for drawing conclusions, analyzing and decision making, learner applies information to new circumstances.

The literature and the information obtained by our researches directed us in developing our matrix for evaluating "interactions" during the process of operating "distance learning" lessons.

Table 1: Matrix for Analyzing Messages

Message	Unit	Interactions					
		Social		Proc.	Expo.	Expl.	Cogn.
		Negative	Positive		Surface Process		In-depth Process
msg no. 1							
msg no. 2							
msg no. 3							

The researcher divided the interactions into messages. A message can be a single word or a complete sentence. The sentence can consist of a unit of meaning, for example, when the teacher says "your reaction is very exciting and interesting, but how does it complete your idea?" This sentence is a single message but has two units of meaning. The first is a "social interaction" and the second is a "cognitive interaction". We evaluated our analytical model for collecting messages during distance learning lessons. Eight judges observed the same video cassettes of two hours of recorded lessons. Their content analysis was directed by the existing content analysis matrix. The results are presented in table 2. The reliability of the matrix was proven in two stages: 1. Video casette of a DL lesson was given to three judges. They divided the lesson into conversation units; 2. Six judges used the matrix for analyzing the lesson's content.

Findings

Table 2: Correlation between judges in analyzing the content of DL lessons:

	G1	G2	G3	G4	G5	G6
G1 Pearson Correlation Sig. (2-tailed) N		.801** .000 40	.899** .000 40	.881** .000 40	.881** .000 40	.682** .000 40
G2 Pearson Correlation Sig. (2-tailed) N	.801** .000 40		.815** .000 40	.800** .000 40	.697** .000 40	.593** .000 40
G3 Pearson Correlation Sig. (2-tailed) N	.899** .000 40	.815** .000 40		.923** .000 40	.702** .000 40	.744** .000 40
G4 Pearson Correlation Sig. (2-tailed) N	.881** .000 40	.800** .000 40	.923** .000 40		.709** .000 40	.789** .000 40
G5 Pearson Correlation Sig. (2-tailed) N	.606** .000 40	.697** .000 40	.702** .000 40	.709** .000 40		.661** .000 40
G6 Pearson Correlation Sig. (2-tailed) N	.682** .000 40	.593** .000 40	.744** .000 40	.789**.00 0 40	.661** .000 40	

** Correlation is significant at the 0.01 level (2-tailed).

Conclusion

The teacher-learner interaction was found to be an important factor in evaluating the learning process. Five different interactions were defined: social, procedural, expository, explanatory and cognitive. The collected research data led us to construct a matrix for evaluating the teacher-learner interaction. The reliability of our matrix was proved by six judges to have a significant correlation (at the 0.01 level) between these six judges. The information collected by our matrix can help in understanding the role of distance learning. It helps in drawing conclusions on the advantages and disadvantages of different kinds of technologies. During the past twenty years our research has directed us towards developing a model for decision making: where, when and how to use different means for achieving defined aims (Katz & Offir 1990, Offir 1988, 1990a,b,c). We were led to the conclusion that measuring the "interaction" should be performed under natural circumstances, where he teacher feels free to behave naturally. Any stressful atmosphere will affect the teacher-learner interaction. Our research has tried to define the most suitable circumstances for measuring these interactions.

Schools that plan to introduce DL into the classroom should do so only with teachers who are classified as high level risk-takers, or after DL has been shown to be a useful teaching instrument. The teacher will then be more inclined to accept DL as a new , non-threatening teaching method. This study directed us towards finding a method for combining different means to achieve the aim of education: content analysis of distance learning can supply information which will help in the decision making process in the DL field. An effective tool for analyzing the content of a lesson can help define the role of distance learning and the role of the teacher in the process of learning. Distance learning can be effective in transferring knowledge when there is no other method for reaching this information.

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Evaluation of World Wide Web Delivered University Courseware: Creating an Instrument Appropriate for a New Course Delivery Medium

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Abstract: Research was performed during the 1998 and 1999 calendar years that had as its purpose the development and validation of a course/instructor evaluation instrument specifically for use with graduate and undergraduate courses delivered online via the World Wide Web. The primary goal of the study was to develop an instrument that would collect valid perception data from students at West Texas A&M University concerning technology of delivery, course content, and instructor related aspects of courseware delivered via the Internet. To this end an instrument was developed using the input of two panels of university faculty, administrators, and staff, and repeated pilot studies to collect data on the validity and reliability of the instrument. Feedback received from the expert panels, short and long-term pilot studies, and analysis of the collected data provide preliminary evidence to support the validity and reliability of this Internet delivered course-specific evaluation instrument.

Introduction

As the increased use of instructional technology in teaching becomes ever more necessary in higher education, the use of computer technologies to deliver course content to students constitutes the new frontier. Because the possession of a university degree in the latter part of the twentieth century has become more and more essential to career success, access to a university education for all that desire it has become a priority for universities large and small. One method of providing such access to students who have not previously had the opportunity to attend a university is to deliver course work to the student through the use

of newly available Internet based technologies. The delivery of courses in post-secondary education via technological means, while not new, has gained greater impetus through the expanded use of Internet technologies that center on the World Wide Web. Through the use of the World Wide Web, undergraduate and graduate courses can be delivered without any limits as to the geographical location of the student. Johnstone (1997) has found that students who elect to take courses via technological means have an expectation of convenience and ease of access. This desire on the part of traditional and non-traditional students for higher education delivered to them on their own schedule has driven the strong growth in both institutions of higher education offering such electronically delivered courseware, and the range of courses offered. Twigg (1994) finds that non-traditional students in particular define their role as a participant in higher education differently than their younger counterparts. Older students tend to view themselves as discriminating consumers of an educational product. Because of this view these students do not view themselves as limited to what professors and administrators of higher education think they need.

In addition to the differing perceptions and expectations of students for on-line delivered courseware, the medium of delivery also plays a role in shaping how students' perceive their experience as a student in this new type of learning experience. While several authors (Tait 1993; Dringus 1995; Cresswell & Hobson 1996; Johnstone 1997; and Magalhaes & Schiel 1997) have addressed the need for high quality evaluation of courses delivered at a distance, there is currently a dearth of research studies published that offer validated evaluation survey instruments specifically written for World Wide Web delivered courseware. It is the above listed differences in perceptions by potential consumers of distance delivered courseware that makes valid evaluation of student perceptions and experiences in these courses essential to university administration and faculty.

This study took place during 1998-1999 academic years at West Texas A&M University in Canyon, Texas. West Texas A&M University is a member of Texas A&M University System that serves the panhandle region of Texas. This region of the state of Texas has an approximate population of 700,000, with the university having an approximate enrollment of 6,800 students. In the fall semester of 1997, West Texas A&M University implemented four courses for online delivery through the World Wide Web with a total enrollment of approximately 125 students. Currently (fall semester 1999) 33 different courses are offered with a total enrollment of approximately 660 students in initial enrollment. West Texas A&M University currently plans to make available 25% of its course offerings via World Wide Web delivery by the year 2003.

Of the many challenges faced by universities and instructors who develop and offer online courseware, course evaluation may be among the most difficult challenges to address. In this study, a new instrument was developed to collect course evaluation data for courses that are delivered online through the World Wide Web. The first phase of the development process involved the associate Dean of Information Technology, research specialists, and faculty who have designed and facilitated online courseware. The new instrument developed as a result of this process was designed to collect data concerning student perceptions of course content, instruction, and delivery. The second phase of the project involved analysis of the data gathered from participants in the study to determine internal reliability and the benefits and limitations of using the Internet to conduct online course evaluations.

During the first three semesters that courses were offered online at West Texas A&M University, no course evaluation instruments were distributed for the collection of student perceptions as to course and instructor. The university had used (and still uses) a Course/Instructor Evaluation Questionnaire (CEIQ) instrument which was an adaptation of the Aleamoni Course/Instructor Evaluation Questionnaire (Aleamoni 1978). This instrument had been used to gather student perceptions as to course and instructor for some ten years prior to the offering of online courses at WTAMU, but had not yet been applied to online courses due to the early stage of development and implementation of this new instructional medium.

Much research has been written on the validity and reliability of using standard survey questionnaires to assess student perceptions of instruction and course content quality (Costin, Greenough, & Menges 1971; Centra 1973; Cashin 1988, 1990, 1995; Abrami, D'Apollonia, & Cohen 1990). However there is very much less literature that deals specifically with either the development or validation of online course-specific student evaluation instruments. The research team began their investigation with an Internet search for

instruments currently used to evaluate online courseware. This search conducted in January 1999 found less than 5 such instruments that were accessible. The majority of the instruments located and evaluated were structured using the familiar Likert type questions that sought to quantify student perceptions of perceived course and instructor quality. A similar search conducted in late November 1999, found a much larger number of such evaluative instruments available for study, although their quality ranged from comprehensive to perfunctory. Due to the lack of existing instrumentation available for adaptation at the beginning of the study, it was determined that the development of a new instrument would be necessary.

This newly developed instrument must be valid and reliable, and the data collected through the use of this instrument should be able provide data that will be valuable for formative and summative evaluation of courseware. It is essential that instructors whose online teaching effectiveness is being evaluated through such an instrument have confidence in the fact that the instrument being used to evaluate their teaching can actually gather data that is validly measuring their level of success with students in this new teaching medium. If instruments used in the evaluation of online delivered courses have previously been validated only for use in the traditional classroom, confidence can be diminished in the feedback generated by those evaluations by online faculty.

Method

As World Wide Web courses became more widely implemented and include the participation of more faculty members at West Texas A&M University, concerns were raised by the faculty teaching online courses as to whether the evaluation of courses delivered via the World Wide Web would be comparable to the evaluation of courses delivered in the more traditional manner. Due to the dearth of World Wide Web course delivery evaluation instrumentation in the literature, the need for a delivery method specific course and instructor evaluation instrument became clear to both those who administrate and those who taught online courses at West Texas A&M University. The first goal in developing such an instrument was to provide for a comprehensive validation strategy through which the validity of the instrument could be quantified procedurally and later statistically.

This study was pursued in two main phases. In the first phase, a panel of web courseware development faculty, administrators, and staff were gathered at West Texas A&M University in the fall semester of 1998 for the purpose of developing a course evaluation instrument. The expert panel assembled consisted of LeAnn McKinzie, Associate Dean for Information Technology, James Izat, assistant professor of instructional technology and research, Charles Mize, program head of instructional technology, and Trey McCallie, instructional technology graduate student and WTOnline university network programmer. This panel met to decide on the initial form of the instrument and questioning domains to be used in gathering data. Three main questioning domains were chosen; they included questions designed to elicit perceptions as to delivery technology, course content, and instructor. The questions in the delivery technology domain sought information from students as to how they perceived the role of the Internet-based technologies used to deliver online courseware in their overall course experience. The course content domain questions were written to collect data on students' perception of the quality, structure and value of the course content as they experienced it through the online course presentation. Lastly, the instructor evaluation domain sought to determine how students viewed the contributions, expertise, and responsiveness of the instructor. Incorporated into the first draft were instructor and course content questions that were reflective of the five main questioning domains of the CIEQ (Aleamoni, 1978) instrument used to evaluate classroom-based courses (course value, method of instruction, instructor attributes, course material, and student interest). The second phase of the study began with the completion of the first draft of the online courseware evaluation instrument. This instrument was distributed among several instructors of courses that were offered through World Wide Web delivery for comment. These comments were evaluated and, when appropriate, incorporated into the instrument. The draft instrument was then distributed to a class of graduate students at West Texas A&M University. The students participating in this pilot study were asked to complete the survey instrument and check for proper wording, phrasing, and time of completion.

This second draft of the instrument was then rewritten as a World Wide Web based point and click form and posted on the university server which hosts online courseware. Instructors of online courses were requested to encourage their students to participate in the study by evaluating the courses in which they

were currently enrolled using this instrument. Additionally, all students currently enrolled in World Wide Web based courses were notified by email of the existence of the instrument and were asked to use the instrument to evaluate the course or courses they were currently taking. A point and click World Wide Web address was included in the email sent to all students enrolled in online courses to enable the students to easy locate the web site where the instrument was posted.

Data gathered from the spring 1999 semester field study was used to refine and further focus the instrument used for distribution to summer online courses. Similarly data gathered from two summer session distributions was used to further refine the instrument distributed in the fall semester of 1999. Data collected in each of the three field trials of the instrument have been analyzed to characterize the perceptions of study participants of their online course experiences. Also gathered data was used to discover the strengths and weaknesses of the online evaluation instrument, and the use of the Internet to evaluate student course perceptions. At the time of the writing of this paper data has been gathered from the fourth distribution of the instrument. The accumulated data will be used to perform a factor analysis of the questions used to quantify the validity of the instrument.

Findings

The process through which the instrument was developed progressed through two expert panels (research and development, and online teaching faculty), and both a small and a large-scale pilot study. When the data from the first three distributions (Spring, Summer I, and Summer II semesters of 1999) of the instrument were analyzed to determine a reliability coefficient for the questions used to gather data from the three questioning domains, a standardized item alpha coefficient of .7784 was obtained.

Data collected through the summer semester included 204 usable responses reflecting a total response rate of approximately 30% of students who were requested to participate in the study. At the writing of this article approximately 185 further responses have been gathered from students enrolled in fall semester 1999 courses, a response rate of approximately 35%. Of those students responding, approximately 28% were male, and 72% were female. Students responding to the survey were from a range of ages, including 38% from 23-30 years of age, 27% from 31-40 years of age, and 18% from 41-50 years of age. The remaining 17% of respondents were either under the age of 22 (14%) or over the age of 50 (3%). This result is affected by the fact that West Texas A&M University has a strong population of non-traditional students, and that graduate courses were predominant (graduate 64%, undergraduate 34% in respondents) in the online offerings of the university in the early stages of its development. The majority (53%) of students responding to the survey instrument reported having taken no online courses previous to the course they were evaluating, while an additional 31% of respondents reported having taken either one or two classes previously. Respondents to the study reported confidence in their mastery of course material taught as is evidenced by the fact that 71% reported that they expected a grade of "A", while 27% expected a "B." Only 2.5% reported an expectation of a grade less than "B." When respondents were asked how long they spent completing the survey, 96% of respondents reported that it took 15 minutes or less, while 74% reported taking 10 minutes or less.

Although text boxes were provided for respondents to comment upon the instrument itself, there were no comments or suggestions submitted. Similarly there were no comments added by respondents concerning questions that should be added or deleted. Respondents did, however, use the text boxes provided to comment on their instructor and/or their course.

Conclusions

Many lessons were learned by those researchers who worked together on this project during the 1998-1999 study period. Chief among these lessons is the finding that the traditional method of inviting participation in a study that is facilitated through technological means (i.e. the submission of a world wide web point and click form after notification by email) has not resulted in the rate of return desired by the researchers. While this low rate of return is not as significant an issue during the pilot testing phase of a validation study as it would be when the instrument, the researchers has hoped for a higher rate of return overall. In the

traditional classroom setting achieving a high rate of return on such an evaluative instrument is relatively straightforward, collecting such data through the internet has the potential to be somewhat more challenging. The maximization of student participation in online course evaluation will depend upon the implementation of new technologically enhanced methods developed and used to compel students to participate in an online-based course evaluation regardless of type. The use of such methods will allow the return rate of online course evaluations to approach or even exceed the return rate of evaluative instruments administered in the classroom.

A second lesson learned was that in any process which has as its goal the development of an instrument for the purpose of evaluating instruction there is a need for involvement of all effected groups in the development process. Those researchers who wish to develop such an online course specific evaluative instrument would be well served to involve the faculty, both those teaching on-line and those not, in the development process. Those faculty members who are teaching online will most probably be doing so without great experience in using Internet and World Wide Web technologies and media, and will view some trepidation evaluative methods that will affect their overall teaching effectiveness ratings.

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New tools for assessment in distance education

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Abstract: This paper describes a strategy for improving the quality of distance education assessment provinding a set of complementary tools to help on formative evaluation. Regular forms to assess learning are analyzed and Kirkpatrick's model for evaluation is described as well as a set of tools to provide capability to asses according this model. The set of complementary tools includes consensus, tracking, voting and self-evaluation.

1.Introduction

Learning assessment became a challenge to those working with distance education. In its definition of learning assessment, Bloom, Hastings and Madaus (Mendes 1998), proposed that the evaluation process should includes a great variety of evidences that go beyond the traditional final examination pencil and paper based. In a face-to-face context, professors use more than just formal mechanisms to evaluate students. Body language, participation, quality of questions proposed by students are good indicators of learning, In distance education what normally occurs it is the use of formal mechanisms only. It occurs not only because of the lack of accessible mechanisms that can assist instructors on this task, but also, because many professors prefer to work with more traditional methods of evaluation.

However, thanks to evolution of networks and computers and especially the Internet, mechanisms, that can fill this gap started to show up. Tools became available, to keep track of students activities and interactions with learning environment, with colleagues and with the professor. These kind of information present new opportunities for monitoring the way students learn and for learning assessment.

The use of the Internet for distance education assessment offers many advantages:

- Reduction of the distribution costs;
- The corrections and updates are simpler, therefore they are carried through in an only site, being immediately spread to all students;
- Several techniques for evaluation are possible using multimedia for the between professor and students and between students;
- The Internet facilitates collaborative writing;
- The student has more easiness in sending feedback allowing formative and evaluation

A research conducted by Dirks [Dirks] with instructors of distance learning MBA programs presented some questions like: Considering all the time you spend on this course (100%), how much of that time do you think you spend on student assessment (writing tests, grading, giving feedback, and reporting scores)? Answers indicated that the newer teachers, 2-9 years teaching, spent over half their time on assessment (56%), those with 10-19 years experience spent less time on assessment (46%), and the career instructors, 20+ years teaching, spent the least amount of time doing assessment (35%). The primary reasons given for having assessments include providing feedback, giving grades, and motivation. The four types of assessment most commonly mentioned are: case studies, exams, papers, and projects. All of them requires extensive time to grade and are very difficult to get automated help to do the evaluation.

Other researches point also that what is often used for assessment in distance education are the

following:

- individual works developed individually and sent by regular mail or by email
- assessment based on contributions for group discussions
- tests (automatically handled by computer program)
- term papers (analysed by professor or assistants)
- oral or written tests conduced in the presence of the instructor (some times through videoconference) or with a remote assistant.

Learning theories state that group learning has significant relevance and must be supported also in distance education. Participation in group activities, cooperation and collaboration must be supported and graded. But there are a lack of good tools to help evaluate the participation of the distance education student in group activities.

Slowly, thanks to evolution of networks and computers and especially the Internet, mechanisms, that can fill this gap started to show up. Tools became available, to keep track of students activities and interactions with learning environment, with colleagues and with the professor as indicated in figure 1.

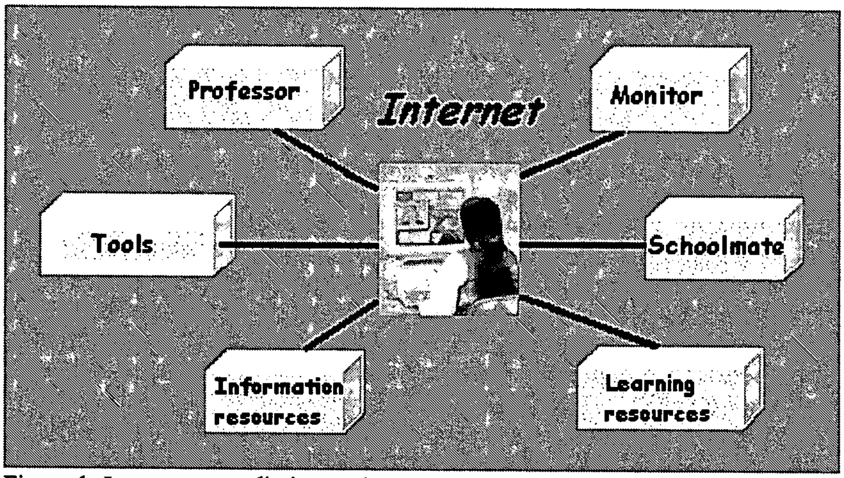

Figure 1: Internet as mediating tool

These kind of information present new opportunities for monitoring the way students learn and for learning assessment.

As stated by Tucker (Tucker 1998) the CMDL (Computer Mediated Distance Learning) classroom is routinely a far more scrutable educational environment than the physical classroom. The virtual classroom's electronic data storage, retrieval and exchange system (i.e., the text of student and faculty transactions, communication logs, file structures and information presentation algorithms that exist on the file server's hard disk drives) represent concentrated, structured and highly accessible artifacts of the learning transactions. These artifacts can be retrieved, analyzed and reported via highly economical, automatic processes operating in the background of the communications system.

This work presents a proposed solution for assessment on distance education mediated by Internet using innovative approaches based on Kirkpatrick model for evaluate training problems and will describe how they where implemented.

2. Assessment models and tools

There are today some systems, available in the market, that provide detailed information on the evolution of the student working at distance mediated by Internet. Examples of this kind of system include, CyberQ, WebCT and AulaNet. Statistics of usage and regular approaches for testing like multiple choice quiz and term papers are usually possible in these kind of systems.

Donald Kirkpatrick developed a model of evaluation, used in training programs. It recommends a

division of the evaluation process in four levels (Kirkpatrick 1998):

- Level 1 : **Reaction** - level measures how those who participate in the program react to it. It may be called a measure of student satisfaction.
- Level 2 : **Learning** - can be defined as the extent to which participants change attitudes, improve knowledge, and/or increase skill as a result of attending the program.
- Level 3 : **Behavior** - can be defined as the extent to which change in behavior has occurred because the participant attended the training program
- Level 4 : **Results** - can be defined as the final results that occurred because the participants attended the program.

Mendoza is other researcher that that it is also relevant to investigate student context to find out which aspects of course contents he/she is in the know (Mendoza 1999). So an aspect to be also considered is the lack of suitable tools to asses their current level of knowledge and skills. Mendoza recommends utilization of techniques, other that conventional ones, to collect data and suggest formative evaluation as well as summative evaluation. To achieve formative evaluation is important to make easy for the students not only inform their opinions and feelings about how course is going on but see this contributions being handled and considered.

To help in all these tasks and also support evaluation as proposed in Kirkpatrick model one should have a tool that would help organize polling and receive data in a suitable form to allow counting and summarizing results. To do this, it was designed a system aimed to support flexible and dynamically built of enquete for polling. The system has a WWW interface that allows designing of different kinds of multiple choice questions. Basic data informed are question and alternatives. Depending on type of desired measure the system ask for:

a) Feedback for each alternative
b) Indication of correct answer
c) Nothing more, just counting incidence of selections on each alternative

Option **a** is used for questions inserted in the learning path to ask for active response. Option **b** is used for testing and give grades. Option **c** is used for polling purposed. This system was designed to complement regular tools used to assess distance education students. The following mechanisms have been selected to assist in the evaluation process in this framework:

- **Tool of consensus**: based in the Delphi technique, allows on time creation of enquete proposing instigating questions, as well as the collection and tabulation of responses. The tool has the capability to keep track of each student's level of contribution to the discussion as well as enquete responses.
- **Tracking tool**: the register of learning activities (accessed page with dates and time) is important because it allows the professor to monitor the progress of students trough the course. The collected information will show that type of access the student has made (visited units, tools used, etc), as well as the time spent on it.
- **Voting tool**: aimed to provide conditions for a fast feedback for the instructor on specific subjects.
- **Self-evaluation tool**: allows the dynamic building of enquetes for self-evaluation by professor and by students.

It is important to stand out that this proposed work is not an alternative approach to assessment rather it is a complementary one and is supposed that may be used together. Each on of this tools are supposed to be used to help evaluate at more than one level in Kirkpatrick model

To implement the tracking tool, a generic interface was designed to intermediate all the interaction of the student with the server. Interactions are processed in real time (for authentication purposes) and periodically in batch to generate records in a student data-base.

To implement the voting, consensus and self-evaluating tools a set of CGI programs where developed to allow dynamically create pages with questions and propositions (HTML forms) that are presented to students and collect their answers (Tarouco 1997).

Conclusions

It is our believe that formative evaluation plays an important role to get distance students motivated because

they feel a sense of not being lost in space. Just the opposite, they feel that being closely monitored and having their opinions being asked often is more like having a personal tutor that pay attention on way they do and what they say. This kind of attention provided by the system helps to minimize solitude that sometimes is referred as main desisting factor from students.

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Trickle Down Technology: A Distance Education Approach to Professional Development

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Abstract: Technology is definitely a part of our world but all too often that world does not include the K-12 classroom. Technology seems to stop short because of lack of teacher training, lack of well developed lesson ideas, and the fact that universities are not offering courses that model the use of technology in the content areas. The Trickle Down Technology (TDT) Project offered a three-pronged solution: a collaboration between college faculty in education, current K-12 teachers, and pre-service teachers. While college faculty grew more comfortable with technology, they began to integrate computers into their classes, while helping K-12 teachers do the same. Concurrently, faculty modeled technology application as a part of the curriculum and helped their students develop lesson plans for K-12 classrooms. The teachers then implemented these lesson and provided online feedback to the preservice teachers.

Introduction

Educational technologies have been traced historically to the advent of movable type in the fifteenth century, to illustrations in seventeenth-century books, and to slate chalkboards in eighteenth-century classrooms (Jonassen, Peck and Wilson, 1999) . Educational technologies in the twentieth century include the first lantern slide projectors, radio, motion pictures, and most recently the personal computer. As each media emerged, educators realized the importance of professional training and the development of new teaching strategies that would transform the technology into a partner in the learning process rather than a substitute for the teacher.

The Trickle Down Technology (TDT) Project, funded through a grant from AT & T, offered the impetus needed to change the way both K-12 and university educators capitalize on technology in the classroom. The project had three key components: the modeling of technology in the university classroom, online technology workshops, and finally interactive communication among inservice and preservice teachers. Each of these components of the project will be discussed in this article.

Modeling Technology in the University Classroom

All too often, the only technology training offered to education majors is a single course on instructional media. In that class, students are offered a directives on how to load software, access the Internet, and change the bulb in the overhead projector. To add to the problem, university faculty seldom model technology in their classes due to the time needed to prepare a lecture that integrates the new media.

In the TDT Project, three professors were paid a stipend to integrate technology into their daily teaching. They were also assigned a graduate student who was available to create PowerPoint materials, conduct Internet searches, and assist with the technology during the class. As the instructors became more proficient with the technology, the graduate student was phased out, thus motivating the instructors to become self-sufficient with the technology.

As the project began, instructors were tentative about using technology to convey the message of their lectures. However, within a few weeks, PowerPoint presentations became the norm and a "technology team" approach among the instructors was initiated. Through email, the sharing of ideas and techniques was suddenly a daily occurrence.

Modeling of technology integration as only one of the tasks assigned to the university instructors. The nine faculty were encouraged to participate in bi-monthly chats to discuss their success and concerns as the media became more pervasive in their classrooms. The online chats provided written evidence of the steep learning curve involved in re-thinking the way universities teach. Through the chats, it became evident that software and hardware were only a part of a much larger picture. Instructors were changing their thinking to embrace technology as a partner in the learning process. The faculty found that students could now actively share their new knowledge, rather than memorizing facts from lectures, textbooks, and computer software. One instructor commented , "The classroom computer is simply a tool, but if we think about technology as a learning tool that students learn *with*, not *from*, then the nature of student learning and that of instruction must change".

Online Chats among University Professors

Twice per month, the nine professors met online in a recorded chatroom to discuss the integration of technology into their classes. The chats offered a place for these nine, novice computer users to discuss the utilization of the computer to illustrate a point, to enhance a lecture, to provide a hands-on approach, or to problem-

solve with their students. Although the chat occasionally included discussion of technical difficulties, this was generally discourages in lieu of topics that focused on synthesis of technology with content.

The first chat of each month had a pre-defined agenda such as, "Using the Internet in the University Classroom". Professors were given the agenda several days prior to the chat as well as websites on the topic. They were asked to share personal experiences that related to the topic and comments on the readings.

The second chat of the month, was a open forum where any topic related to the TDT Project could be discussed. The three universities rotated the responsibility for hosting these open forums. If a topic in the forum required prior preparation, the university that was presenting the topic was asked to email the material to the other two colleges several days prior to the chat. Although the chats were scheduled for 30 minutes, most chats lasted well from 45-50 minutes. One chat, "The Time Consuming Nature of Technology", lasted well over 60 minutes and resulted in nearly 35 email messages during the week that followed.

Role of the University Student

The TDT Project not only changed the role of the instructors but also had a profound influence on the students. Students were assigned the task of developing two lesson plans per month that combined some facet of technology with the content area they were studying. The first lessons were low tech with little more than stale material combined with a word processor or the Internet. As the students "lived" the use of technology in their university classes, they began to see that integrating new media meant more than "updating the same old lesson".

By the end of the third month of the project, low-tech lesson plans were transformed into technology-rich ideas that focused on learning *with* technology. Students moved away from lesson that "taught technology" to lessons that utilized the classroom computer for simulations, research foundations, experimentation, and open-ended, student directed projects. Examples of these lesson plans are available online.

Each month nearly fifty lesson plans were carefully reviewed by the nine faculty for both content and use of technology. One lesson was selected each month for implementation in a classroom in each of the three states, Washington, Nebraska and Wisconsin. Teachers were given three weeks to institute the technology-rich plan and to provide online feedback to the student who developed the lesson. While the chat was dedicated to the student who authored the lesson and feedback from three teachers who executed it, other teachers, education students, and

professors were invited to join. In this way, the preservice teachers received a wide variety of feedback on their lesson ideas including a regional focus and the education requirements for the individual states.

Teachers were asked to respond to the following questions:

* What did your students like about the lesson?
* What would you change if the lesson were to be implemented again?
* How did the lesson fit with your curriculum content?
* What advice would you give the student author of this lesson?
* Explain any problems you encountered during the actual implementation of this lesson?
* What auxiliary learning did you see taking place during this lesson?

The chat was logged and available online to anyone participating in the project. The student author was given a printed copy for future review. Making the chat logs available online allowed the education students the opportunity to learn strategies for developing successful lessons that combine technology with content. The website recorded nearly 50 hits after each online lesson review.

Technology Training for Teachers

Most universities across the United States offer from one to five credits in Instructional Technology. This limited focus is insufficient to prepare teachers to succeed in classrooms that are wired for Internet, linked for internal communication, and programmed with attendance and assessment capabilities. Teachers are unprepared to utilize teaching strategies in combination with technology and content. The TDT Project attempted to rectify a portion of this void through a series of online professional development workshops. Each workshop focused on technology topics that were addressed in the lesson plans and one or more of the following: word processing, spreadsheet, database, PowerPoint, Hyperstudio or the Internet. Not only did the workshops provide a simple and quick way for teachers to develop personal skills with the software, the hands-on activities also outlined numerous techniques for synthesizing the software with current curriculum. The teachers (also university students and professors) could access the online lessons any time, twenty-fours per day, seven days per week. Each lesson was designed to take no

more than twenty minutes to complete so teachers could easily review the lesson during a short break or before or after school without taking an excessive amount of time away from their preparation or other instructional tasks.

Three Regions and the TDT Project

In addition to the enhancement of technology in the delivery of content, the TDT Project was instituted to identify regional educational perspectives including the influence of ethnic diversity and rural vs. urban diversity on technology in school systems throughout the United States. Only though this mix could the integration of technology in today's schools truly be studied. The diversity of the schools chosen provided the student teachers as well as the professors an insight into educational systems across the U.S. and the opportunity to chat with teachers who teach in distinct educational regions.

Although all schools fall under the jurisdiction of the United States Department of Education in Washington D.C., the manner in which that education is dispersed can vary from state to state depending numerous factors including: monies allocated to education, the number of students, and the geographic and ethnic diversity of the state. The number of computers per classroom, for example, varies widely from state to state and region to region. In the TDT Project the number of computers varied from one computer per classroom to fifteen. Some of the schools had a vast library of software while others had only the software purchased personally by the teacher. Some schools had parental support for the advancement of technology, especially the Internet, while others still feared the use of technology in the classroom. All of these factors added to the enriched knowledge gained not only by the student teachers at the three universities, but also the professors who must prepare students to teach in all geographic and ethnic regions of the United States and the world.

Summary

Throughout history, media and numerous technologies for learning have influenced the delivery of education. Most recently, for example, the computer has invaded instructional settings and has provided the possibility for improving the learning process. For that improvement to take place, the teacher must be provided with the methodologies and strategies for successfully combining technology with content. Students must be given the opportunity to learn *with* technology, not *from* technology and finally, universities must model the development

of technology-rich activities and lessons in all content areas. The TDT Project provided funding and support to accomplish these goals.

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Shifting Focus from Teaching to Learning - ICT as an incentive to reform teacher education

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Abstract: New information technology introduces new challenges for the teachers - and also for the teacher training system. To make the new teachers really understand what the new learning environment is all about, they should be exposed to the new methods during their own training process. Therefore our revised teacher training programme includes netbased learning material, thus demonstrating the *dual mode* system, where both off and on campus studies are integrated. The close relation between training and *practice* is focused as well as *PBL* and *CSCL* methods. Students should also have an introduction to how netbased learning material is constructed, the *pedagogy of open learning*, and be given an overview of *services and tools* available on the net. All of these fields are subject to rapid development, and have to be revised continuously.

Changing role of the teacher

Traditional teacher education

Teacher education varies between different countries and cultures. A general goal, however, seems to be that the students in a teacher training situation are supposed to acquire sufficient subject and pedagogical knowledge to conduct the learning process of their future pupils. The teacher's role in primary school is often a mixture of a *sage on the stage*, an entertainer and a social worker. At secondary - and higher - levels, the subject content is more focused, and the goal is often to transfer as much of the teacher's knowledge as possible to the pupils. The tradition is to tell them, ask them to read books and keep them on their toes by requiring exercises done and giving test. The role of the pupils is traditionally that of recipients and accumulators of knowledge and skills.

Training of new teachers is done by much the same methods, only at a different level. Experienced professors and senior teachers are striving to transfer their own knowledge, experiences and skills to new generations of teachers. The teacher training is in itself a conservative process, keeping up traditions that '- have always worked.' New research and findings have led to new trends and methods, but the system of knowledge transfer persists. Now the time may have come for a real change, perhaps a new paradigm.

The new role for the teacher

The introduction of new technology does not imply that the teacher may leave his duties to the computer. Instead of being the sage on the stage, however, he is rather expected to guide his pupils to acquire know-

ledge from a variety of sources - many of them available through Internet. For new teachers to manage this role they should themselves have experience from these kinds of learning environments.

Technology & challenges

Learning environments based on new technology impose new challenges on the teachers - and on the teacher training system. Advanced and broad band networks, PCs being able to present sound and graphics, animations and video as well as texts and simulations, call for new skills and approaches by the teachers. To an even higher degree this also goes for teacher educators. The technology is there, but how does the academic staff, may be in their fifties, manage the new challenges? Is it easiest to continue the traditional way? We have tried out some ways to change the system.

Dual Mode Learning Environment

Over the past eight years we have developed courses that gradually have evolved from traditional lectures in the classroom, to Open and Distance Learning (ODL) courses. We have developed, implemented, tested and evaluated different models where the physical location of the student is of less importance with respect to how the content shall be presented and taught. Work has been directed towards a situation where a student is a student, no matter whether he or she is actually an internal or an external student. The focus is on what methods to use in working with the content. This means in practice that internal and distant students are participating in the same courses and working with the same material. An important goal for this work is to make models for teaching which is the same for both on-campus and external students, a dual mode learning environment where internal and external students interact and work together. By introducing this model new ways of teaching on-campus have also been found, with the clear intention of making internal students more responsible for their own learning, where the teachers are tutors or guides in the learning process. Different tools have been tried to make an interactive learning environment a place where the students take part.

Internet

Most of learning material, exercises and assignments, are distributed through Internet. In this material are included references to books and URLs, integrated video shots to illustrate actions etc. The Internet is also used as a forum for discussion, exchange of views and experiences with the learning material and assignments. This is building an electronic learning environment where both learning material and student work are presented and discussed.

The contact with the students is also kept electronically. Student assistants and teachers are available for net based interaction and guidance, and tools like IRC are used to create co-operating groups. This is done both for external and internal students. Teaching in the classroom is no longer dominated by the teacher with students as passive listeners. The Internet is gradually becoming an arena for teaching and guiding, where problem based learning methods are dominant.

Student activity

By including interactivity in the course material students are forced to be active and to take part in the course. In some courses the material is "opened" to the students, encouraging them to add information to the content, ask questions, show examples and present personal experience directly in the material, not in a separate newsgroup. This is done by letting the student make *annotations* to the material. This is making the curriculum a "living" and dynamic learning environment, and not a static material made once and for all by the teacher. To make this evolving material, a tool called WebOrama is developed as part of the SHARP project (http://www.softlab.ntua.gr/sharp/). Annotations made by students are available to all participants.

The attitude among internal students is still often based on behaviouristic learning theory and the belief that the best way of learning is to be taught by a teacher. The traditional *delivery* of facts and scientific material in the classroom, or over the Internet, should not be thought of as learning. Such lessons should be considered as information. The students have to interact with the material to acquire knowledge. Focussing on constructivistic learning theories and not on delivery of information the teachers invite the students to work on the entire course to construct their own knowledge.

During the first stages the students may be slightly confused, and have problems to get started. Many students need some time to adjust to this new way of working, with courses mainly based on student activity and the teacher as a guide. But the feedback from the students shows that after adjusting to this way of studying, they find it to be an efficient way of working and learning.

In our courses we focus on using the Internet as an interactive working arena. Internet must not be used as an excuse for presenting linear text, but as a tool to increase student activity. If knowledge is gained through work, Internet must be more than a delivery system for information. It has to be a place for work and active learning.

Focus on Practice

One of the main dilemmas in teacher education, and in other kinds of professional education as well, is and has for a long time been, finding the correct balance between theory and practice. There is a tradition for discussing these problems among students, teachers and philosophers of pedagogy. The counterparts in this discussion are on those who will place the learning situation on the university or college campus, and on the other side, those who will make practice the main arena for teacher education. In Norway it may be that until now the first group has won this discussion. Teacher education is and has for years been a theoretical and academic kind of education - with some practice added. There has been a gap between theory and practice. Even though educators have spent a lot of efforts to bridge theory and practice, there still seems to be a fear that increased focus on practice will reduce the academic quality of the education, and thereby reduce status for teaching as a profession. This is often described as the "fear of tyranny of experience" (Kvernbekk, 95, Weniger, 90), trying to avoid a teacher education where "practice is enough, and one doesn't need theory". It is difficult to understand this fear. A practice-based teacher education could as well be based a theory. By placing the theoretical reflection in the context of practice, the reflection will obtain a new dimension.

In general there are two main perspectives on the theory-practice relation. The first is to consider practice as an application of theory. This is usually how the students understand theory, as some kind of recipe for their own teaching. Among others Donald Schøn is distinctly critical to this way of thinking. He characterizes this as "Technological Rationality", a way of thinking based on the view that a scientist should develop general principals that the practitioner should follow. Schøn points out that this creates a totally wrong image of what practical competence is. He is concerned with the distance that exists between a discipline's technical rationality and the experienced practitioner's reflection in action and the research based reflection on action (Schøn, 86). The Swedish language researcher, Ingela Josefson, points out that the main question should be: "How can we secure that practice impress the theory-lessons" and not "How can we secure that theory lessons impress the students practice."(Josefson, 91) This is a constructivist point of view. Theory should also be something, that students construct by themselves, not always something served to them as general, established knowledge. A new practice-based approach to teacher education is suggested based on the didactic concepts of Problem Based Learning, within the framework of Computer Supported Collaborative Learning.

A platform of knowledge- and learning theories for PBL-based CSCL

Problem Based Learning (PBL) is derived from the older "case-study method" and is introduced as a fundamental pedagogical method, a model and concept initially applied in different fields of health education. One of the founders of the PBL term, Howard Barrows, points out 3 main goals for PBL:

- Students should achieve knowledge they can use in their professional work
- Students should be responsible for their own learning
- Students should develop skills for problem-solving

One common demand of a PBL environment is that the learning activity should reflect well known scientific thinking and methods. The working model is called "the 7 steps" (Pettersen, 97), with references back to John Dewey's ideal-model for problem solving (Dewey, 33). According to Timothy Koschmann the acronym CSCL has been established as a designation of an emerging paradigm within the ICT-area. Very briefly Koschman characterizes the CSCL-paradigm as a paradigm with focus on

> *.. the use of technology as a mediational tool within collaborative methods of instruction (Koschman,96,p2).*

According to Koschmann previous paradigms approach learning and instruction as psychological matters (Computer assisted instruction (CAI), Intelligent Tutoring Systems (ITS), and Logo as Latin). CSCL is built on the research traditions of disciplines that are devoted to understanding language, culture and other aspects of social settings, like anthropology, sociology, linguistics and communication science. The foundation of this learning theory is within the tradition of the Soviet socio-cultural theories and Vygotskys *Theory of cultural historical psychology* with references to the movement of social constructivism. On the other hand the paradigm combine insights from the Vygotskian school with insights from American pragmatism, represented by Dewey and Mead, and the contemporary work of sociologists and anthropologists like Rogoff and Lave and theories of situated learning and situated cognition.

PBL and CSCL may be placed on a common platform of learning theories supported by three pillars:

- The learning psychology pillar: *social constructivism*
- The learning theory pillar: *situated learning*
- The knowledge-sociology pillar: *critical pedagogy and project-organized learning*

These pillars are tied together within the epistemological framework of Wittgenstein, Polanyi and Schøn with focus on the relationship between tacit and focal knowledge.

Why CSCL and PBL?

Timothy Koschmann et. al. sketch up a theory-based (not technology–driven) approach for design of CSCL-tools, applied within the framework of Problem-Based Learning and the context of medical education. They call this approach Computer-Supported Problem-Based Learning (Koschmann , 96, p.83). The main argument for introducing this approach to medical education is the complexity of the domain, handling ill-structured problems in ill-structured domains. The characteristics of ill-structured problems are, according to Barrows and Feltovitc, primarily the dynamic character of this kind of problems. Problems unfold over time and change as new information is obtained. Secondly there are several ways of solving a problem and collecting information, relevant for the solution. Finally, there will be no "one and only" solution to this kind of problems, and decisions have to be taken in the absence of definite knowledge (Barrows and Feltovich, 1987). Koschmann et.al. point out the special challenge that education related to ill-structured domains represents:

> *For example, because of the problem of multiclassifiability and the irregular patterns of features across cases of the same type, classification of cases cannot be done in any simple regular manner. Further, teaching conceptual knowledge in the abstract will not prepare the student for the concepts' variations and combinations with other concepts that practice will demand. Finally, each problem that challenges performance is unique with respect to the definitive parameters that it lacks and the possibilities for their definition.* (Koschman et. Al , 1996, p-87)

The PBL-approach has been spread widely within health education both as a method and as a didactic basis for educational institutions within the field. The same has not happened within teacher education, in spite of the fact that constructivism as philosophy in general has deep roots in the pedagogical environment within teacher education. Somehow it may be said that the teacher educator *preaches* constructivism where the health care educator *practices* constructivism. Is there a difference between these kinds of education that

could explain the different ways of implementing a problem based concept or is this just a matter of traditions? There is no simple answers to this question. Most likely the answer is that there is a combination of causes. The main reason for the differences seems to be related to how problems emerge within the education. In education of health personnel it is relevant to define problems as cases and look for the treatment of the defined cases. This is a very concrete starting point which for example fits well to the 7 steps process prescribed for Problem Based Learning.

In teacher education there will be an extra didactic meta-layer and therefore less focus on 'finding solu- , but rather point out directions for making a suitable learning environment. This will be on a more abstract level than proposing concrete treatment of a patient. A consequence is that the problem defining process in teacher education in many cases has to be more complex.

Another problem is that the traditional organization of the main practice field, primary and secondary schools, give little support to a didactic based on constructivism. It could be considered as a paradox to use a constructivist approach in educating teachers for a non-constructivist practice. On the other hand, it could well be the only way to turn practice towards constructivism by starting education of new teachers in a different way.

Preparing teachers for open and flexible learning

Introducing ODL in Teacher Education

To introduce this new concept in teacher training, the most natural way should be to train them by teaching them ODL through ICT based ODL. Learning by doing has always been a sound principle. In this case there may be an alternative approache to expose them to a basic course on 'Learning-to-learn through ICT', where the first, introductory part is presented in a traditional way, either as a face-to-face course in a lab or as a printed text. After one or two sessions of this kind, the rest of the course is delivered on-line, by ICT. This way they should be able to compare the two methods and also have to learn to make good use of other on-line courses.

Pedagogy in Open Learning, PiOL

The other alternative is to offer a course on how to construct ICT based ODL material by attending an Internet course that demonstrates the content. The course provides a basic understanding for newcomers in the field of course ware development, and will hopefully also demonstrate new ideas for the more experienced developers. This on-line course on *Pedagogy in Open Learning* has been offered to national and international audiences since 1996. Every term it has undergone some revisions and has gradually evolved into the form it has now. A major objective is to provide *guidelines* for the development, implementation and running of open and flexible, net-based learning environments. These guidelines are based on experiences from user trials and evaluation of several national and European projects, as well as on theoretical discussions.

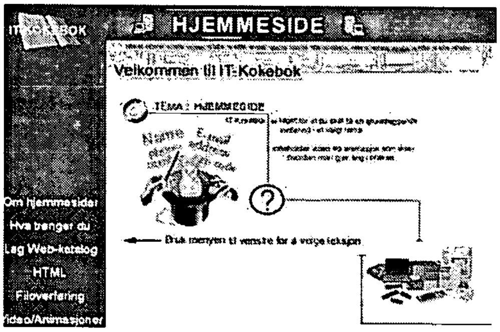
Resources on the network

Netbased studies are based on a multitude of tools and resources. Some of the central, on-line 'assistants' are mentioned below.

A distinction is made between *educational pages and supporting pages*. An important goal is to stimulate communication between students, between students and tutors, and between students and teachers. Information about the assignments, extra help and answers to the questions are available on the web-site through the lessons, the discussion groups, *the IT recipe book*, the *Topic Search"* ,the *Oracle-service* and the *Note Book*. The web pages are divided into public and non-public pages, where non-public pages are protected by password.

IT recipes book (cooking book), Topic Search, Oracle-Service and Note Book

The *IT recipes (cooking book)* is a tool for students that need extra help when it comes to topics like using a browser, making homepages etc. The IT-cookbook offers an introduction to the chosen theme on a basic level and provides the students with a number of different topics, known to be difficult to previous participants of the course (How to make their own homepages etc.). Each topic consists of explanations, directions, video and animations to show the students how to practice it themselves. In addition to the lessons and animations/ videos, the IT-cookbook also offers an encyclopaedia, explaining over 4000 words within computer terminology.



Topic Search, Oracle-Service and Note Books

The *Topic Search* is formed as a text-search where the students can search through the lessons of their course (both new and previous editions) for an explanation of a word or phrase. The search then gives the opportunity to go through the lessons and find the context in which the word or phrase appears, or an explanation to the word/phrase. The results appear as links to the various lessons that match the search.

Through the *Oracle-Service*, the student can get the answer to his/her question concerning the course, within a short period of time. The answer is given through e-mail. The oracle-service shows the status of the tutors, who are online/offline or occupied, at all times. The panel of the oracle-service consists of the course providers and several assistants.

With less and less hours where the students actually see each other, it is important to create a feeling of community, and each student contribute by making own personal *note book* during the start-up phase of the course. In these personal *Note Books* (available to all the students), they write about their own experiences during the course. By this the feeling comes that the course site belongs to every participant and grows with each individual contribution. It becomes a true *evolving knowledge base*. Through the personal note books, the participants have a unique possibility to inspire each other and give each other feedback during the course.

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New Horizons in Distance Education: Re-mapping the Pedagogical Terrain

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Abstract

This paper presents a case study of an online block of four courses leading to certification of secondary teachers who are presently teaching in middle and secondary schools on an emergency certificate. The courses were taken by sixteen post-baccalaureate students over fall semester 1998 and spring semester 1999. The primary goal of this project was to answer the question, can distance education courses actually be aligned to pedagogical practices which serve the needs of a rapidly-evolving, technology-assisted, information-driven society? Data was gathered from students and professors, as well as ExCET test (state licensure exam) results. The outcomes of the case study supported the belief that online courses could be interactive and problem-solving in nature, making use of the student's teaching placement. Consideration of current issues in teacher preparation and that access to a laboratory for real time assignments supported the success of the students in their work environment and on their required exam for certification.

Perspective

In a time when modern culture is linked by telecommunications technologies in ways never before possible, people transmit and process information, conduct business, collaborate in research, and engage in social and political discourse in dramatic new ways (Kapor, 1998, Wriston, 1996). Jobs are being redefined, and the age-old restrictions of time and space are imposing fewer limitations than ever before in economic/social/political arenas. Education, typically a bastion of cultural values, has been slow to adapt to the radically changing cultural landscape that characterizes this Age of Information. Education, stifled by bureaucratic norms, historical values, and linked to the political and economic destinies of its constituents, struggles for a cost-effective way to enter the efficient development of a technological infrastructure to effectively serve the needs of a changing clientele. The intensity of effort required to implement such development monopolizes professional energies that need to be put into understanding the pedagogical implications of technological development in order to guarantee its effectiveness (Traub, 1997). Unfortunately, this lack of focus on the pedagogical implications of technology, resulting perhaps from a lack of human resources for exploring this problem or society's faith in scientific progress may have detrimental results. Institutions implement new technologies under the assumption that "if we bring the technology, they will come," or more specifically, "if we bring the technology, they will learn." Such blind faith may actually diminish the effectiveness of educational technologies and transform the profound and dynamic tools they offer into the static appendages of outmoded pedagogy.

Higher education has been particularly challenged to apply technological tools to meet the needs of its faculty and students. Economically speaking, the introduction and implementation of new technologies within a higher education compels institutions that are perpetually concerned with finances and funding to maximize the efficiency and effectiveness of such implementation. From a pedagogical perspective, higher education institutions are acutely aware that they need to meet the diverse needs of student populations whose characteristics are continually transforming beyond those of the traditional student (Dalziel, 1997).

Contemporary students need alternative times to attend classes because many of them work as they attend school; indeed, they often need to access information "just in time," in order to meet the demands of their jobs, and they need to accelerate beyond traditional course units of time and content. As a solution to these diverse needs, distance education is heralded as an excellent vehicle to help such students

move across the challenging terrain of higher education towards their uniquely individual destinations. Unfortunately for these students, distance education classes may often rely on pedagogical techniques and traditions that are not consistent with the changing needs of society. Traditional courses are put on-line in a traditional pedagogical manner, with didactic lectures, quizzes and paper assignments. Yet today's highly interactive society demands that its citizens think critically, problem-solve, and see outside traditional paradigmatic structures (Cox, 1997, Frazier, 1997, and Boetcher, 1997). Thus, effective educators must prepare students in a manner consistent with the needs and demands of their society. Distance education in particular needs to provide the types and extent of interactivity consistent with the new global society. But the question is: Can distance education courses actually be aligned to pedagogical practices which serve the needs of a rapidly-evolving, technology-assisted, information-driven society?

Purpose of the Study

The purpose of this study is to analyze a case study that examines a block of secondary teacher education methods courses taught at a mid-size state university using a web-based distance education approach for sixteen post-baccalaureate students who were teaching in grades 7-12 on emergency certification during the 1998-99 school year. The primary component of this project was to evaluate the development of an on-line learning environment that replicated some of the primary needs of the information-driven society in the context of the courses. Strategies implemented to support this goal were:

- Professor created problem-posing curriculum that required students to take the information they were learning in their methods courses, synthesize it, and apply it within the context of their own school or classroom.
- Professor created public cyber spaces for students to publish their work and to react to the work of their peers.
- Professor created public cyber spaces for students to debate, solve problems, and dialogue about current issues and concepts associated with the courses and their work.
- Professor modeling of meaningfully integrated technology in order to support a problem-posing curriculum.
- Students learning of requisite technological skills for engaging in class activities.
- Student reflection about their learning through journals, conversations, and electronic portfolios.

Methodology

Informants for this study include sixteen post-baccalaureate university students teaching on emergency certification, two professors, and the scores of the sixteen post-baccalaureate university students on the ExCET (state licensure exams) test. Data sources for this project include:

- Syllabi for the four courses in the distance education methods block
- Students' electronic papers, projects, field notes, response logs, and forum responses posted 30 classes meetings that were held over the course of two semesters, (36 weeks).
- Sixteen student-created web pages.
- Instructors' field notes from throughout the semester.
- One 60-minute professors' taped debriefing following the course.
- Sixteen end-of-course evaluations by students.
- Sixteen student EXCET scores.

Analysis

The course syllabi were analyzed for evidence of pedagogical practices that support the needs of a rapidly evolving, technology-assisted, information-driven society? The students' electronically posted papers, projects, field notes, response logs, and forum responses were analyzed qualitatively looking for evidence of theory to practice connections reflective of the changing pedagogy. The instructors' field notes

were analyzed qualitatively for evidence of professor reflection about their own theory-to-practice alignment with the changing needs of an information-driven, technologically-assisted society in the design and implementation of these courses. Sixteen end-of-course evaluations were examined for student satisfaction in meeting their learning needs according to the traditional university evaluation rubric.

Findings

Formative evaluations made at the close of Fall 1998 indicated student, instructor, and supervisor satisfaction with the methods' block. Students report a high correlation between material studied and its relevance to their classroom practice. Students, professors and supervisors also addressed areas of concern and recommendations for improvement.

The professors for the methods-on-line class published web pages to deliver information about the structure and content of the course, but the threaded message boards became the forum for students to interact with the class community, professors and other students in the class. Threaded message boards served multiple instructional purposes in the Spring 1999 component of the block. They provided a mechanism for the professors and students to:

- deliver information about the structure and content of lessons,
- post expository assignments discussing the application of theory to classroom practice,
- report primary data collected,
- post lesson plans and construct instructional strategies,
- summarize and reflect upon assigned readings from texts and journals,
- evaluate textbooks & class assignments,
- participate in book club discussions,
- present persuasive arguments on educational issues,
- analyze educational issues and current events, and
- simulate classroom practices through role play.

In a typical lesson, a professor posted:

- information about the dates and times the assignments were due for any particular class meeting,
- questions which guided student inquiry into the lesson,
- introductory information about the topic and supporting links to sites on the web, which provided a basis for linking student prior knowledge to the topic to be studied, and
- threaded message boards for students to respond to the readings, discuss their responses with each other, or post other instructional activities products.

Student Interactions with Web-Based Lessons

Learning Community Discussion via Threaded Message Board

While professors created web pages for each "class meeting" and primarily presented the structure and the content of the lesson on these web pages, they used the "forums," or threaded message boards, to reply to immediate questions about the lessons and to give feedback to student responses to the lessons. Students were also required to respond to their colleagues original postings and responses made by other class members. For example in SED 560, *Advanced Techniques and Methods of Instruction*, the lesson for class meeting three was designed to help students focus on their educational philosophy as they studied a range of learning theories and instructional models. After reading, students were asked in an open forum to explain the rationale and theory that supported their educational decisions and practices. As a first step toward the development of their educational philosophies, students simply summarized the four basic learning theories being studied: Behaviorism, Gestalt theory, Field theory, and Cognitive theory. The responding professor and members of the class were able to provide immediate feedback to the student by affirming the accuracy of what had been written. They extended the definition of cognitive theory, thus extending the content of the lesson and changing the structure of the original presentation of the material.

In addition to delivering responses related to information about the structure and content of the lesson, threaded message boards provided a forum for posting expository assignments which helped make explicit the application of theory to classroom practice. One student, Lee Ann, illustrated how she used a behavioristic instructional strategy in her Spanish classroom. Then she made explicit how the instructional task was related to the theoretical definition of behaviorism. The forums provided a public space for her to articulate her understanding of the four basic learning theories. She used the threaded message boards to give her a public forum to reflect on her classroom practice and connect an element of that practice back to the theories she was studying. This posting of expository assignments encouraged a dialogue between students in the class and the rest of the learning community about the connection of the learning theory to classroom practice, giving them time and space to explore the connections.

Posting Primary Data

Providing a mechanism for delivering information about the structure and content of lessons and a public space for posting expository assignments led to making a more explicit connection between the educational theory and classroom practice. The threaded message boards provided a space for publishing primary data collected about the use of technology in the schools in which these post-baccalaureate students taught. For one assignment, students inquired into how technology was being used to support teaching and learning in their schools. They collected data and interviewed colleagues to find out about how they thought it helped and/or hindered the teaching and learning process.

Through the use of threaded message boards to disseminate primary data collected by the students, they had an opportunity to have their work read and responded to, and to read and respond to their classmates. This helped increase an awareness of the vast disparity among the schools and districts surveyed regarding the use of technology in teaching and learning and it helped increase students' awareness about the possibilities and limitations of technology within education as perceived by educators. The public forum gave an opportunity for rapid publishing, reading, and response by professional colleagues, thus increasing the magnitude of their primary research.

Posting Lesson Plans and Textbook Evaluations

As part of the methods block of courses, students were required to write lesson plans that were supported by the learning theory they were studying and included the instructional strategies which exemplified this theory. The threaded message boards provided a public forum to publish lesson plans. The open nature of this forum allowed students to give and receive feedback on each other's lesson plans, to test them against the theories or constructs they studied, and helped them to be accountable to a more extensive audience than just the instructor.

Students learned to evaluate instructional materials and had the opportunity to read, reflect and respond to each other's evaluations. Once again, the public nature of the forums increased awareness of each others' responses. Students reflected on the fact that textbooks have enormous influence on students; the amount of classroom time students spend reading textbooks; and the rights and responsibilities teachers have to evaluate text materials for their own classrooms, school, district, state, or national curriculum committees. Through the public nature of their posted evaluations, students realized the variety of opinions and perceptions that were held by textbook evaluators, and began to realize how this diversity of opinion could impact the larger economic and social issues surrounding textbook evaluation and purchasing. Students reported in the post-course debriefing, that they felt an increase in responsibility about textbook choice and reported feeling like they had an entry point into the process of textbook evaluation and purchase. They reported an increase in confidence after reading each other's evaluations. The evaluation task was not just limited to their perspective, but expanded to include the perspectives of the diverse group of peers who evaluated and posted to this forum.

Book Club Discussions

As part of the teaching and learning process, students read and discussed current education books

online through interactive forums. The discussions were held "book club" style with 2 or 3 students facilitating the discussion for each book club meeting. These students posted open-ended questions and class members responded on the forum and posed questions of their own. Discussions consisted of anything that the readings prompted the readers to think about - issues, concerns, questions, and comments.

The books were challenging, and controversial. They were chosen to challenge traditional view points and to encourage students to think, debate, and push the frontiers of teaching. The books were *Grading in the Post-Process Classroom: From Theory to Practice* (Hourigan et al, 1997) and *Life in Schools: An Introduction to Critical Pedagogy in the Foundations of Education* (McClaren, 1998). With the open parameters of this assignment, the student control of the discussion, and a public forum in which to discuss these issues, students increased their postings to the forums and the length of their responses. Student discussion leaders for the first book club meeting, posted questions to encourage processing the text. Students responded to the leaders pulling in many personal and professional experiences to passionately argue their points about assessment.

Students' responses addressed the issues the discussion leaders raised and greatly expanded those issues with anecdotes and illustrations from their own professional and personal experience. The open, public nature of the forum, as well as the assignment, opened boundaries of traditional teacher-directed assignments, allowing students to discuss be books and pertinent issues in a manner consistent with literary discussion in a real world context. The discussion, mediated by the technology, opened the way for everyone to speak and to be heard. Students commented in the post-course debriefing that, in regular classrooms, they could sit silently and just listen, not having to form or offer an opinion, but, in these public forums, there was no place to hide. They had to consider the issues in the context of the multiple perspectives people used as they responded, and, moreover, they had to form an opinion and be able to justify their stance. The students credited this requisite participation with a great deal of their growth in this course.

Analysis of Current Issues

Current events that affected the educational community and society at large were used to encourage students to analyze the issues using the theories, concepts, and strategies that guide educators as they make critical decisions. Immediately after the shootings at Columbine High School, in Littleton, Colorado, an assignment was posted as a part of the SED 590 *Advanced Methods of Classroom Management* course that pressed the students for their interpretation of what had happened. The students were to use the context of the material they were reading and working with related to conduct disorder, emotional problems, and physiological problems. They were asked to describe what they believed to be an appropriate effort or approach to the issue of school violence.

The students' responses to the forum were thoughtful and thought provoking. Again, the very public nature of the forum, coupled with the fact that peers would be reading and responding to their ideas caused students to answer with care, knowing that they would have to defend their stance to their peers.

Simulation

Lastly, threaded message boards were used for the purpose of role-play and/or simulation. One simulation assignment presented a scenario from an Assessment, Review, Dismissal (ARD) Meeting (staffing of special education students). The online students were asked to prepare a contingency contract based upon their particular teaching situation and the age level of their students. The online students were to create the main character in the parameters of the students who they worked with in their teaching assignment. The contingency contract was posted to a forum where the other students could read each person's approach to dealing with the simulated student

Through this public forum, students could freely examine each other's responses to the problem posed for this simulation. They reported that this not only provided a benchmark for their own thinking but greatly expanded their opportunities to examine multiple solutions for the problem. Once again, done in a traditional classroom assignment, the opportunities for peer feedback might not be as significant. And, once again, there could be no silent observers. Everyone had to offer a solution and had to hold their own solutions up to the scrutiny of their peers.

ExCET Test Scores

Teacher certificates are given to those individuals who meet the required course of study and successfully perform on one licensure examination related to the content area the teacher will be certified in and one related to pedagogy. Fifteen of the sixteen online class members passed both exams on their first attempt, a 94% pass rate which exceeded the face to face class statistics for other sections of the methods block of courses.

Recommendations

- Educators must situate learning in the context of problems that require students to take the information they are learning in their courses and synthesize it and apply it within a real world context.
- Educators must facilitate virtual communities of learners who work in small, collaborative groups to achieve a common goal.
- Educators must create public cyber-spaces for students to debate, solve problems, and dialogue about current issues and concepts associated with their courses and their work environment.
- Educators must model the meaningfully integrated technology in order to support a problem-posing curriculum.
- Students should learn technological skills in the context of engaging in class activities.
- Student should have opportunities to reflect about their learning through authentic means such as journals, conversations, and electronic portfolios.

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Three Community Building Strategies and Their Impacts in an On-Line Course

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Abstract: This paper describes three instructional strategies designed to support community building in an on-line graduate teacher education course. The impacts of these strategies are also discussed briefly.

Two common problems noted in the literature on distance education include a sense of isolation on the learners' part and insufficient support for learning. Many researchers (see, for example, Dede 1997; Zhang 1998) propose that the development of learning communities helps to provide interaction and support for distance learners, thereby breaking down these barriers to learning. Moore (1997) notes that a "good quality distance education program not only delivers high quality presentation of information but also provides a high quality personal experience for every individual student to interact with that information..." (p.6). This paper describes three instructional strategies designed to support such personal experiences in an on-line graduate teacher education course. The impacts of these strategies, which support such experiences by encouraging the development of a learning community, are also discussed briefly.

The course described is *L530: Computer-assisted language learning*, an elective in the Master's program in Language Education at a large midwestern university. Participants in this methods course are pre-service and in-service teachers of second or foreign languages. The Web-based course is offered three times per year and runs concurrently with the on-site version once per year. More about the development of the course can be found in Egbert & Chao (in press).

Strategy 1: MOO Field Trips

MOO field trips are one of the central activities in the course. Participants are introduced to text-based virtual environments on the Internet through metaphoric on-line "field trips" on their computers. Since MOOing requires synchronous interaction (all participants must be on line at the same time), the complication of scheduling is unavoidable. Different time zones often require that the class meet late at night or on a weekend for the MOO field trip. Other preparation includes contacting the field trip sites to ask for permission for a group visit and providing sufficient information to help participants prepare for it. Despite these potential complications, participants find this experience rewarding.

Description of the Activity

In a unit where the focus is on classroom atmosphere, we take participants to two MOOs: SchMOOze University, a MOO designed specifically for learners of English as a foreign or second language, and TAPPED IN, designed for teacher professional development.

The SchMOOze U visit is the first opportunity for the distance participants to meet and interact synchronously; the trip is not only a new learning experience but also a rare opportunity to socialize for the on-line class. Typically, an itinerary for the trip indicates that in the first trip participants will be introduced to ways of helping their learners function in this environment. Participants explore this environment in small groups with the instructor providing necessary support. During this time, participants realize the difficulties involved in text-based MOO navigation. They also see possibilities as well as problems in interacting with people outside of the class in this environment. Participants realize that they must develop ways of supporting learners and of dealing with safety concerns. A follow-up discussion is conducted asynchronously on the class electronic discussion forum after the first trip. The purpose is for participants to talk about their experiences and insights from the perspective of a new learner. Participants also discuss potential activity designs using this virtual environment.

On the second trip, to TAPPED IN, the group is introduced to a different kind of MOO setup by an outside expert from the host site. The expert helps with some of the participants' concerns and questions. The group tries out some of the activity designs that they came up with after the first field trip. The discussion in the MOO is in-depth and related to teaching and learning in the MOO environment. Another follow-up discussion is conducted in the class discussion forum for participants to compare and contrast their experiences in the two MOOs and to discuss their insights from the perspective of educators. The student facilitators and the instructor then conclude the activity with a summary of the discussion.

Impacts

We observe two kinds of impacts of this MOO field trip activity: (1) it encourages collective reflection and (2) it fosters a sense of community within the on-line group.

Encouragement of Collective Reflection

Reflection is an important daily activity that a successful teacher must do in order to learn from her experiences, successes and mistakes in everyday practice (Schon 1987). During the MOO field trip, the participants experience how it feels to lack control, what kind of help is useful, and how they can manage the flow of conversation to become active and independent participants. Since the experience is full of new opportunities and ideas, participants are eager to share their thoughts after the trip. We see participants reflect on the issues in the roles of both learner and teacher. Examples of the kinds of questions upon which participants reflect are presented in Table 1.

	Participants as learners reflect on:	Participants as teachers reflect on:
Affective issues	• The feeling of losing control or being left behind. • The appreciation of support from the group or from the instructor.	• How to provide learners with more support. • How to make sure that the environment is safe for our learners. • How to prepare to support learners.
Skills and structure issues	• Difficulties in following the conversation with many people talking all at the same time. • "How painful it would have been if I couldn't type fast enough."	• What kind of activity structure will be helpful. • What the maximum number of participants should be. • If this learning environment is suitable for every level of language learners or if it is only for the

	• "Where are the graphics?"	advanced learner. • What if a learner cannot type well. • How related this on-line "talk" is to developing writing ability. • How people become used to all-text interaction. How visual learners react.
Purpose	• "Why do I want to come here by myself?" • "What can I get/learn from coming to a MOO besides joking around with other learners?" • "I was just being silly."	• What kind of activities/assignments might be useful. • What good learners get by coming here often. • Whether it is possible to have serious discussions on MOOs. • How to facilitate discussion in this medium so that it is more than a socializing activity.

Table 1. Participant reflections on their MOO field trips.

Fostering a Sense of Community Within the On-line Group

The second important impact that MOO field trips have is facilitating a sense of community. In this Web-based distance education class, participants use the asynchronous conferencing tool for most of the discussions. Although conferencing requires daily participation, the interaction is very different from that in the MOOs. In the conference, responses are delayed and little emotion is usually expressed. The result is a serious, business-like, no-fuss *academic* discussion. The MOO field trip is just the opposite. The participants' initial excitement is obvious by the way they and the instructors greet each other and interact light-heartedly. For example, on one occasion the instructor noticed that one participant from Kuwait suddenly became quiet for a long time during the MOO visit. Once the group knew that this person had a headache, everybody started asking the reason and asking her to take care and not to worry about having to leave early. During the MOO trips, the group finally has the chance to pay real attention to each person, giving sincere care, voicing concerns, and developing friendships. After the trip, even the asynchronous discussion becomes more personal.

Our observations have convinced us of the power of synchronous interaction in fostering a sense of community in on-line classrooms. Following the suggestion of previous student groups, we have moved the MOO visits to an earlier part of the course so that a sense of community can be developed from the beginning of the semester.

It is important to note this activity would not have worked as well if developing a sense of community were all we wanted from it. MOO field trips are meaningful to our participants because they match perfectly with our goal of encouraging our participants (who are language teachers) to use technologies selectively and reflectively. When the excitement of on-line socializing dies down, we need to show that there is a deep meaning in this experience.

Strategy 2: Integrating Experts

Johnson (1997) and others support the integration of mentor teachers into teacher education courses. She concludes that making such links can help pre-service teachers link theory and practice and become more integrated into the community. At the same time, mentors or external experts are encouraged to reexamine their own practice and expand their role to that of teacher educator. In this on-line methods course, experts are integrated into the final project.

Description of the Activity

During the first week of this four-week project, participants hand in a one-page inquiry brainstorm that briefly explains a problem that she has or anticipates in her language classroom. The participant also describes her learners and their goals and proposes a variety of possible solutions to the problem. Participants then find an external expert who is willing to facilitate the development of a solution. Participants find experts through professional electronic discussion groups, a Web search of similar topics, a review of the literature associated with the topic, or a recommendation from the instructor. Participants consult with their expert during the development of a technological solution to the problem that they outlined. Participants are responsible for contacting this colleague and for the interaction that they have. Along with the solution, participants complete and turn in a reflection, which describes

- How the project a) solves the problem posed and b) meets conditions for optimal learning.
- How/whether the participant's learning goals (new skills or knowledge) for the project have been met (difficulties/ problems encountered and how they were solved).
- How the solution could be improved in terms of the 8 conditions for optimal classroom language learning discussed in class (if more time/money/skills were available).
- How the professional colleague helped (or didn't) and what difference it made to the project.

One of the criteria for grading was the degree of interaction with colleagues, inside of class and out.

Impacts

Participants' projects range from designing authentic grammar activities on the Web to creating lessons that integrate technology for other teachers to use. In their reflections, learners noted that "my colleague gave me lots of useful suggestions" and "I really appreciate my colleague...Hopefully, this project can really assist EFL high school students." Some of the participants interact with more than one "consultant" to get several views of their solutions; often, participants receive help with technical problems from one expert and content ideas from another. One student noted that for her it was "an unforgettable and

Broader than the idea of classroom community, integrating experts into this project helps participants to understand and become more a part of a wider community of practice. In addition, through the combination of working on a personal inquiry project and doing so with colleagues external to the course, learners come to think of themselves as less dependent on the course instructor and more able to use their own resources to develop effective solutions to classroom problems and to find collaborators within the community.

Strategy 3: Small Group Case Studies

Learning with case studies can offer participants a variety of opportunities to expand and extend their skills, problem solving abilities, and grasp of contemporary issues in today's classrooms (Sudzina, 1999). Working on case studies also helps participants to build on shared experiences and promotes team building and a sense of community among learners (McLellan, 1998). The small group case studies used in this course allow participants to work closely with two or three of their classmates on a problem scenario that is closely related to their teaching contexts. The discussions within teams take place in a team space or chat room found in the course's electronic forum. This discussion is open to other participants and the instructor, and participants in each team are encouraged to critique, provide encouragement, and recommend ideas to help other team efforts.

Description of the Activity

At the start of the course during a recent semester, the instructor surveyed participants about their interest in and commitment to teaching various levels of learners (elementary, secondary, and adult). Three case study scenarios were then designed to encourage participants to work on issues and concerns related to using technology in the language classroom. Participants were placed in teams to work on a case that, as far

as possible, related to their interests. The instructor also attempted to group participants based on their diverse learning experiences and expertise with technology.

Participants began planning and organizing tasks for their project by using the course's chat room facility on the conferencing forum. These synchronous chats were aimed at helping team members to brainstorm ideas for the project and to work out task assignments among the team members. Participants continued working on the project using the course's asynchronous conferencing forum. Several electronic folders were created to help participants organize this content. This included a Proposal Sample folder that contained guidelines, a Resource folder where participants could point others to related works, and a Discussion folder for participants to work through ideas on the case study and attach works-in-progress. The goals for these asynchronous discussions were to build on and refine ideas for the final product.

Impacts

Working through the case studies, participants develop a continuous sense of collegiality with their on-line classmates. This leads to the creation of invaluable support groups in the class. Since the team has to decide on solutions within a limited time (five weeks), many participants use a wide variety of tools and strategies to interact with their peers. Through this process, their thinking about the issue at hand becomes deeper and more meaningful than if they were to complete the project on their own. In addition, participants' reflections reveal that through working on case studies in small groups using different communication modes, they feel:

- encouraged (*"...great job!! this chat is encouraging me to work harder ..."*);
- they optimized and extended their abilities (*"I found the courage to do some summarizing and push for development of our ideas"*), and (*"I don't usually take a leadership role, but was able to do so to some*
- their efforts were rewarding (*"I learned a lot from being able to develop something WITH other working with a variety of educators was very enriching"*); and
- they learned other useful skills (*"There are also lessons about management"*).

Several considerations were taken into account when designing the case studies for this class that can be used as a guideline for similar courses. First, instructional and learning strategies in CALL learning environments as discussed in assigned readings were integrated. In addition, the case studies addressed the contexts for which CALL-related instructional strategies were designed and implemented. This involved having participants discuss the learning conditions and consider possible administrative constraints faced in these instructional settings. The need for participants to interact and share ideas in various ways (e.g., e-mail, chat rooms, document exchange, etc.) was made an integral part of the activity. Finally, opportunities for feedback (such as formative assessment and reflections) were built into the discussion as well as into the final report.

Conclusion

There are many ways for participants in an on-line methods course to become members of a class or wider community, but these opportunities must be carefully planned and well facilitated. In *L530*, the computer-assisted language learning methods course, the three strategies of MOO field trips, integration of experts, and use of a case-based format impacted learners in important ways. These strategies encouraged learners to think deeply about the course content and its applications, create bonds with other members of the community of technology-using language teachers, and to reflect about their teaching practice. By both helping participants overcome the sense of isolation that to many is inherent in distance education and providing alternative ways for participants to receive support for learning, these strategies are assisting us in meeting our goal of delivering quality distance teacher education.

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Technology in the classroom: Implications for Teacher Education

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Abstract: This paper argues that if ICT is going to become an integral part of instruction in elementary and secondary schools, then changes need to made in preservice and inservice programs for education students and practising teachers. Suggestions for assisting students to understand pedagogically appropriate uses of ICT are described. In addition a proposal for an instructional sending studio and receiving classroom is made. Uses for the facility are described and include applications at the undergraduate and graduate levels. The facility could be used to provide much needed research about the best uses of ICT in elementary and secondary classrooms.

Introduction

Rural and Northern areas in Saskatchewan have small student populations; however, the demand for an extensive range of courses has not decreased. Budgets are not large enough to allow hiring of specialists in all subject areas; nevertheless, students need these courses to fulfill requirements for entry to many post-secondary programs. In spite legislation requiring provision of equitable programs, they are becoming more difficult to deliver with limited funding.

Information communication technology (ICT) is capable of resolving these educational concerns to some extent. A variety of alternative program delivery systems/mechanisms are being suggested as means to provide equity in education in rural and northern settings. Televised and on-line courses originating from within or outside the province can be found for most subject areas. Within Saskatchewan, a few urban schools televise physics, calculus and other courses to areas where only small numbers of students want to take a course. Other courses, which originate inside and outside the province, are available on-line. However, in Canada, education is a provincial responsibility; there is no federal department of education as in the United States. Consequently, individual provincial departments of education are concerned about the quality of courses available on the Internet, and whether or not they adhere to provincial guidelines

The purpose of this paper is to explore some of the implication on teacher education of the increased use of ICT in delivery of curricula. The initial section describes the assumptions used to limit the scope of the paper. The next section presents a discussion of potential uses of ICT and some concerns/myths about the use of ICT in education. The third section is a discussion of teacher education and professional development for practising teachers including some ideas about distance education. The final section describes a research facility that author would like to see established at his university to further the study of ICT in teaching and learning.

Assumptions upon which paper is based

Because ICT has an enormous range of potential uses, some assumptions are employed to limit the scope of this paper. The assumptions are, of course, open to debate. Because of my professional classroom experience I have a good understanding of the realities of classroom teaching and learning. The suggestions made within this paper are intended to be manageable for faculties of education, school administrations and classroom teachers.

First, teachers are assumed to be doing a very good job in the classroom. They are well educated and care very strongly about their profession and their students. Teachers have a professional attitude toward the

quality of the instruction they provide and understand much more about what actually goes on in the classroom than most computer business persons. Second, the goals and policies of education in our province (and other Canadian provinces) are delineated in provincial education documentation. In Saskatchewan this documentation (Saskatchewan Education, 1999) has a sound philosophical base and is probably the most consistent package in Canada. The uses of ICT must fit within provincial programs and philosophy. Third, some use of ICT is inevitable and desirable; however, ICT is surrounded by an enormous amount of hype and many claims, which are not supported by research. Fourth, much more goes on in classrooms than the explicit curriculum lay out in curriculum guides. In classrooms throughout Canada implicit educational goals are achieved which are not written down but are intended nonetheless. These implicit goals are of great importance in the development of citizens and must not be unintentionally eliminated through the use of ICT or any other instructional strategy. Finally, it is assumed that whatever funding is spent on ICT cannot be spent on other school programs. The result of spending considerable amounts of money on ICT means that some program is discontinued, some building repair is not made, or some teacher is not hired. Franklin (1999) argues that when technology is introduced we should remember that students matter more than computers, and that planning to implement the use of technology should be aimed at minimizing disaster.

Uses, Myths and Concerns of ICT in Classrooms

Some uses of ICT in education are more likely to occur than others. The most obvious applications for students to learn to use include, word processing, spread sheet usage, data base creation and access, presentation, multi-media software and web design software. Students will increasingly use these types of software applications as tools in completing their assignments and presenting their work. Just as obviously, teachers will increasingly use ICT for administrative and professional purposes. Computers are now routinely used to record marks, attendance, student information, and to generate reports to parents. Teachers will continue to increase their professional use of ICT for lesson planning, instruction and communication. Communication by computer between teachers and administrators is now routine and will probably grow to include some form of communication with parents.

The Internet sites are increasingly being used as resources for students and teachers, especially as budget limitations reduce the purchase of other kinds of resources. Teachers, students and parents will use email communications more extensively, and new forms of communication will almost certainly include visual images. The chat room facility of web-based software is being used by students to communicate among themselves because its asynchronous nature allows them to work together on their own schedule.

ICT is being used to provide alternative delivery of curricula, especially at the secondary and post-secondary levels. Whether with one-way or two-way student-teacher communication, courses will be offered at a distance. Teachers at the receiving end may be able to assist in facilitating learning for those students who access such instruction. Teachers involved in the sending of distance instruction will have to learn instructional skills that are not normally taught as part of teacher education courses.

Software for classroom use is targeted at each subject area in every grade level. Teachers have to learn to evaluate this software as to its suitability in their classroom situations, and learn how to use appropriate software in meaningful ways with their students. Because of limited computer resources within individual classrooms all students will not be using the computer(s) at the same time. Software and hardware are used to collect and manipulate data in senior science laboratories. Drafting software and graphic design software have been adopted for use in practical and applied arts courses. Many high school year books are being created exclusively through the use page maker software and scanned images.

Educational research has discovered a great deal about how students learn and what types of experiences are most appropriate for particular age and developmental levels. Some proposed uses of ICT in classrooms are not appropriate to the developmental level of the students. We know certain types of activities and instruction cannot work at lower grade levels because these students do not yet think abstractly. Many proposed uses suggest that students will learn on their own with little supervision. For example, some suggestions for ICT involve elementary students learning at home with little or no teaching supervision sitting in front of a computer screen working through computer assisted learning exercises. This approach may be appropriate for adult learners who work from more intrinsic motivation, but it is not likely to succeed for

younger students. Caring and interaction from teachers is an essential part of learning, especially for younger children. Students must interact with people to learn how to work with them. These abilities are developed as part of every activity and all interactions in all K-12 classrooms. While some communication skills can be developed in isolation using computers, other important forms of communication cannot be. Reading non-verbal signs are extremely important in understanding others; body language and facial expressions are not obtainable using computers alone.

The adoption of technology has led to a downgrading of personal experience in education (Postman, 1991; Franklin, 1999). Human beings are tending to devalue their common sense about educational decisions. For example, common sense tells us that ICT cannot replace teachers. Yet, in spite of this knowledge we listen to arguments that performance of students taught by computer is as good on standardized tests as those taught by teachers and begin to wonder if teachers can be eliminated. Parents in rural communities in Saskatchewan are very clear about the expectation that their children should be in the presence of teachers and other students (Fleming & Pain, 1996). Yet, in spite of this common sense conclusion we persist in considering the replacement of teachers with ICT.

A claim frequently heard is that students will be able to interact using email with the scientists (or writers, or other professionals) who made discoveries (or wrote a book). The argument goes something like, "who better to explain the discovery than the person who made it." Sooner of later, reality will set in. First, scientists (and other professionals) do not have the time to interact with a significant number of students, any more than famous actors and actresses have time to answer their fan mail. Second, a teacher may well be able to explain a discovery better than the scientist to students in his/her classroom. Scientists who work at the frontier of knowledge are not known for their ability to communicate their ideas in ways that are clearly understood by adults, let alone children. Some of the hype and dreams that pass for policy development are just that, hype and dreams.

Lastly if we look at predictions made about computers made in the last decade or so, many have not come to fruition in quite the manner predicted. Computers have a have life expectancy of less than five years, meaning that they must be replaced much more frequently than imagined. I recall someone (maybe Bill Gates) arguing no long ago that no one would ever need a computer with more the 64 kB of memory. The quality of computers has increased as they become faster and have greater memory capacity; however, the demands of new software are constantly increasing requiring ever more powerful machines to run them. The wonderful "486" of a few years ago has become a paper weight or doorstop as a new piece of software is chosen with memory requirements that exceed those of the "486". This is perfectly planned obsolescence.

The most important criterion in adopting any ICT for classroom use is that the use be pedagogically appropriate. Teachers require workshops and other experiences to assist them in understanding the uses and limits of ICT. Appropriate uses are not necessarily what are advertised by manufacturers. Teachers have to be helped to understand that as professionals they can develop new and creative uses for ICT on their own.

Teacher Education and Professional Development

Fewer educators at the elementary, secondary, and post-secondary levels than is optimal are integrating ICT into their classrooms in ways that are meaningful to students and pedagogically appropriate. Without appropriate teacher education and professional development ICT resources can be wasted. For example, computers sit idle, or are used by students to "surf the net" with no direction or plan. In spite of the great range of wonderful resources on the Internet, it can be a very ugly and unfriendly place to explore. Without supervision and censorship, students (especially younger ones) are in some danger if allowed unlimited access. Preservice and inservice teachers require workshops and other developmental opportunities in order to learn about pedagogically appropriate uses of ICT. If teachers are going to use ICT in their classrooms, then they must use it well and in such a manner as to improve education.

Preservice and inservice teachers both require assistance in learning to integrate ICT into the curricula. Inservice teachers generally have more practical experience and background than do preservice teachers. Inservice teachers are more experienced in classroom decision making. In the following preservice teachers are presumed to be enrolled in university teacher education programs and gaining their ICT experiences as part of their courses. Inservice teachers are presumed to access some form of professional

development that could be part of a university program, but is more likely outside of a university setting. The ICT component of professional development and teacher education will in many cases be very similar.

Most advocates argue for the integration of ICT into the curricula of all subject areas. That is, ICT should not be restricted to computer science courses and computer labs; rather, students should have access to computers in each classroom for use in all courses. This approach is recommended because students need to learn to use ICT while performing problem based and authentic tasks in all subject areas. If ICT is to be available in all classrooms, then teachers will have to acquire some technical knowledge of ICT, and considerable knowledge of how to choose appropriate instructional uses for ICT in their classrooms.

Constructivist teaching, student-centred classrooms, critical and creative thinking skills, problem solving skills, and facilitation of student learning have been presented as reasons to adopt more ICT in classrooms. While all of these are desirable goals for classroom teaching, none is dependent on ICT, or even made more easily obtainable by ICT. Any and all of these characteristics can (and should) be developed with or without computers; however, achieving them is dependent on the structure of the assignments given to students, the choice of instruction, and the relationship developed between teachers and students. Constructivist teaching does not imply a particular style of instruction, rather it describes a particular model (theory) of student learning which teachers use to interpret learning in their classrooms (Millar, 1989).

Teacher education programs will still need to prepare their graduates with solid foundations in instruction, planning, educational psychology, learning theory and classroom management. None of these skills and knowledge is required in less degree if ICT is integrated into the curricula. No one is arguing that teachers need only to be able to install and to turn on a "learn to read" or some such program, and then stand back and not interfere with the "computer as teacher". Current teacher education programs need to incorporate ICT as appropriate to specific subject areas but not at the expense of other instructional skills and knowledge.

Students in teacher education programs need opportunities to incorporate the use of ICT in their studies. Preservice teachers need access to a variety of software and hardware with which they can experiment. They need opportunities to develop skills that will enable them to assess and evaluate software for use in their classes. Classroom use of ICT must be consistent with the goals of each curriculum and be age/grade appropriate. Because of the rate of change of titles and limited budgets teacher decisions must be made wisely.

Another issue, which must be addressed, is which aspects of ICT are to be included at which grades and in which subjects. Integration of ICT into the curricula seems like a simple directive, but the reality for classroom teachers is that they have so much to choose from that the task has become impossible. What are the appropriate aspects of ICT to be integrated into K-3, 4-6, 7-9, or 10-12? This concern is a policy issue and falls to other jurisdictions. Although several attempts have been made to delineate the appropriate sills and knowledge for grade levels, they have not been adopted in all curricular jurisdictions. More work needs to be done to resolve this issue. Do we postpone learning to write or read so that students can learn to "surf the net" or use computers in some other manner?

Practising teachers who are actively developing uses of ICT for their students have additional needs to those of preservice teachers. These teachers' concerns center around classroom uses of ICT and ensuring that their students are getting the best use of the available resources. The main problem, as I see it, is that classroom teachers do not have time in their schedules and lives to spend hours learning how to use various software and hardware in their instruction. Regardless of their dedication, they do not have great deals of spare time to spend learning about ICT. Many blockages can occur when working with computers and software, and each can bring an individual planning session to a halt. Without resolution the blockage stops all planning and tomorrow's lessons are not prepared. Support and professional development must be provided and be on-going. Teachers simply cannot be given an hour inservice, handed the software and be expected to use it in their classrooms the next day. Teaching is a much more complicated process than is imagined. "Just-in-time" support (assistance) has been described as a better means of assisting classroom teachers (Richmond, 1997). This type of support is designed to be available to teachers on very short notice. Support personnel must be available to assist teachers as they plan to include ICT into their instruction. Richmond argues that teachers need just-in-time support because studies have shown that they abandon ICT when the are stymied by some aspect of its use. Another solution is for an individual teacher to develop expertise with a single program and act as mentor to other teachers for that program. Professional development time must be provided in some manner by school administrations. Success of this approach is

less likely to occur if development of skills and knowledge is to be achieved on teachers' own time.

Each school division or administration has unique problems and concerns in delivering curriculum. Solutions are frequently most suitable when developed locally. One way to facilitate development of solutions to problems to ICT implementation would be to allow a teacher (or teachers) to have a "developmental semester." During a semester (or other length of time) teachers would be relieved from teaching and supervision duties and charged with exploring a local ICT problem. The goal would be for the teacher(s) to develop a resolution that would be implemented at the end of the "developmental semester". Teachers who know about the resources and personal in their communities could construct a viable resolution to the concern or problem. University faculties of education could provide advice and support to these teachers and could report in a formal manner on the locally developed solutions. Solutions could be published as research reports, but would be more useful in an electronic format in order to be more accessible. In some cases the work accomplished by teachers could fulfill part of the requirements for a postgraduate degree.

Distance education requires separate consideration because the teacher and students are not at the same location. Distance education courses can be delivered through correspondence, television or the Internet. Some form of distance education is very likely to be in rural and northern schools. Although most people think of the teacher who teaches from a distance, an increasingly important role exists for teachers (and other persons) at the receiving end. The role of assisting students who are accessing distance education has not been discussed to any great extent. In some models of distance education, persons at the receiving location may become an important component in distance education.

In preparing this paper I talked with two instructors who have taught using televised forms of distance education. One taught calculus and geometry to grade 12 students; the other taught university courses to students off-campus. Both instructors indicated that the flow of instruction was quite different from their regular classroom experience. This characteristic was the result of not being in the presence of the students. No immediate feedback was available and this lack made pacing of lessons different from regular teaching. Students were in contact by phone, but this type of communication was not the same, or as immediate, as personal face-to-face contact in a classroom. Both instructors thought that the sending teacher should be a specialist because of the skills required for this form of instruction. In distance education lessons have to be scripted more. Even referring to ones notes or lesson plan was perceived differently in distance education than in a regular classroom. Teacher education programs should develop courses and facilities to assist teachers in building skills and knowledge necessary for this type of instruction.

The second role in distance education is that of the supervising teacher (or person) in the classroom at the receiving end. Very little seems to have been written about his/her role. Courses or workshops could be developed to provide these persons with opportunities to learn how to assist students who are taking courses through distance education. Students need not learn completely on their own. This type of course would also have application for classroom teachers who are assisting students using computer-enhanced instruction. Models of distance education usually assume that students work independently without assistance. Teachers and other persons in the proximity of students are going to be asked questions, but little has been done to examine how these interactions can be made most effective.

A Proposal for a Research Facility

In closing this paper I am proposing the creation of a facility to explore research and development of the use ICT in educational settings. Establishing an ICT research facility at (or close to) a university would facilitate research and development into ICT, as well as, provide a range of opportunities for teacher education and professional development for teachers and administrators. The kind of facility I am suggesting would have state of the art equipment, which would be acquired through partnerships where possible to avoid the costly replacement every few years, and have access to the current educational software. The facility would be designed around an ICT classroom that could act as both a receiving classroom for distance education and as a classroom to model the use of ICT in practical use. In addition a sending (or transmitting) room/facility would be located in the same building so that feedback about instructional strategies could be provided immediately.

Such a facility would have uses for all educators and payback to the partners who contributed to the

project. Preservice teachers would be able to use the facility to develop skills and knowledge required for appropriate classroom use of ICT. They could also explore various means of distance education at both the receiving and sending ends. The realities of classroom ICT use and distance education could be experienced first hand. The sending facility could also be connected to classrooms in nearby schools thus allowing elementary and secondary students to be part of the process. Teachers could experience strengths and weaknesses of distance education, and would be able to provide developmental criticism to those at the sending end. Elementary and secondary students could point out deficiencies and strengths of a particular distance education approach more rapidly than any group of adults.

During the school year or in the summer, workshops of varying lengths could be held for teachers and administrators. These workshops would be designed to assist participants in understanding the strengths and weaknesses of ICT and to help them design other uses for their individual situations. Graduate students could interact with these persons to design research that would examine various components of projects. Graduate programs of research at masters and doctoral levels would be able to make use of this facility to evaluate or develop educational uses of ICT. Partners would benefit in that they would receive feedback about the hardware and software from educators in a variety of educational roles. This type of facility would benefit all members of the educational community in Saskatchewan (and probably a lot of other places).

Closing Thoughts

Public demand will ensure that some ICT makes its way into the classrooms of Saskatchewan and other jurisdictions. The most important consideration is that ICT act a resource and tool for students and teachers, and not come to drive education in the province. Student learning will always be a slow, challenging process and teacher instruction will always be a challenging and rewarding process. Learning is a cognitive process that occurs in minds of children (and teachers) as the result of knowledge construction that individuals carry out to make sense of their experiences. ICT will not change the way people learn. Knowledge building is an individual process that cannot be handed over to computers. ICT must not be portrayed as a technological panacea for educational concerns.

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Introducing ODL in Teacher Education - an On-Line Course on How to Create On-Line Learning Environments

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Abstract: Learning through practice has always been a sound principle. In this case it concerns learning how to construct ICT based ODL material by attending an Internet course that demonstrates the content and uses the 'learning by doing' slogan. The guidelines are based on experiences from different national and international ODL projects. It provides a basic understanding for newcomers and will hopefully also demonstrate new ideas for experienced developers in the field. The target groups are teachers, developers and providers of ODL, working or intending to work in the field of ODL, providing opportunities for life-long learning. Further on parts of the course seem to be of general interest for people collaborating across boarders. They seem to have a need for common competence in order to exchange information and knowledge. The learning environment in which the course takes place, is created as a series of examples of how to design and implement a virtual learning environment using multimedia.

The On-Line Course

Background

The NITOL group (Norwaynet with IT for Open Learning) (Ask, B., & Haugen, H., 1999) has for more than 5 years designed and created net based on-line courses. Based on demand for sharing our experiences from several projects and courses a new course was designed. This new on-line course on *Pedagogy in Open Learning* has been offered to national and international audiences since 1996. Every term it has undergone some revisions and it has gradually evolved into the form it has now. A major objective is to provide *guidelines* for the development, implementation and running of open and flexible, net-based learning environments. The guidelines are based on experiences from user trials and evaluation of several national and European projects, as well as on theoretical discussions. Experiences from earlier versions, have been worked into the new course. It has become part of IT-curriculum for teacher training at several institutions, and has been accepted for credits in different countries, with reference to the ECTS - European Credit Transfer System.

Target groups

Target groups are teachers, developers and providers of ODL, working or intending to work in the field of ODL, providing opportunities for life-long learning. Providers of in-service and further education for teachers are of particular interest as a target group. Teachers in secondary schools, academic staff at universities and colleges, personnel in charge of training programmes for corporations, companies and public administration, staff at adult education institutions, lifelong learning programmes etc. Students of pedagogy, of ICT or teacher training, will also benefit from the course. In their future jobs they need to be qualified for organising learning environments that exploit the potential of ICT. Parts of the course seem to be of special interest for people who collaborate across boarders and who work internationally.

Main goal

The course Pedagogy in Open Learning (PiOL) intends to prepare a basis for development and applications of ODL material that uses ICT as a medium to supplement and/or offer an alternative to traditional ways of learning. In Norway every teacher is supposed to engage in ICT in two ways: to use ICT for learning purposes and to learn ICT for using purposes. This course forces them to do both. The students of this course shall learn how to design and implement learning material and environments that are open, flexible and readily accessible for different groups of users in search of education.

In addition, adult learners and people working in international organisations need a common competence in order to share know how and information. Parts of this course seem to be relevant for upgrading them.

The candidates shall be trained to act in the society in general and in the educational system in particular, as resource personnel for the exploitation of new ICT to

- create a basis for providing lifelong learning
- prepare 'just-in-time' learning facilities (when and where it is needed)
- implement new ways of teaching and learning
- offer courses to satisfy needs for new knowledge and skills
- assist in the process of creating a fruitful learning environment using multimedia technology

As part of teacher training this serves two purposes to:

- it introduces ICT-based ODL students and teachers attending further and in-service training
- it forces - or offers – the teacher trainers to engage and experience ICT-based ODL.

Content

The course is intended to function as netbased[1] background guidelines for development, organising and running ICT based ODL activities. It thus has to cover a wide variety of topics. On the basis of experiences, the following main topics are covered:

- Introduction to ODL and to the technical basis for ICT based ODL
- Theories of learning; cognitivism, constructivism, situated learning etc., related to ODL
- Structures of learning material, hyperstructures, different modes and media
- Creation of a web based learning environment
- System dynamics and simulations as learning tools
- Design and development of learning environment, net based support, discussions etc.
-

In addition, adult learners and people working in international organisations seem to have special interest in these topics:

- Collaborative learning; net based resources and facilities for interaction
- Learning organisations and lifelong learning
- Applications of networks and communication (Internet, www, collaborative tools etc.)
- Examples, demonstration of courses and lessons based on ICT/Internet

Most of the themes mentioned above, are fairly self-explanatory. The intention is to introduce some concepts and models relevant to ICT-based ODL, based on experiences and on-going work from the institutions responsible for the course. The students' own knowledge and skills are important resources in the learning environment of the course itself. Participants with theoretical and practical background in education and pedagogy, are particularly valuable for the further development of the learning environment. The practical approach also demonstrates advantages, difficulties or challenges, general freeware tools and possible drawbacks of on-line learning.

[1] The term 'netbased' should be construed broadly enough to include emerging technology such as high-bandwidth networks, wireless telecommunications, interactive video etc.

Technical and organisational aspects

Most of the course activities are now (1999) technically based on Internet and World Wide Web environments. A multimedia computer and network literacy is a prerequisite. At the same time it is assumed that a great part of the target group are not necessarily IT professionals, but do rather have their strengths in pedagogy or other professions. Several of the themes in the course concern issues related to practical applications of the relevant technologies, demonstrating examples and encouraging the students to practice a variety of tools themselves.

A particular challenge for educators developing ICT based learning material, is the inherent potential of hyper structures as compared to traditional, linear presentations of information. All 'lessons' of the learning material of the course are distributed through a fixed web address with links for downloading modules. Other parts of the learning material are based on other techniques, e.g. use of synchronised, interactive video and presentation programmes, use of collaborative tools such as Team Wave, in order to exchange information and know how.

In the EuroCompetence project (EuroCompetence, 1999) the parts of this course that are relevant for adult learners and people in international organisations will be offered as a separate course, called Learning to Learn by ICT. The course will be running during the spring 2000.

Discussions are mainly performed on News conferences, by links to individual 'workbooks' or collaborative tools. Personal messages are exchanged by e-mail and mail lists. But there are also options for automated support, e.g. FAQ, SOS, Oracle services and for synchronous net meetings etc. for exchange of views. Thus the exchange of experiences between all participants implies the opportunity of better understanding and insight into the problems arising.

It has been an active choice not to use proprietary software. The courses are developed on bases of general tools, Internet, www etc

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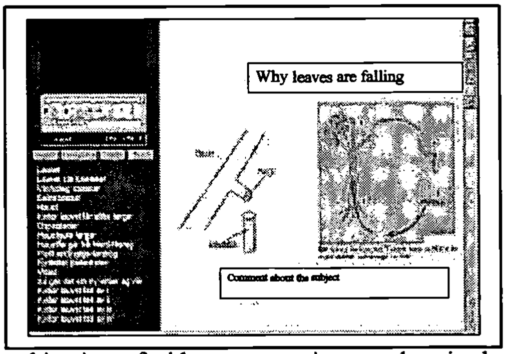
The figure shows an example of one way of organising a learning environment. In this learning



environment there is a combination of video presentation synchronised with a power point presentation. The list to the left indicates keys or links to switch between subtopics.

Pedagogical and methodological approaches

Students of this course are supposed to have a certain background in general educational theories. The main idea behind presenting guidelines as an interactive course is based on the *learning-by-doing* principle. The focus is on the process rather than the outcome. The learning environment in which the course takes place, is created as a series of examples of how to design and implement a virtual learning environment using general tools and multimedia. For example, within this learning environment, the use of hypermedia is described as well as used as tools for management of the environment. When the students attend the

course, they meet a learning environment that includes facilities to help them to manage their own learning environment. By implementing different guidelines/handbooks telling students for example how to create a WebPages, how to download files etc. students can immediately start to manipulate their learning environment. Access to facilities like on-line oracles as well as guidelines are components that add to a learning environment

Different tools for collaboration between participants are necessary part of the course. Furthermore, collaboration between teachers at different institutions occurs as an interesting component in this environment. A variety of professional profiles at the co-operating institutions strengthens the whole environment and even makes teachers take on the role of 'students'. In effect, learners, teachers and practitioners collaborate in constructing a hypermedia based learning environment. Electronic hypermedia based learning material constitutes a forum among and between students and instructors/teachers. It allows a high level of interaction for everyone, especially in raising questions and sharing access to the continuous discussions.

In a net-based learning environment like this, the role of the teacher is no longer defined by tradition, and learning is no longer seen as the passive acquisition or absorption of an established and often rigidly defined body of information. The former role of the teacher has been to acquire formal knowledge, find efficient ways of sharing it and to determine whether the students have learned what has been taught This has been the traditional role of the teacher, to have the major responsibility for what and how the students learn. (Koschmann, T. 1996). But to-days learning environment opens up for a discussion of what the role of the teachers is going to be: A sage on the stage or a guide on the side? (Retalis, S. & al. 1997). A virtual learning environment seems to indicate that teachers' tasks are moving from lecturing and 'teaching' towards supervising and assisting students. Students are becoming more responsible for discovery and self-learning while teachers take on the role of facilitators. Occupying a seat in a physical classroom for a specific period of time may soon become the exception rather than the rule.

In this learning environment both the teachers and the students will be challenged to adapt to their new roles. Teachers are asked to articulate more clearly their goals, objectives and expected outcomes, while students are asked to take on more responsibility for their own, self-directed study and learning. The use of 'notebook' forces the students to take part in a learning material 'production'. Access to each others 'notebooks' enriches the total environment and may create lots of professional discussion. The notebook also serves as part of the assessment procedure.

Visions

The PiOL course is created in order to prepare higher educational institutions and staff members for future requirements. The International Council for Distance Education, ICDE, predicted already in 1994 that there will be shifts

- from objective, general knowledge to constructed, adapted knowledge
- from an industrial to a knowledge based society
- from teaching and lecturing to facilitation of learning
- from books and paper based hand-outs to applications of ICT based material for learning
- from traditional universities and colleges to new structures not yet defined

The driving forces behind these changes are

- 'pushes' by the new information and communication technology, the information explosion and political/economic desires to increased productivity in education,
- 'pulls' by the changing job structures with new skills and knowledge requirements, R&D challenges within higher education, and a general desire for more education and better qualifications among the general public - a trend of lifelong learning.

In this environment ICT based open and flexible learning systems seem to be the nearest solution. Technology is continuously improving, providing faster, broad-band and more flexible systems that can offer even better learning environments than can be demonstrated today. Students of the PiOL course

should therefore not believe that they are fully trained for future tasks in the field by the time they pass their exams. But they should have learned how to learn, how to collaborate and how to develop new learning arenas for their own future students and have in mind that education should produce individuals who have a sound working knowledge base, who can use that knowledge when called upon to do so, and who are willing and able to continue the learning process after schooling. In order to meet these challenges, our prediction is that the field of ODL will develop and expand very rapidly in the years to come.

International collaboration and joint development implies a higher and broader spectre of professional skills and backgrounds. Teacher trainers and researchers in education are considered to be key personnel in this evolving of new learning facilities. Models presented here are only a first introduction to future development of ODL projects, intended for reaching larger audiences and making more learning *'available when and where it is needed'*.

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A New Program for the Inservice Training of Computer Studies Teachers Through Distance Education.

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Abstract:
There currently exists a crisis in education in the natural sciences (mathematics, physical science, computer science and biology) in South Africa (Arnott et al:1997). One reason for this crisis, is the huge shortage of qualified Computer Studies teachers. This paper will discuss some of the reasons for this shortage. It will then focus on a new innovative learning program (leading to a degree in science education) being developed at the University of South Africa (Unisa) for the preservice and in service training of Computer Studies and Computer Literacy teachers. Training will be done through distance education. The proposed didactical and subject related content of the new program will be discussed.

Introduction

There currently exists a growing demand for Computer Studies teachers at secondary school level and computer literacy teachers at primary school level in South Africa. Because of this great need, schools often use teachers from other disciplines (eg. mathematics, physical science and accounting) to teach Computer Studies. These teachers have no formal training in computer science and therefore don't have the necessary subject knowledge to teach the subject. The new program being developed at Unisa will specifically address this need.

Reasons for the Crisis in Computer Studies Education

The crisis, as far as teachers are concerned, can be attributed to a combination of two related causes:
- There exists a huge shortage in Computer Science teachers.
- This shortage has led to a large numbers of teachers from other disciplines, without any qualifications in Computer Science, being appointed to teach Computer Science.

One of the main reasons for the shortage of Computer Studies teachers, is the fact that the teaching profession in South Africa is currently typified by low morale. This is due to increasing difficulties in maintaining discipline and the inability to handle racial and other conflict amongst pupils. Parents are placing undue pressure on teachers to obtain unreasonably high results (especially in so called up market schools) . Furthermore, teachers find it difficult to adapt to new teaching paradigms (eg. outcomes based education) being employed by a new government.

Another reason, not unique to South Africa, is the relatively low salaries, which lead many teachers to the more lucrative business sector. Computer Studies is probably the school subject suffering the most due to this "greener pastures syndrome". Trained Computer Studies teachers are in high demand from businesses offering computer literacy training courses, companies training their own employees and even governmental technical colleges (which offer, if not much higher salaries, then at least higher "prestige" and less discipline related problems). Many ex-teachers simply start their own businesses, working from home, offering private computer literacy or programming courses. Some teachers even discard teaching completely and take up positions as programmers or other computer related careers.

A third problem, more unique to South Africa, is the so called "brain drain" experienced by the country since Å1994. A great number of young, newly qualified teachers, leave the country to teach and gain experience, mostly in Britain, wherethey seem to be in high demand, and other European countries.

A problem that new teachers find very annoying and time consuming, are the prevention and elimination of viruses and the repairing of damage caused by hackers. Computer Studies learners are often highly gifted individuals with their own computers at home and too much time on hand to experiment. It often gives them great satisfaction to hack into or disable the computer network at school.

Many teachers have to teach in a school environment where they get little or no support from colleagues and principals who do not understand the unique nature and problems facing the Computer Studies teachers. They normally are the only teacher teaching the subject at their particular school. For the beginner teacher this means that no advice from experienced teachers is available. They often have to set up the computer centre, take responsibility for the everyday functioning there of, *and* help administrative personnel with any computer related problems. For many beginners, this daunting task is the final straw to break the camel's back.

Problems with Current Training Programs

The new program should cater for the training of new teachers (thus students fresh from school) *and* the in service training of current teachers trained in some other discipline, but teaching or planning to teach Computer Studies. Even teachers specifically trained as computer studies teachers experience problems when first entering their profession. Thus before embarking on the development of a new program, the deficiencies in these teachers' training need to be considered in order to better equip new teachers.

From a preliminary study into the problems experienced by current teachers, the following aspects, were mentioned.

- Their knowledge pertaining to the installing and administrating of a networked computer centre for the school, is not sufficient.
- Some teachers (especially females?) feel that they possess insufficient knowledge on computer architecture and the newest hardware developments.
- They experience some problems related to the assessment of practical work (programming) done by their learners (mark allocation in particular seems to be a problem).

Currently Unisa does not offer any courses specifically geared towards the training of Computer Studies teachers. Teachers have to do either a BSc-degree in Computer Science or a B.Comm degree in Information Systems and follow this up with a post graduate teaching diploma, where only one module (Computer Studies subject didactics) is related to Computer Studies teaching.
This prepares students well for computer related careers (programmers, database administrators, etc.) but not well enough to be good Computer Studies teachers.

Teachers who have some post-school (tertiary) training in education (trained to teach other disciplines) may be aware of a variety of teaching methods. However, because of the fundamental deficiencies in subject knowledge, they are unable to teach innovatively since they lack the confidence acquired by a solid grounding in computer science. In addition, much of the teaching theory was acquired in a context substantially different from the environment in which they work, and they have insufficient knowledge or opportunity to develop meaningful practices appropriate to their situations.

In view of this, great care need to be taken with the development of a learning program for preservice and in service teachers who may or may not already possess a secondary teaching diploma.

New Program

The current higher education system in South Africa has to be remodelled by creating a single co-ordinated higher education system (National Commission on Higher Education: 1996). This has led all Universities to design new and redesign old curricula. The new program in Science Education (Stream: Computer Studies) is one of the new programs being developed.

A *program* is a purposeful and structured learning experience designed to enable learners to achieve pre-specified exit level outcomes (Jordaan&Kilfoil:1999). It can therefore be defined as a coherent combination of units of learning (modules) expressed in an outcomes-based format which leads to one or more qualifications, serving an academic and/or vocational purpose (Reynhardt:1999). A program should have recognised entry and exit points (qualifications) and usually comprises core modules (compulsory for all students on a particular program) (SAQA:1998), elective modules (a group of modules from which a choice must be made in order to achieve the purpose of the qualification and to attain the required number of credits at a specific level) (SAQA:1998), and fundamental modules (modules which form the basis needed to undertake the education, training or further learning required in the obtaining of a qualification) (SAQA:1998).

A *module* is a coherent, self-contained unit of learning, designed to achieve a set of specific learning outcomes which are assessed within that unit of learning (Reynhardt:1999). A program is composed of a number of modules. A module has a standardised size and a designated credit-weighting in the overall program (Reynhardt:1999). One module should require 120 notional study hours (Jordaan&Kilfoil:1999). *Notional study hours* are informed estimates of the average time (spent in any variety of ways e.g. attending lectures, tutorials, practicals, independent reading and writing) that an average learner, entering with the correct level of assumed knowledge, would need to master the specific outcomes of a unit of learning (Reynhardt:1999).

The *qualifications* that can be obtained in the program are:
- a national higher certificate after completion of 12 modules;
- a national diploma after completion of another 10 modules;
- a B.Sc. degree (Science Education) after completion of another 8 modules (thus 30 modules in total).

The program will offer students recognition of prior learning in order for students who already possess a teaching diploma to be exempted from doing the education related modules. The proposed program was designed to meet both the SAQA (South African Qualifications Framework) requirements mentioned above, and the specific needs of teachers, as well as to eliminate the problems with the current training programs.

The Specific Outcomes of the Program

Students who have completed the program, will:
- Have acquired the knowledge necessary to teach secondary school Computer Studies. This knowledge includes:

- Basic computer concepts, terminology and definitions

- Computer architecture and networks

- Some basic mathematics and statistics
- Be able to assist learners in acquiring this knowledge
- Be able to use an integrated computer package and assist learners in acquiring the necessary knowledge and skills to use such a package
- Be able to analyse a problem and develop an algorithm to solve the problem
- Be able to translate this algorithm into an executable computer program by means of critical and effective use of a programming language
- Be able to assist learners in acquiring these programming skills
- Be able to provide help concerning the use of computers to other members of staff in an educational institution.
- Be a responsible computer user
- Convey an attitude of responsible computer use, taking ethical aspects into consideration, to learners
- Effectively manage a computer centre at an educational institution

Target Market of the Program

- Current teachers from all disciplines who are interested in teaching computer studies.
- Current Computer Studies teachers that don't have the necessary qualifications.
- Adults (not currently teaching) wanting to become Computer Studies teachers.

- Lecturers at teachers training colleges and technical colleges wanting to lecture Computer Studies/Science (Degree).

Modules for the Certificate

Fundamental modules:
- *Basic Computer Literacy:* This involves the use of an integrated computer package.
- *Elementary Statistics:* Specifically related to education eg. calculation of means, modes and variances of learners' marks.
- *Elementary Mathematics:* The elementary arithmetic and algebra needed for Computer Studies.
- *English Comprehension Skills:* A module specifically developed to teach English second language students (the majority of the South African population) scientific reading and writing skills.
- *Educational Themes I:* Learning and teaching strategies in the adolescent years.

Core modules:
- *Introduction to programming I and II (2 modules):* Basic programming skills using Pascal.
- *Computer Concepts:* Basic hardware and software concepts.
- *Social Impact of Computers:* Issues such as computers and the law, computers in education, computers and medicine, ethics, privacy etc.
- *Computer Studies Classroom Practice I:* Didactical issues specifically related to Computer Studies.

Elective modules:
Any 2 modules from:
- *Theoretical Computer Science I*
- *Introduction to Business Information Systems*
- *Linear Algebra*
- *Applied Linear Algebra*
- *Precalculus Mathematics*
- *Applied Statistics*
- *Gifted child education*

Additional Modules for the Diploma

Fundamental modules:
- *Educational Themes IIA:* General teaching methods and classroom management.
- *Educational Themes IIB:* Media science, critical assessment and classroom research.

Core modules:
- *Computer Studies Classroom Practice II:* Didactical issues specifically related to Computer Studies, with special reference to assessment.
- *Computers in Education:* Issues related to the use of computers in education e.g. CAL, CAI, multimedia.
- *Introduction to programming III:* Programming in C++, including an introduction to recursion and elementary data structures such as arrays and files.
- *Data structures I:* Pointers, linked lists, trees, graphs, stacks and queues using C++
- *Data structures II:* Recursive and iterative searching and sorting methods on data structures discussed in *Data structures I.*
- *Computer organisation:* The digital logic level, microprogramming level and machine level of the computer; assembly language programming.

Elective modules:
Any 2 modules from:
- *Any of the elective modules not done for the certificate.*
- *Theoretical Computer Science*
- *System Analysis*
- *System Design*

Additional Modules for the Degree

Core modules:

- *Operating Systems and architecture*
- *Computer Networks*
- *Principles of databases*
- *Database design and implementation*
- *Computer Science Education and Logical Thinking Skills*

Elective modules:
Any 2 modules from:

- *Theoretical frameworks in education*
- *The education system and school management*
- *Multicultural education*
- *Education law and professional ethics*

AND any 1 module from:

- *Advanced programming*
- *Theory of computer science*
- *Advanced software development*
- *Software project management*

Vocational Opportunities

- Certificate: Teacher at secondary school (up to grade 10)
- Diploma: Teacher at secondary school (up to grade 12)
  Lecturer at a vast number of private institutions offering computer courses.
  Programmer
- Degree: Same as for the diploma
  Lecturer at technical college/teachers training college
  Computer Specialist/Professional
  Data base administrator
  Depending on choice of elective modules:
  Systems analyst/designer/developer
  Project manager

Conclusion

A familiar cycle of mediocrity, whereby inadequately qualified teachers are turning out students who are themselves poorly prepared for either the job market or tertiary education, has become prevalent in South Africa. The need for teacher upgrading and the delivery of new, well qualified teachers, is thus undisputed. It is believed that there is scope for a diploma and degree course specifically geared towards the training of Computer Studies teachers. Due to the fact that the majority of students that would benefit from such a course, are in service teachers, the distance education offered by Unisa would go a long way in alleviating the crisis in science education in South Africa.

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Meeting the needs of Distant Learning through the use of PowerPoint and RealPresenter

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Introduction

The changing demographics of colleges and universities are creating new challenges for faculty. The traditional student who attended college full time for four years after graduating from high school is now in the minority. At my university, the average age for undergraduates is over 24 years old and is over 34 for master level students. Given that most of the students in the College of Business Administration are juniors and seniors, our average undergraduate age would be even higher. Most of our students work between 20 hours a week and full time with a typical student taking between ten and twelve units per semester, instead of the 16 required to graduate in four years. Colleges and Universities are also exploring the ability to teach courses off campus to be able to reach a larger student population through distant learning classes.

One way to help to try to meet the challenges of these non-traditional students and programs is through the use of computers and the World Wide Web (WWW). But being a relatively new, and a rapidly changing and growing, medium, most faculty have done very little to tap the power of the WWW. In a survey of my students last semester, approximately 75% had access to the internet from either home or work, making the internet an accessible resource for most students. With the number of libraries that have internet access increasing, and student labs on campus, the argument that students do not have access will soon be a thing of the past.

The two areas where the Internet has been used are as a virtual library and as a means of communication. Other than posting syllabi, class schedules and reading lists, little has been done in the area of content creation on the web.

The virtual library aspect can be seen in the use of the web as an online resource to find information for class reports, including up to date financial statements, stock prices and news. Many journals and newspapers are now posting their issues online which can make it easier for doing research.

Communications can be done in both synchronous and non-synchronous modes. Chat rooms, even if currently somewhat inefficient as a result of our unfamiliarity with talking with a keyboard, and in the future, real-time two-way audio and video, allow for conversations through the web. Non-synchronous communication can include email, news groups and message posting.

However, I feel that it is in the area of content creation where computers and the web may have the largest impact on meeting the challenges of the 'new' university. This paper will discuss creation of online lectures including both the visual and audio components. The method used is within the capabilities of most faculty without needing TV studios, technology experts, or expensive equipment.

Procedures

A relatively unknown feature of Microsoft's PowerPoint 97 program is the ability to record audio files while doing a presentation. RealAudio has taken advantage of the feature by creating a plug-in program for PowerPoint 97, called RealPresenter, that can convert the PowerPoint slide file plus the audio files into a synchronized RealMedia file that can be used with low bandwidth and streamed from a server.

The first step in creating the RealMedia file is to create the PowerPoint 97 slide file. A few points need to be considered when creating the file. The RealMedia conversion does not incorporate any builds or animation, so if a build is desired, the first part should be put onto a slide, then the slide copied and the second part added. The sequence of the two slides will appear to be a build up of text. Another point to consider is that the PowerPoint

slides are compressed into .jpg files and any small detail is lost or distorted in the compression. Finally, for some unknown reason, if the slides are numbered with the automatic numbering feature, they all come out as slide 'number 1' during the conversion.

The recording of the audio files can be done either live during a classroom lecture, or prepared outside of class. When I am going to miss a class due to a conference, I will prepare a lecture in advance for the students to watch while I am gone. I have also prepared lectures in advance that review materials the students are expected to know when they start the class. A high quality microphone will greatly improve the sound quality. For recording during class lectures, I have purchased a wireless Sony microphone which allows me to walk around during the presentation.

To start recording the lecture, click on the 'slide show' button on the top menu in PowerPoint and then on 'record narration.' You will need to click the box in the lower left-hand corner of the dialogue box that says to link the files and click on 'Settings.' The audio setting you select is somewhat a function of your voice. I have found that '11,025 Hz, 16 bit, mono' works well for me. That creates about 21KB of sound files per second or about 50-60 MBs per 50 minute lecture. Note that in the conversion process, the 50 MBs of audio files will be compressed down to 1 or 2 MBs. When you click 'OK' on the record narration dialogue box, the slide show will start and the audio will be recorded.

During the slide show progress as usual. The only limitation is that you can not go backwards and re-show a slide. If I have a question on a previous slide, I will stay on the current slide and discuss the previous slide. Going backwards would write over the original audio file which would then be lost. You may use the pause recording feature and then resume if you want to take a break. When you finish the presentation, a couple of dialogue boxes will pop up asking if you want to save the timings and click yes. It will also ask you if you want to review the timings and I usually say yes. I then save the file to make sure that the timings have been saved.

The next step is to create the RealMedia file. I had previously downloaded RealPresenter from http://www.Real.com for $39.95 and installed it. It is a plug-in on the PowerPoint Tools drop down menu. After selecting 'Publish to RealMedia' you are asked a series of questions. I usually use the 'Internet' target audience so that the file can be played over a 28.8 modem. It then asks for a file name, ending in '.rm' for RealMedia. You can then enter a title, the author's name and a copyright. When this is complete, the program converts the slides into '.jpg' files, compresses the audio files and synchronizes the two into a final RealMedia file. When completed, you have the option of listening to the file which I usually do just to make sure it worked properly.

The final steps are to post the RealMedia file on a server and link to it. Most web servers can be used for the RealMedia file. However, RealAudio offers a specialized server package that is designed for streaming audio and video. The link to the file actually requires an intermediate step. A link from a web page must go to an intermediate text file that has a one line that starts 'pnm://' followed by the address of the RealMedia file. For example, if the RealMedia file is stored at 'media.your.edu/presentation.rm,' then the one line would be 'pnm://media.your.edu/presentation.rm.' The intermediate file allows the RealMedia file to start downloading into a buffer and after about thirty seconds the file will start playing while continuing to download in the background.

Conclusions

The use of RealPresenter to convert PowerPoint slide presentations and recorded audio into RealMedia is a relatively easy way of creating online content that incorporates both audio and video. The RealMedia files can be used in distant learning and for student review. The program has a low bandwidth requirement and a low production cost which makes it feasible for many faculty to start using immediately without extensive support from Instructional Media centers. While the future may bring in greater bandwidth and full screen video, this method of presenting lectures online can be currently put to use.

New tools for assessment in distance education

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Abstract: This paper describes a strategy for improving the quality of distance education assessment provinding a set of complementary tools to help on formative evaluation. Regular forms to assess learning are analyzed and Kirkpatrick's model for evaluation is described as well as a set of tools to provide capability to asses according this model. The set of complementary tools includes consensus, tracking, voting and self-evaluation.

1.Introduction

Learning assessment became a challenge to those working with distance education. In its definition of learning assessment, Bloom, Hastings and Madaus (Mendes 1998), proposed that the evaluation process should includes a great variety of evidences that go beyond the traditional final examination pencil and paper based. In a face-to-face context, professors use more than just formal mechanisms to evaluate students. Body language, participation, quality of questions proposed by students are good indicators of learning, In distance education what normally occurs it is the use of formal mechanisms only. It occurs not only because of the lack of accessible mechanisms that can assist instructors on this task, but also, because many professors prefer to work with more traditional methods of evaluation.

However, thanks to evolution of networks and computers and especially the Internet, mechanisms, that can fill this gap started to show up. Tools became available, to keep track of students activities and interactions with learning environment, with colleagues and with the professor. These kind of information present new opportunities for monitoring the way students learn and for learning assessment.

The use of the Internet for distance education assessment offers many advantages:

- Reduction of the distribution costs;
- The corrections and updates are simpler, therefore they are carried through in an only site, being immediately spread to all students;
- Several techniques for evaluation are possible using multimedia for the between professor and students and between students;
- The Internet facilitates collaborative writing;
- The student has more easiness in sending feedback allowing formative and evaluation

A research conducted by Dirks [Dirks] with instructors of distance learning MBA programs presented some questions like: Considering all the time you spend on this course (100%), how much of that time do you think you spend on student assessment (writing tests, grading, giving feedback, and reporting scores)? Answers indicated that the newer teachers, 2-9 years teaching, spent over half their time on assessment (56%), those with 10-19 years experience spent less time on assessment (46%), and the career instructors, 20+ years teaching, spent the least amount of time doing assessment (35%). The primary reasons given for having assessments include providing feedback, giving grades, and motivation. The four types of assessment most commonly mentioned are: case studies, exams, papers, and projects. All of them requires extensive time to grade and are very difficult to get automated help to do the evaluation.

Other researches point also that what is often used for assessment in distance education are the

following:

- individual works developed individually and sent by regular mail or by email
- assessment based on contributions for group discussions
- tests (automatically handled by computer program)
- term papers (analysed by professor or assistants)
- oral or written tests conduced in the presence of the instructor (some times through videoconference) or with a remote assistant.

Learning theories state that group learning has significant relevance and must be supported also in distance education. Participation in group activities, cooperation and collaboration must be supported and graded. But there are a lack of good tools to help evaluate the participation of the distance education student in group activities.

Slowly, thanks to evolution of networks and computers and especially the Internet, mechanisms, that can fill this gap started to show up. Tools became available, to keep track of students activities and interactions with learning environment, with colleagues and with the professor as indicated in figure 1.

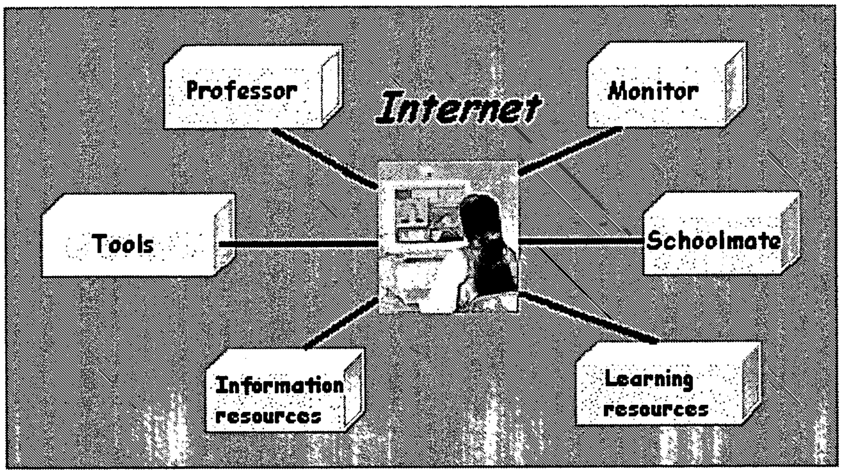

Figure 1: Internet as mediating tool

These kind of information present new opportunities for monitoring the way students learn and for learning assessment.

As stated by Tucker (Tucker 1998) the CMDL (Computer Mediated Distance Learning) classroom is routinely a far more scrutable educational environment than the physical classroom. The virtual classroom's electronic data storage, retrieval and exchange system (i.e., the text of student and faculty transactions, communication logs, file structures and information presentation algorithms that exist on the file server's hard disk drives) represent concentrated, structured and highly accessible artifacts of the learning transactions. These artifacts can be retrieved, analyzed and reported via highly economical, automatic processes operating in the background of the communications system.

This work presents a proposed solution for assessment on distance education mediated by Internet using innovative approaches based on Kirkpatrick model for evaluate training problems and will describe how they where implemented.

2. Assessment models and tools

There are today some systems, available in the market, that provide detailed information on the evolution of the student working at distance mediated by Internet. Examples of this kind of system include, CyberQ, WebCT and AulaNet. Statistics of usage and regular approaches for testing like multiple choice quiz and term papers are usually possible in these kind of systems.

Donald Kirkpatrick developed a model of evaluation, used in training programs. It recommends a

division of the evaluation process in four levels (Kirkpatrick 1998):

- Level 1 : **Reaction** - level measures how those who participate in the program react to it. It may be called a measure of student satisfaction.
- Level 2 : **Learning** - can be defined as the extent to which participants change attitudes, improve knowledge, and/or increase skill as a result of attending the program.
- Level 3 : **Behavior** - can be defined as the extent to which change in behavior has occurred because the participant attended the training program
- Level 4 : **Results** - can be defined as the final results that occurred because the participants attended the program.

Mendoza is other researcher that that it is also relevant to investigate student context to find out which aspects of course contents he/she is in the know (Mendoza 1999). So an aspect to be also considered is the lack of suitable tools to asses their current level of knowledge and skills. Mendoza recommends utilization of techniques, other that conventional ones, to collect data and suggest formative evaluation as well as summative evaluation. To achieve formative evaluation is important to make easy for the students not only inform their opinions and feelings about how course is going on but see this contributions being handled and considered.

To help in all these tasks and also support evaluation as proposed in Kirkpatrick model one should have a tool that would help organize polling and receive data in a suitable form to allow counting and summarizing results. To do this, it was designed a system aimed to support flexible and dynamically built of enquete for polling. The system has a WWW interface that allows designing of different kinds of multiple choice questions. Basic data informed are question and alternatives. Depending on type of desired measure the system ask for:

a) Feedback for each alternative
b) Indication of correct answer
c) Nothing more, just counting incidence of selections on each alternative

Option **a** is used for questions inserted in the learning path to ask for active response. Option **b** is used for testing and give grades. Option **c** is used for polling purposed. This system was designed to complement regular tools used to assess distance education students. The following mechanisms have been selected to assist in the evaluation process in this framework:

- **Tool of consensus**: based in the Delphi technique, allows on time creation of enquete proposing instigating questions, as well as the collection and tabulation of responses. The tool has the capability to keep track of each student's level of contribution to the discussion as well as enquete responses.
- **Tracking tool**: the register of learning activities (accessed page with dates and time) is important because it allows the professor to monitor the progress of students trough the course. The collected information will show that type of access the student has made (visited units, tools used, etc), as well as the time spent on it.
- **Voting tool**: aimed to provide conditions for a fast feedback for the instructor on specific subjects.
- **Self-evaluation tool**: allows the dynamic building of enquetes for self-evaluation by professor and by students.

It is important to stand out that this proposed work is not an alternative approach to assessment rather it is a complementary one and is supposed that may be used together. Each on of this tools are supposed to be used to help evaluate at more than one level in Kirkpatrick model

To implement the tracking tool, a generic interface was designed to intermediate all the interaction of the student with the server. Interactions are processed in real time (for authentication purposes) and periodically in batch to generate records in a student data-base.

To implement the voting, consensus and self-evaluating tools a set of CGI programs where developed to allow dynamically create pages with questions and propositions (HTML forms) that are presented to students and collect their answers (Tarouco 1997).

Conclusions

It is our believe that formative evaluation plays an important role to get distance students motivated because

they feel a sense of not being lost in space. Just the opposite, they feel that being closely monitored and having their opinions being asked often is more like having a personal tutor that pay attention on way they do and what they say. This kind of attention provided by the system helps to minimize solitude that sometimes is referred as main desisting factor from students.

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Distance Education Insights from Eight Case Studies in TESOL Teacher Preparation

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Abstract: This paper presents vignettes from eight case studies in which distance education was employed in the preparation of ESOL (English to speakers of other languages) teachers in various locales around the world. The teacher educators involved in these cases employed a variety of communications media and information systems, and they worked with both pre-service and in-service teachers. The course objectives varied widely also. Nevertheless, out of the diversity in these cases emerge a number of lessons of great value to all professionals involved in teacher education at a distance. Foremost among these lessons is the fact that quality distance education involves considerably more than simply offering a traditional classroom course at a distance via modern technology. Success in distance education calls for an understanding of a number of complex, interrelated factors. It also requires overcoming a variety of instructional/learning challenges that do not normally occur in traditional classroom settings.

Overview of the Cases

In recent years, information communication technology has been widely and enthusiastically employed to facilitate learning in educational settings where teachers and learners are at a distance from one another. The preparation of teachers of English to speakers of other languages (TESOL) is certainly no exception to this trend. Distance-learning courses for preparing teachers of ESOL exist in a variety of innovative, interesting forms around the world, as the following vignettes illustrate.

The University of South Florida (USA) offers a Web-based training program for K-12 teachers who live in remote areas or who have responsibilities that preclude them from attending a traditional course. The nature of this distance-learning program has evolved through several stages—from a traditional, information-transmittal format, to one that is much more interactive, and finally to one that is now both collaborative and constructivist in nature. Working in teams and individually, teachers engage in readings, role-plays, case studies, lesson evaluation/adaptation exercises, and group discussions that leave them better prepared to teach mainstreamed limited-English-proficient students more effectively.

In the Middle East, the Open University of Israel offers courses for teachers of English as a foreign language. An in-service EFL methodology course for practicing teachers has been offered in two forms—via two-way interactive satellite television and by e-mail. In both of these, participants learn about the nature of communication, classroom management, integrated group work methodology, the whole language approach, and other such topics. Comparing Israeli teacher educators' experiences with these two different delivery systems reveals the relative advantages and disadvantages of each. These advantages are related to factors such as course content, student population, accessibility of institutional facilities, and available staff.

Since 1992, the University of Saskatchewan (Canada) has been developing and offering a distance-learning program for teachers and potential teachers who are not able to study on campus. This pre-service program uses a wrap-around model—with audiotapes, videotapes, and a CD-ROM supporting a print-based core consisting of a course guide, textbook, and package of article reprints. The university offers six different courses leading to a certificate in teaching English as a second language and aimed at developing teachers' classroom techniques for building students' language skills. Aligning these courses with established indicators of quality distance education (University of Wisconsin, 1996), such as "Know the learners" and "Design for active and effective learning," has been part of the course designers' quest. In the process, they have learned

that successful distance education involves much more than simply delivering an existing on-campus course to remote learners. They have also come to the conclusion that distance-education programs must be evaluated on their own terms, not in comparison to face-to-face instruction (Shale & Gomes, 1998).

The English Language Institute of York University in Toronto, Canada, collaborated with the Regional English Language Centre (RELC) in Singapore a few years ago to create a distance-learning program intended to develop the teaching and language skills of local teachers of English as a foreign language in Thailand. In this program, as in the one originating in Saskatchewan, print was the primary delivery medium, but audiotape and videotape support was also provided. Teachers relied on the local postal system for delivery, and phone calls constituted the primary means of communication between tutors and participants. Despite the apparent simplicity of this arrangement, educators encountered a variety of complex, interrelated challenges not usually present in traditional classrooms, such as participants' feelings of isolation and their lack of communication with peers.

Teacher educators at Brigam Young University in Utah (USA), are piloting a flexible, video-anchored "professor plus" distance education model to meet the challenge of preparing hundreds of widely scattered K-12 teachers who are seeking a state Bilingual/ESL endorsement. The current program has evolved from a live course offered over a statewide, state-sponsored, two-way audio/video transmission network to its current form. Through their experiences the educators involved have learned the importance of not only using appropriate telecommunications and information technology but also designing and employing the most effective pedagogical approach.

At the University of Northern Iowa (USA), students earning an MA degree in TESOL go through a one-semester teaching practicum experience. Although students in this practicum teach at a number of schools throughout the state, they are still required to participate in weekly seminar meetings. These meetings are now conducted via the Iowa Communications Network, a two-way voice and video interactive environment made possible by fiber-optics connections. In this way, although the participants are in classrooms across the state, they can interact as if they were sitting in the same room together. Nevertheless, communication is still occasionally hampered by other, social and experiential characteristics of the teachers involved.

Indiana University (USA) offers 19 Web-based courses for teacher development and basic teacher preparation, including one on computer-assisted language learning. More than 1,000 people have taken these courses, which employ a variety of Internet-related telecommunication systems and information technologies (ranging from basic e-mail and class listservs to video conferencing and streaming). Developers of these courses strive to meet the challenge of creating an electronic classroom learning environment that models the pedagogical concepts that they teach.

On the coast of the Arabian Gulf, local English teachers upgrade their language skills and work towards a BA degree at the nine different centers of the United Arab Emirates University Distance Learning Program. Their instructors work diligently to meet the challenge of creating and delivering semester-final examinations for courses at these widely scattered centers. Maintaining the exams' reliability, validity, security, and cultural sensitivity is a special challenge in this setting.

Insights from the Cases

All of the above vignettes represent full, detailed case studies that will soon appear as chapters in a book to be published by Teachers of English to Speakers of Other Languages, Inc. (Henrichsen, 2000). These cases clearly demonstrate that distance learning is very much a part of the preparation of ESOL teachers around the world today. They also illustrate the important point that quality distance education involves much more than simply taking an educational program that has been developed in a live, face-to-face context and then delivering it at a distance using technology. Success in distance education calls for an understanding of a number of complicated and interrelated factors including, but not limited to, educational technology. Successful distance education also requires overcoming a variety of instructional/learning challenges that do not normally occur in traditional classroom settings.

As can be seen from the vignettes, the cases themselves took place in a variety of settings—four different states in the United States (Florida, Indiana, Iowa, and Utah) and four other countries around the world (Israel, Canada, Thailand, and the United Arab Emirates). The teacher educators involved in these cases employed a variety of communications media and systems—traditional print, telephone, audiotapes, e-mail,

satellite television transmissions, videotapes, the World Wide Web, and two-way interactive voice and video networks. The courses involved both pre-service and in-service teachers. The course objectives varied also—ranging, for instance, from the development of basic language teaching skills, to the sharing of insights and information gained during a teaching practicum, to the creation and implementation of Internet-based tests that are not only valid and reliable but also culturally sensitive and secure.

Despite their variety, these cases had a number of things in common, and out of their diversity emerge several insights of value to all professionals involved in providing teacher education at a distance.

• First among these lessons is the already-mentioned fact that quality distance education involves considerably more than simply offering a traditional classroom course at a distance via modern technology.

• A corollary lesson derived from these cases is that teamwork and flexibility are crucial to the success of distance-education efforts.

• Further, a common challenge addressed in most of the case studies is how to overcome isolation and supply the elements of human interaction and community that are usually taken for granted in face-to-face teaching situations but are often missing in distance-learning arrangements.

• Yet another important lesson emerging from these diverse cases is that the use of more complicated technology does not necessarily translate into better teaching or learning. In fact, each information communication medium has its own strengths, and in a well-designed program, rather than competing with each other, these different media can work together in a complementary fashion. Also, in many remote areas, simple, "old fashioned" communication systems may actually work better than the newest, complicated information technology.

• Furthermore, in any setting, technologically simple distance education can still be advanced in other, important ways, such as its instructional design. This final point—that the pedagogical approaches employed are just as important as the content or communications systems themselves—may be the paramount lesson learned from these eight distance-education cases.

Conclusion

The insights gained from studying and comparing these eight different cases involving the use of distance education for preparing ESOL teachers can help develop our understanding of important challenges common to distance education in any setting. Providers of teacher education at a distance frequently encounter similar difficulties, regardless of where and how their programs are offered. The experiences of others, as presented in these case studies, can teach us how to avoid these common problems, or at least how to deal with and overcome them. In addition, even when their challenges are non-typical, the experiences of ESOL teacher educators in various distance-learning settings around the world can inspire other teacher educators working in distance-education programs to face their particular difficulties and eventually achieve success.

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DIVERSITY AND INTERNATIONAL

Section Editor:

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Entering the new millennium with the discussion of diversity and technology are signs of educators addressing two important factors that provide the sparks that can improve the future. The papers in this section are few but impressive. They suggest ideas and concepts that can be used as an initial beginning or an extension of existing programs. These ideas bring people together because by bridge the gap between cultures through the use of technology.

The papers are all unique in that they stress the importance of helping all young people reach their maximum potential through the use of technology, their gateway to the future. The papers are grouped based on the theme, "bridging the gap through diversity and technology." For example, the first paper by Foster and Snider at Texas Woman's University discuss the importance of bridging the gap between the students who have full access to the latest technology and those who do not. They focus on three essentials that would keep what they call the "digital divide" from getting wider. The inadequate quality of technology use, teacher preparation and exposure to technologically proficient role models in the home present problems that can be solved through a commitment of training and support by administrators and teachers.

The papers by Snow from Northern Arizona University, and Bennett project director for the Navajo Education Technology Consortium, support each other by a focusing on a project that involves 13 school districts in three states, two universities, two community colleges, two departments of education, and the National Indian Telecommunication Institute. Snow's paper focuses on the project design through goals and objectives, training sessions, and first year accomplishments. Bennett's paper describes the project from the director's point of view. He discusses staff development, cultural inclusion and the infrastructure improvements that are being used to usher the Navajo culture into the electronic age.

Continuing in this same vein is the paper by Chisholm from Arizona State University West. He focuses on preparing the young by starting with preservice teacher preparation. The author provides students with an authentic experience that develops diversity awareness and multicultural teaching skills with a secondary purpose of modeling technology integration and expanding student computer competency. Preservice teachers participate in many activities that do not mirror a conventional university course. Aided by technology, the author discusses the limitations and the benefits of working with preservice teachers in this fashion.

The paper by Suarez from the University of Alabama provides another experience grounding teachers in cultural pluralistic concepts that help them move beyond print media, by developing and implementing activities designed for all students. This technological multicultural course provides students with a unique way of developing a meaningful way of sharing aspects of their culture and community.

In another paper, gender representation on school web pages is an important issue investigated by Maboudian from the University of Houston. The study uses semiotic methods to examine web site visuals for evidence of differences in gender presentation. Because pictures send such an important message to the public and to students who view the sites, the author discusses the cybiotic design of visuals on a web page that may suggest either stereotyping or equity. This paper gives guidelines to creators of web pages.

The second set of papers bridge the gap of cultures through an international flavor. The paper by Carey from the University of British Columbia, Canada focuses on investigating and comparing how 12 students (5 ESL and 7 native speakers of English) negotiate meaning in an on-line bulletin board or face to face mode of communication environment. The author studied the interaction of how students from diverse backgrounds were influenced by and negotiated meaning of inadequate academic content schema. The use of the virtual seminar and how it facilitated the second language acquisition process led to a gradual increase of participation in course seminars. The final paper by Biazus from the Universidade de Caxias do Sul of Brazil focuses on using art education in a digital environment. The main purpose of the study was to verify how and whether the digital environment can provide a practice that is effective for students. This process invites a challenge that is clearly a new way of entering the millennium. Bridging the gap through electronics promotes a quality education for all.

"At-Risk" Learners and the "Digital Divide": Exploring the Equity in Access Issue

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Abstract: Education has been considered the "key to success," and technology, in recent history, has been considered "the great leveler"—capable of providing "keys" to all learners without regard to their race, ethnicity, or gender. Most recently, the term "digital divide" has surfaced, referring to inequitable access to technology. Within this divide, the "haves" are more likely to enjoy greater access to technology than the "have nots." The long-term negative effects of this phenomenon are being felt by those in certain segments of society who are effectively marginalized by a lack of equitable access to technology. This paper focuses on at-risk learners by examining the factors that contribute to the "digital divide," the possible long-term effects of this phenomenon, and effective classroom uses of technology that challenge the negative impact of the "digital divide."

Introduction

While technology is assuming an increasingly important role in our society, the "digital divide" between the "haves" and "have-nots" is widening at an alarming pace. Sculley (1997) describes this era as "an opportunity that is given only to few generations in history . . . if we respond with our best creative energies, we can unleash a new Renaissance of discovery and learning" (p. 142). In order for all members of society to assume full membership, however, it is imperative for them to have equitable access to the emerging technologies that will fuel this "new Renaissance."

The term "digital divide" has been applied to a phenomenon wherein the "significant growth in computer ownership and usage overall . . . has occurred to a greater extent within some income levels, demographic groups, and geographic areas, than in others" (McConnaughey & Lader, 1995, p. 2). Historically, the U. S. telecommunications policy's goal has been to provide affordable access to telephone service to all Americans; however, McConnaughey and Lader contend that "while a standard telephone line can be an individual's pathway to the riches of the Information Age, a personal computer and modem are rapidly becoming the keys to the vault" (p. 2). Consequently, the "digital divide" has become a national concern. Those who do not have access to state-of-the-art technology are marginalized in a society that increasingly relies on electronic literacy to navigate everyday existence. Not surprisingly, the effects of inequitable access are being felt in our schools as well as in the larger society.

In reviewing research literature, six themes emerged. Four of these themes emerged as contributing factors in the inequity of access referred to as the "digital divide." Two additional themes emerged related to probable consequences of and possible solutions to the "digital divide."

Factors Contributing to Inequity

Quality of State-of-the-Art Technology

A large segment of the American society is marginalized, or unable to assume full membership, because technology is not as readily available to them as it is to other segments of society (Lichtman, 1998). Neuman (1990) adds light to this phenomenon saying "it has become a truism that wealthy school districts [which have fewer at-risk students] own more computers than impoverished ones and that they augment their numbers so rapidly that the gap between rich and poor schools is widening rather than shrinking" (p. 158). Trotter (1996) further dissects the problem positing that although schools have, in general, lowered their ratios, "27% of school computers are . . . all-but-obsolete models" (p. A17).

According to Coley, Cradler, and Engel (1997), "the ratio of students to computers goes up as the percentage of Title I students increases" (p.12). The relevance of this observation to at-risk learners is explained in Cunningham's and Allington's (1994) assertion that "socioeconomic status is highly correlated with academic success" (p. 1). Thus, children who are served by Title I resources are often characterized as "at risk for school failure" and are the students with less favorable student to computer ratios.

Differences in student to computer ratios show that access to emerging technologies in schools has changed over time. Coley et al. state that, historically, Title I funds have been used to provide technology resources, and in the past, Title I schools were more likely to have more favorable student to computer ratios than non-Title I schools. More recent figures, however, suggest that Title I resources are no longer able to maintain a state-of-the-art status (Coley et al.). Often Title I schools that were able to build technology resources continue to show favorable student to computer ratios only because much of the available hardware is *the obsolete equipment which, when originally purchased with Title I funds, was state-of-the-art*. This explains the Coley et al. 1997 overall figures for student-to-computer ratios that show only a slight difference between high-spending districts (9.7 to one) and low-spending districts (10.6 to one). When these figures are disaggregated, however, figures for *state-of-the-art* computers, in Title I and non-Title I schools illustrate a vastly different comparison. According to 1997 figures, "schools where less than 20% of the students qualify for Title I have a ratio of about 22 students per [multimedia] computer, compared to a ratio of about 32 students per computer in schools where 81% or more of the students are eligible for Title I" (Coley, et al., p. 15). These figures illustrate that children in schools with higher numbers of at-risk students must share their state-of-the-art computers with more students. Thus, there is a much greater gap in access for state-of-the art computers than for computers in general.

Inadequate Quality of Technology Use

Compounding the problem of inadequate *quantity* of state-of-the-art technologies for at-risk students is the problem of inadequate *quality* of use. While the "haves" often use technology in ways that promote higher order thinking skills, the "have-nots" are more likely to be involved in activities that employ the lower order thinking skills (McAdoo, 1994). Possible activities that promote higher order thinking skills are projects that require access to

the Internet as a resource for research topics. The information students have analyzed and synthesized may subsequently be shared with presentation software. Additionally, the "haves" who are involved in these activities may attend schools that "are more likely to use computers to teach higher order literacy and cognitive skills through the use of programming languages and sophisticated graphics and simulation tools for mathematics and science instruction" (Emihovich, 1992, p. 501).

Conversely, the "have-nots" may be more likely to employ lower order thinking skills utilized in programmed learning, (i.e., computer-generated drill and practice activities with a limited focus). At-risk students often use computers to promote the development of specialized skills, and in the process, they are placed in a passive role with the computer controlling the environment. Using instructional technology to address skills is "often called computer-based instruction (CBI) or computer-assisted instruction (CAI)" (Grabe & Grabe, 1998, p. 82). Grabe and Grabe divide CAI or CBI into the following categories: tutorials, simulations, drill and practice, educational games, and exploratory environments. They report this type of instruction is moderately effective, providing "positive--but incomplete--experiences . . . [and they suggest] that guiding the student, especially in ways necessary to develop complex mental skills, is frequently beyond the capabilities of present applications of technology" (p. 111). Furthermore, Clements (1994) maintains that "the most promising uses of computers have nothing to do with programmed learning" (p. 33). He suggests programmed learning be replaced to a large degree with authentic purposes for integrated computer use that include word processing and publishing, computer simulated mathematical manipulatives, programming, computer painting tools, and problem-solving computer activities. These authentic uses of technology sharply contrast the programmed learning at-risk students often encounter.

Inadequate Teacher Preparation

The third factor that contributes to the "digital divide" is how teachers use technology in their classrooms. Technology in and of itself is not a cure; its efficacy is determined by how it is integrated into the curriculum (Clements, 1994; Fabry & Higgs, 1997; Kongshem, 1996; Laffey & Musser, 1998; McAdoo, 1994). While the availability of ample, high-quality technology opportunities is crucial, teachers' attitudes about and abilities with technology also greatly affect students' equitable access to these tools. According to Fabry and Higgs (1997), only 16% of all teachers are willing to try new ideas and are successful users of technology. This might be attributed to a lack of time to develop skills and confidence in abilities, limited spending allocated to training, and a scarcity of technical support personnel.

Teachers' fears, inadequate training, and lack of support are compounded by teachers' perceptions of technology's impact in the classroom. Laffey's and Musser's research subjects voiced these beliefs: "computers . . . [have] a higher value . . . in the future work environment than in the future school environment . . . [and they] will interfere with the teacher-student relationship" (p. 236). Cunningham and Allington (1994) described an added dimension to these concerns. They maintained that in schools with large at-risk populations, "teachers are instructed to 'teach the basics.' The basics usually referred to are the three r's--reading, 'riting, and 'rithmetic" (p. 181). Thus, basic skills become "the real work" and children are exposed to technology only in a skills practice environment or after "the real work" is complete. Additionally, the difference in the types of technology that different

groups of students are exposed to is often decided by educators who assume that "children must demonstrate competency in lower level skills before they are ready to progress to more complex cognitive skills" (Emihovich, p. 501). Emihovich refutes this notion, concluding from her studies of children who scored low on standardized tests, a determining factor for at-risk status, that their low scores did not preclude them from learning high-level computer concepts.

Adequate teacher preparation is an essential catalyst of any effort to close the "digital divide." In addition to providing teachers with instruction in how to integrate technology in the classroom, with technological support, and with the time to develop these skills, teacher preparation must also address attitudes about technology's place in the classroom. A goal is to replace the perception of technology as an "add on" for students who have mastered basic skills with a perception of technology as a basic skill. Thus, educators meet the needs of their at-risk students by exposing *all* learners to the kinds of technology experiences that will offer a greater chance for success in our technological society.

Inadequate Exposure to Technologically Proficient Role Models

Although at-risk students' exposure to rich technology experiences in school greatly affects their level of electronic literacy, the home environment also plays an important role. Often, at-risk students reside in technologically poor households with less exposure to technologically proficient role models (Lichtman, 1998). According to Lazarus and Lipper (1994), parents in more affluent homes are supplementing their children's technology education. They report that "whereas 48% of households with children whose family income is $50,000 or more have a child using a personal computer, only 7% of households with family income under $20,000 do" (p. 10). Consequently, in many cases the children who are at-risk and experiencing inequitable access to technology in school are the same children who are least likely to have access outside school.

Access to computers in the home is but one component of the role of the home environment. Lichtman (1998) reports that the parents of at-risk students often lack experience with computers. This may make them reluctant to encourage their children to pursue technology because they are unfamiliar with emerging technologies and possibly apprehensive about potential negative effects of technology on their children's lives. This perspective is in sharp contrast to that in homes where "as family members become techno-literate at home and at work, they are coming to regard computers as an important tool for education" (Trotter, p. A17). Consequently, at-risk children who are often technologically underserved in the schools also have fewer opportunities to encounter technologically literate role models outside the school environment.

Effects of Inequitable Access

The effects of inequitable access to technology can be felt socially, politically, and financially. Inequitable access marginalizes segments of society and creates an "information underclass" of people who are "digitally dispossessed" (Topping, 1997, p. 11). Lichtman (1998) contends that considering "the increasing importance of the Internet in political and social discussions . . . the disadvantage of the disconnected becomes a critical problem for our society as a whole" (p. 47). Menchaca (1997) further details the phenomenon taking the position that future social and economic viability hinge on access to technology and its role in access to learning and power. Furthermore, Lazarus and Lipper (1994) assert the premise that "as businesses lean more heavily on telecommunications and electronic technology, American workers must increasingly learn the ways of electronic communications just to carry out their day-to-day responsibilities" (p. 7).

The long-range potential ramifications for students with underdeveloped electronic literacy skills are daunting. As these students mature and enter the adult world of employment, they will find that employers increasingly expect workers to be able to navigate technology and use it effectively, and the rewards for possessing these abilities will be manifested in better-paying jobs (Lazarus & Lipper, 1994; Lichtman, 1998; Trotter, 1996).

Electronic literacy is becoming more important to employers as jobs increasingly demand "both basic literacy . . . at a relatively advanced level, and information technology skills" (Lazarus and Lipper, 1994, p. 7). The consequences for those who are unprepared to respond to the demands for proficiency with the new technologies are felt in less attractive employment positions. Recent figures show that two thirds of college graduates use computers at work compared to fewer than one tenth of high school dropouts, and in 1992, a college graduate earned 83% more than a high school graduate (p. 8). Thus, research literature highlights the "digital divide's" potential for long-range detrimental effects on financial viability.

Effective Uses of Technology

The use of technology as a scaffold "that is specifically engineered to assist learners in performing tasks for which they would otherwise be unprepared" can lessen the impact of the "digital divide" (Laffey, Tupper, Musser, & Wedman, 1998, p. 75). Kongshem (1996) describes effective scaffolding where computers are used "much like carpenters use hammers--as tools to construct authentic, personal, and meaningful projects" (p. A21). This quality of computer use is in sharp contrast to drill and practice programs with repetitive practice of basic skills intended to increase fluency.

Effectively integrating technology in the classroom requires a foundation comprised of state-of-the-art technological tools and an environment conducive to integrating these tools seamlessly across the curriculum. In this type of environment, "computers are active agents, extending the users' abilities, enabling them to create new problems and to devise new solutions. When used actively, the tools help the user to accomplish personal goals and objectives" (Bowman & Beyer, 1994, p. 22).

The nature of the environment most conducive to effective integration is one that includes the changing roles of teachers and students and provides effective scaffolding. Such an environment integrates technology across the curriculum and implements it as a tool to facilitate connectivity, integration, and productivity. The traditional direct instruction model, sometimes referred to as "chalk and talk," has been widely accepted as effective for delivering predetermined content. Such a construct does not effectively prepare students for a technology-rich society that requires a great deal of synergy and non-linear productivity. Today's classrooms are evolving to reflect the following modern model offered by Tapscott (1999) by realizing shifts in thinking about teaching and learning from

- linear to hypermedia learning;
- instruction to construction and discovery;
- teacher-centered to learner-centered education;
- absorbing material to learning how to navigate and how to learn;
- school to lifelong learning;
- one-size-fits-all to customized learning;
- learning as torture to learning as fun; and
- the teacher as transmitter to the teacher as facilitator.

A model such as Tapscott's recognizes our society's evolution from the Industrial Age to the Information Age.

Conclusions

Education has long been considered the "key to success;" however, in order for education to truly unlock the door to a successful future, educators must address equitable access to high-quality technological experiences. When they are designed for all learners, these experiences prepare them to be contributing, successful members of the "New Renaissance." Effective professional development can raise teachers' comfort level with technology and afford more opportunities to integrate technology in the classroom, but in order to

positively impact the "digital divide" and realize equitable access for at-risk students, teachers must also understand the importance of electronic literacy for all students (Coley et al., 1997; Fabry & Higgs, 1997, Kongshem, 1996; McAdoo, 1994; Neuman, 1990). At-risk children who are limited to using remedial and drill software in order to acquire basic skills are kept from the kinds of technology exposure that will offer their best chances for success in our technological society. The "programmed learning" format places the user in a passive role, yet all children, including at-risk children, need to "become aware that they control the technology and it does not control them" (Emihovich, p. 502).

In order to remedy this situation for at-risk students, the focus for administrators and educators should be on professional development opportunities for teachers with a goal of seamlessly integrating technology as a tool. This integration would be for the benefit of all students, bringing at-risk students into a common arena and challenging the "digital divide."

An integral element of professional development includes a commitment in terms of exploration time and technical support. This commitment would allow teachers opportunities to build the skills and confidence necessary for weaving technology into the very fiber of the classroom. In this way, classroom technology becomes a transparent tool, and teachers and students use technology to support learning and express new knowledge. Thus, teacher preparation and common goals for implementation will have contributed to equitable access and opportunities for all learners to reach their highest potential as contributing members in the society of the information age.

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Integrating Standards-Based Instructional Technology

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Abstract: The Navajo Education Technology Consortium/Education Technology Improvement Plan (NETC-ETIP) project is just entering it's second funding year. This unprecedented project involves 13 school districts in three states (Arizona, New Mexico, and Utah), two Universities (University of New Mexico and Northern Arizona University), two community colleges (San Juan College and Dine College), two departments of education (Arizona and New Mexico) and the National Indian Telecommunications Institute (NITI). The project serves 2,749 teachers in 13 isolated, poor, rural school districts across the 25,000 square mile Navajo Indian Reservation. It is a technology training and integration project funded by a grant from the United States Department of Education under their Technology Innovation Challenge Grant Program. This paper includes a general project overview, a synopsis of year one objectives and accomplishments, and a detailed analysis of the year one Arizona training sessions including results and outcomes.

Project Overview

The project uses a 'training of trainers' model. Each school has designated a training team consisting of one administrator, two teachers, and one parent. Training teams receive instruction in technology and technology integration in one of four regional training centers (Window Rock, Arizona; Kayenta, Arizona; Gallup, New Mexico; or Shiprock, New Mexico). The two Universities (University of New Mexico, UNM and Northern Arizona University, NAU) staff and operate the training centers in their respective states in partnership with the host school district. The training focuses on providing teachers the knowledge and skills needed to create standards based, culturally relevant, technology based curriculum.

The project uses a scaffolding approach to training curriculum. Each school team returns to the regional training center annually to build on what they learned and implemented the prior year. Upon training completion, teams return to their respective schools and instruct all remaining teachers. Each teacher team member is asked to develop at least two standards-based, culturally-relevant, technology-based curriculum modules for use in the classroom. Additional modules are being developed by other teachers. A newly awarded STAR schools grant will take selected curriculum modules (approximately 100 each year) and further enhance and develop them into professional products. These revised modules will then be distributed via NETrain, an interactive, on-line, instructional technology training web page. In addition they will be available for distribution via CD-ROM.

An important feature of the NETC-ETIP project is year-round, on-site technical support for the training teams. Each center site employs a full-time training coordinator. This coordinator (a University employee) facilitates training sessions held each summer (with an exception in year one which had one training sessions in the winter and one in the summer). In addition, the coordinator also provides continuous technical support to the training teams throughout the school year as they train teachers at their schools and integrate the training into their classrooms. Site coordinator support has included additional training, hardware and software assistance, providing additional resources, assisting with the school-based trainings, presentations to stakeholder groups, and more.

The training curriculum is referred to as the Integrated Technology Training Curriculum (ITTC) and is developed by each University with local district input. Overall, the project director provides guidance to insure training uniformity at all four training centers, but actual training session content is flexible through site-based management and local superintendent input, in order to fit each district's long-range technology plans. The ITTC is competency based and incorporates a full range of concepts and skills integral to successful use of technology in the classroom, based upon the International Society for Technology in Education (ISTE) Foundation Standards. Moreover, the ITTC also includes instruction on the integration of state academic

standards, alternative classroom teaching strategies (including constructivism), alternative and embedded assessment techniques, and creating culturally relevant curriculum.

Year One Objectives and Accomplishments

This project had very aggressive objectives for the first year. They included:

1. Recruit and hire a Project Director, University project directors and training center coordinators,
2. Set-up technology training centers, organize the training teams and schedule them for training,
3. Plan and formalize the ITTC training curriculum content (Level I); conduct pre-training workshops with all trainers; and conduct all ITTC Level I training activities (five days each team in the winter),
4. Plan and set-up NETrain designed for on-line training, classroom resources, help desk, and electronic discussion groups,
5. Provide support to individual schools for conducting teacher training at their schools,
6. Plan and formalize the ITTC training curriculum content (Level II); schedule summer training sessions; conduct pre-training sessions with all trainers; and conduct all ITTC Level II training activities (eight days each team in the summer),
7. Project evaluation conducted by project staff, project management committee, evaluation oversight committee, and external evaluator throughout first project year (and subsequent years),
8. Faculty advisory councils created and maintained by each University for articulation and implementation of training curriculum into the teacher preparation programs.

Even though the first year had very aggressive goals and the project was funded late (notification not received until early October with an October 1 start date) all project objectives were met during the first year. During the winter of 1998-1999 (year one), each teacher team received five days of instruction (in one of the four newly created training centers). Teams returned to their schools and provided training to other teachers during spring 1999 (some more thoroughly than others). In addition, some team members created curriculum modules (primarily PowerPoint presentations with some web pages). However, each teacher team member did not produce two modules each as originally planned. Technical assistance and support was provided on-site to the training teams during the spring semester.

During the summer of 1999 (still the first year of the project), teams returned to their training center site to receive the next level of training. Eight days of training were provided to each team. Teams then returned to their schools and most began providing training to other teachers in August and September. Additional training is expected to occur throughout the 1999/2000 school year. In Arizona, each team created a student-centered, problem-oriented curriculum module based upon the Norton model presented in training during the summer session. Each teacher is expected to create at least one more additional module during the school year using the same (or similar) student-centered, problem-oriented approach. An aggressive on-site technical assistance and support campaign was launched in September and continues today.

Analysis of Year One Arizona Training

Winter 1998/1999 (Level I IITC)

The winter training was composed of five days of training delivered from December, 1998 – May, 1999. Sessions were conducted at both training center sites. Day one was conducted during four sessions in December. Days two through four of the training were completed with each team by early February. The fifth day was completed on-site at each school during the school year. This approach was used to minimize classroom absence for teachers. Comparatively, New Mexico took a different approach and held training over five consecutive days starting in late January and concluding in March.

Of the nine school districts and 39 schools, full participation would have been 156 team members. Some schools sent more than two teachers or more than one administrator and overall 159 team members attended at least part of the winter training sessions (88 teachers, 37 administrators, and 34 parents). Only four schools did not have an administrator attend any of the winter training. All schools had at least partial representation at the winter training sessions.

Day one was entitled "The Forest" and was designed to give the team members the big picture or an overall view of the five-year project and the types of curriculum (culturally relevant, standards based technology modules) that will be produced over the length of the project. A project overview, cultural overview, introduction to standards, and a hands-on session previewing culturally relevant technology curriculum (PowerPoint and Web based) was presented.

Day two focused on "Basic Technology Skills." This day started with a discussion of change using the Joel Barker video "The business of Paradigms." A majority of the day consisted of hands-on sessions including Internet navigation and accessing appropriate Internet resources (including search engines); basic word processing including incorporating pictures and text from the Internet; and an introduction to Excel spreadsheets and graphing using a popular classroom math lesson.

Day three was divided into two topics 1) Integrating standards based curriculum, and 2) Peer coaching strategies. Teachers analyzed their progress towards integrating standards, aligned a curriculum with standards, and created a thematic unit with the assistance of technology that was cross-referenced to the standards. They also learned about constructivist teaching techniques and taught a mini-lesson to their peers.

Day four was entitled "Integration and Application." Each team learned PowerPoint while developing/creating a PowerPoint based curriculum module based upon the thematic unit they created in Day 3.

Day five was conducted on-site back in the team's district and school. Joel Barkers "Visions" was used as an introduction to "Building the Team and Creating a Plan." Each team developed a vision and action plan for implementing the spring teacher training within their schools. In addition, communicating on-line, including how to use the project created email discussion list, was covered on-site at each school

All sessions were evaluated by Northern Arizona University using a five-point scale. From day 2two forward a standard evaluation form was used for all sessions. The five-point scale used is shown in (Tab. 1).

5 -- Excellent	4 -- Exceeded my expectation	3 -- Met my expectation	2 -- Fair, below my expectation	1 -- Poor

Table 1 – Evaluation Scale

Day one used a different form for evaluation. Four areas of training were evaluated (grant overview, cultural overview, standards overview, and the technology module presentation). The overall average for day one is included in the data table (Tab. 2) for comparison purposes. Day five was not evaluated consistently in each session and therefore is not included in the data table.

	Day 1	Day 2	Day 3	Day 4
Timeliness of topic		4.1	4.1	4.6
Value of information		4.3	4.2	4.8
Appropriateness of content/organization		4.2	4.1	4.7
Knowledge/expertise of presenter(s)		4.4	4.4	4.7
Effectiveness of communication style used by presenter		4.2	4.2	4.6
Involvement of participants		4.3	4.0	4.7
Value of time spent in workshop		4.3	4.0	4.7
Usefulness of materials		4.2	4.1	4.7
Overall Average	3.7	4.3	4.1	4.7
Total Sessions Conducted	4	9	6	9

Table 2 – Evaluation Results for Winter Training (Arizona), conducted by NAU

As you can see from the data table (Tab. 2), each day except for day one exceeded the expectations of participants. Day five approached "excellent." The days that were mainly focused on hands-on activities (days two and four) were evaluated much higher by the participants, especially day four which was the "integration and application" activity of creating a PowerPoint module. An independent evaluation by SouthWest Laboratories (random sampling of 11 school team members were contacted for a phone interview) corroborated the above data finding the PowerPoint session rated as "The best for you." Why asked why those interviewed responded because it was "practical and operational."

Summary 1999 (Level II IITC)

The summer training consisted of eight days of training delivered from May to September. The first seven days were delivered in the summer at the two training centers; the eighth day was a combined day for all Arizona participants in September. A variety of formats were offered to accommodate the participants during the summer: seven consecutive days, four consecutive days followed by three consecutive days, and three consecutive days followed by four consecutive days. In order to accommodate summer schedules for the teachers (including attending summer school, teaching summer school, vacations, and more) teachers were even allowed to crossover between center sites if space allowed.

Of the nine school districts and 38 schools (one school in Utah dropped out of the project prior to the summer training), full participation would have been 152 team members. Eighty-seven percent of the team members attended at least part of the summer training sessions: 75 teachers, 22 administrators, and 35 parents. It is very important to say that 15 schools (39%) did not have an administrator attend any of the summer training. One school was a 'no-show" and had no representation during the summer training sessions.

Summer training consisted of the following topics:

1. Introduction to the Pricilla Norton Model (1/2 day). This model is a published student-centered, problem oriented approach to integrating technology in the classroom. It includes classroom environment, activities, assessment, and the learning process. Constructivism is the student-centered approach included in the model. (Norton, P., & Wiburg, K. (1998). *Teaching with Technology*. Orlando, FL: Harcourt Brace College Publishers.)
2. Web Page Development using Communicator (1 ½ days). NITI provided web page design training using a Corn Activity. Teams then developed their own web page and created a lesson on the web.
3. Zerkonian Activity (1 day). Teams worked together on a lesson that integrates standards, technology and culturally relevant material and modeled the student-centered/problem-based approach. Teams were required to work in groups to create a trip prospectus for aliens visiting the Navajo Nation. The activity required teams to organize, plan, research information on the Internet, do cost analysis using Excel, do a trip itinerary using Word, and develop a PowerPoint presentation to present to peers.
4. Embedded Assessment (1 day). Northern Arizona Literacy Enterprise or G2 Consultants spent a day on the Arizona State Standards and embedded assessment strategies.
5. Dine (1/2 day). In this session (presented only during two training sessions/40 participants) Dine Community College presented PowerPoint presentations on Geology and the Navajo learning philosophy.
6. CD/Access (1/2 day). A lesson was delivered on the use of educational CD-ROMs in the classroom including how to find and evaluate products for classroom use. Samples of different educational CD-ROMs were provided for team members to try. An introduction to Access (a database), using step-by-step lessons from the Microsoft web page, was also provided.
7. Teamwork/Presentation (varied 2 days – 2 ½ days). Each team was given time to develop an integrated lesson using the Norton Model as a guide. The lesson had to be a student-centered, problem-oriented, culturally relevant, and included embedded assessment for the measurement of content standard achievement. During the last day of the trainings, teams presented their lesson to their peers.
8. Dr. James Knight speaking on "Excellence and Equity in the Classroom" – a presentation that provides teachers with ten things they can do in their classroom to promote student excellence for all students.

All summer sessions were evaluated by Northern Arizona University (NAU) using the five-point scale (Tab. 1) and the standard evaluation instrument for all topics except topic five. Topic five was evaluated using a form provided by the presenters. Three questions were asked: (1) How interesting was the session to you? (2) How understandable was the session to you? (3) How useful was the session? A standard five-point Likert-scale was used with 5 being high and 1 being low. The overall average for topic five is included in the data table (Tab. 3b) for comparison purposes.

As the data tables indicate (Tabs. 3a and 3b) all summer training topics except for the Dine Culture (which used a different evaluation scale) exceeded the expectations of the team members. Of particular note topic two (web page creation), topic four (integration of standards/embedded assessment), and topic eight (Dr. Knight's presentation on Equity and Excellence in the Classroom) approached "Excellent." A significant difference in overall evaluation averages existed between the two center sites (in most cases at least .5 difference). As different presenters were used for the same topic, this may account for some of the variation. Buy-in levels also differed between schools in the two center sites. The site with lower buy-in had the lower evaluation scores. Southwest Laboratories has not yet conducted an independent evaluation of the summer training conducted in Arizona for comparison and validation.

	Topic 1	Topic 2	Topic 3	Topic 4
Timeliness of topic	3.8	4.6	4.0	4.5
Value of information	4.0	4.6	4.2	4.5
Appropriateness of content/organization	4.0	4.6	4.2	4.5
Knowledge/expertise of presenter(s)	4.2	4.6	4.2	4.8
Effectiveness of communication style used by presenter	4.0	4.6	4.2	4.6
Involvement of participants	3.9	4.6	4.3	4.5
Value of time spent in workshop	4	4.6	4.1	4.4
Usefulness of materials	3.8	4.6	4.1	4.5
Overall Average	4.0	4.6	4.2	4.5
Total Sessions Conducted	9	9	8	9

Table 3a – Evaluation Results for Summer Training (Arizona), conducted by NAU

	Topic 5	Topic 6	Topic 7	Topic 8
Timeliness of topic		4.2	4.1	4.7
Value of information		4.3	4.2	4.7
Appropriateness of content/organization		4.2	4.1	4.6
Knowledge/expertise of presenter(s)		4.2	4.4	4.9
Effectiveness of communication style used by presenter		4.2	4.2	4.8
Involvement of participants		4.3	4.0	N/A
Value of time spent in workshop		4.3	4.0	4.7
Usefulness of materials		4.3	4.1	4.7
Overall Average	3.7	4.2	4.1	4.7
Total Sessions Conducted	2 (n=40)	8	8	1

Table 3b – Evaluation Results for Winter Training (Arizona), conducted by NAU

The evaluation instrument also included collection of qualitative data. Five open-ended questions were asked: (1) Aspects which made attendance worthwhile; (2) Can use the information in the following ways; (3) Suggestions for improvement; (4) Additional training on today's topic needed; (5) Identify future workshop topic/suggested presenter(s); and other comments. The written comments had a few consistent themes across all topics and all sessions:

1. Need more time.
2. Need follow-up training/more training and/or time to practice and use.
3. Can use the information with lesson planning and with students in the fall (or see the potential to with more practice/follow-up assistance).
4. Need more sample lessons developed by other teachers to show during training.

Results and Outcomes of Arizona Training

Skill and Application Growth

A technology questionnaire was delivered to project participants in December during the 'Day 1' training session. During those sessions 85% percent (n=130 of 156) completed the questionnaire. A follow-up questionnaire was administered during the fall with a 17% (n=26 of 152) completion rate. The five-point scale used on the technology questionnaire was:

1=Not at all; 2=Limited; 3=Some; 4=I am comfortable using; 5=I could teach someone else

Table 4 summaries the results of the two technology questionnaires. Prior to training, participants expressed comfort in one area only – "I have used a computer". Many areas were below 3.0 indicating very limited, if any, prior experience. With the limited follow-up sample, growth was seen in all areas. Obvious growth appeared in areas where teachers were trained for new skill/software (PowerPoint, web pages). In addition, significant growth also appeared in areas that have a direct impact on students. Using computers with students started close to "some" but is now approaching "comfortable using." Developing lesson plans that

integrate technology, standards, and/or Navajo culture components (the main objectives of the project) started in the "limited" range and now all three categories are in the "some" range after only one year of the five-year project.

Question	12/98	11/99	increase
I have used a computer	3.96	4.58	15.7%
I have used a word processing program	4.0	4.58	14.5%
I have used a spreadsheet program	3.07	3.7	20.5%
I have used PowerPoint or another similar presentation program	1.96	3.86	96.9%
I have used Microsoft Office	2.57	3.68	43.2%
I have used the Internet for email	2.95	4.26	44.4%
I have used the Internet to access web pages	3.02	4.14	37.1%
I have used the Internet to search for information	3.12	4.14	32.7%
I have created web pages	1.65	2.98	80.6%
I have used a digital camera	1.97	2.8	42.1%
I have used a scanner	2.01	2.72	35.3%
I have used presentation equipment	1.66	2.78	67.5%
I use computers with students	3.27	3.81	16.5%
My knowledge of the AZ (or UT) state standards	3.21	3.66	14%
I have developed lesson plans that integrate technology	2.39	3.24	35.6%
I have developed lesson plans that integrate the AZ (or UT) state standards	2.5	3.52	40.8%
I have developed lesson plans that integrate Navajo culture components	2.39	3.02	26.4%

Table 4 – Technology Questionnaire (administered to Arizona participants)

Currently, a standardized survey instrument is being developed for both Arizona and New Mexico participants. The instrument will be on-line and both team members and teachers at their schools will be asked to do a self-assessment at least yearly to track growth in skill development, application, and integration into the classroom.

Implementation in School/Classroom

SouthWest Laboratories conducted random sampling phone interview with eleven of the team members from Arizona schools in spring 1999. Results demonstrated that although most teachers were not able to conduct all the training topics at their schools. However, they were making an effect to conduct some training with teachers at their schools, despite some barriers. Team members were asked if they had conducted training at their schools, all but one (91%) responded they had conducted some training. When asked about the response from their colleagues to the training, 45% had a favorable response; 18% indicated busy schedules/more work being an issue for a favorable response, 18% indicated mixed response, and 9% said they 'didn't say much.' (There was one non-response to this question.) When asked what training had not yet been delivered (of the training they themselves had received) and why the answer focused mainly on the Office software packages (Excel, PowerPoint) with the reasons being 45% did not have the software, 18% did not have time, 9% had hardware issue, 9% was still organizing their team. (There were two non-responses to the 'why' question.) They also asked 'of the training you received, what has been implemented in the classrooms'? Thirty-six percent said none, not much, or don't know. The remaining responses included: scanning of pictures, word processing, email; library—look for research, writing letters, word processing; Internet research, digital camera, scanning, PowerPoint; Word, Excel, PowerPoint. The evaluation report indicated: "It is anticipated that as the teachers' technology literacy increases through the scaffolding of training, increased use of technology in the classroom will emerge. The evaluation, at this early time in the project, was focused on documenting the efforts to develop increased technology literacy among school professionals. Later evaluation efforts will focus more on the impact of the training associated with student achievement and the use of technology."

Technology and the Navajo - Its Time Has Come

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Abstract: This paper describes a comprehensive technology project that benefits the Navajo People. The Navajo live in a sparsely populated region of the West that enjoys few of the amenities of larger urban settings. Isolation and remoteness have created a situation where Navajo children have been unable to get an equal education because of lack of access to modern communications and equipment. This paper briefly summarizes aspects of staff development, cultural inclusion, and infrastructure improvements that are attempting to assist this population enter the electronic age.

The Navajo Education Technology Consortium is an organization designed to meet the needs of a group of people who, like many other people living in rural America, have little access to technology. They do not have equal access to a quality education. In many areas, they can not make a telephone call or use any other distance communication.

The Navajo live in a vast land encompassing parts of three states (Arizona, New Mexico, and Utah). The largest geographic school district in the continental United States lies within the reservation, some 5,500 square miles. Many of the roads are unmarked and unpaved. Few telephone companies care to invest in providing service because of the anticipated low return on investment. Lack of running water and electricity is common. Children have died because parents were unable to find anyone with a telephone to call for medical assistance.

In 1998, twelve public school districts in New Mexico, Arizona, and Utah, one private school, and one BIA school joined together to form The Navajo Education Technology Consortium (NETC). That year, this group, which is comprised of the superintendents from each school district, applied for a Technology Challenge Grant from the US Department of Education to train their teachers how to work with technology.

Partnerships were formed with two universities (Northern Arizona University and University of New Mexico), to provide training. In addition, four training sites were set up in different corners of the Navajo Nation and 102 schools sent teams of four people (one principal, two teachers, and one parent) for training. The teams then returned to their schools and began training the rest of their staff in the material covered in training. Microsoft provided a substantial amount of software for the project. The National Indian Telecommunications Institute provides instruction and guidance on cultural components.

During each training session, the teams learn about different types of software and hardware. They then produce lesson modules which address state standards, contain culturally appropriate material, and have some type of embedded assessment. Digital photography, video production, web page design, and investigation techniques for exploration of the Internet for appropriate resources are taught, then used to include material in modules.

The NETC sought, and was funded a second grant that assists the first grant. A STAR Schools Grant was awarded that will establish an Internet data base browser so that all modules can be accessed by teachers within the Navajo Nation (and elsewhere) via the Internet. Four studio sites are also included in the project that will fine tune teacher produced modules by adding computer animation, studio quality sound, and cultural components. Teacher education students within the universities are sought to assist in the "fine tuning" process. Since some schools on the reservation have little or no Internet access, the project is also testing satellite up and down link capabilities in ten school sites. In others, modules will be available on CDs or DVDs. The emphasis is on sharing information that is relevant to the population of students served, The Navajo.

During the first year of the ETIP grant, 102 school teams were given 13 days of instruction. In the Gallup McKinley County School District (the largest of the consortium districts), the superintendent has mandated 3

days of staff development on technology during the 1999/2000 school year. The principal of each school submits to a university trainer an instruction design for the 3 days of training. The university trainer then offers support to the school teams to address the training desired for that school. In this particular school district, all teachers have three years to become proficient in Microsoft Office (or equivalent) and the use of the Internet as a teaching tool.

The impact for teachers coming out of teacher education colleges is profound. By 2002, all students in Gallup McKinley County School District will expect to use technology in their educational experience. New teachers will be expected to be technologically proficient, not only by the district, but most importantly, by the students.

We don't know what the impact on students will be but one device we are developing is an instrument that will try to determine how a Navajo feels about being a Navajo. In the past Navajo students have not seen themselves in texts, the news, or in films. We are attempting to change that. We are embedding familiar pictures, stories, and aspects of the local environment into curriculum. School becomes a place less foreign and less frightening. We expect to see a positive difference in our students, both academically and socially. The Internet and other technologies offer a bridge over isolation. The Navajo are a proud people living in a world apart from many of the conveniences of more urban settings. This project attempts to allow them to participate in a contemporary educational setting with the advantages of the rest of the population while also allowing them to preserve their cultural heritage.

A Multifaceted Approach to Integrating Computers in Multicultural Preservice Teaching

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Abstract. Research indicates that few education faculty consistently model the use and integration of technology in their instruction. At the same time, few in-service teachers feel well prepared to integrate technology into classroom instruction. As faculty ponder how to bring educational technology into preservice education, they frequently consider its use as an either-or choice: teach asynchronous on-line courses or teach synchronous courses in a classroom. This paper presents a hybrid approach used in an undergraduate multicultural education course. This approach more closely mirrors the reality found in most classrooms.

Introduction

Technology has become a pervasive element in higher education and it plays an increasing role in course design, delivery and content across all academic fields. For example, the 1998 National Survey of Information Technology in Higher Education found that 33.1 percent of all college classes use Internet resources and 22.5 percent of college courses use the WWW for class materials and resources (Campus Computing Project, 1998). Data gathered jointly by the American Association of Colleges for Teacher Education and the National Council for Accreditation of Teacher Education in1996 (Persichitte, Tharp, & Caffarella, 1997) show similar trends in schools, colleges and departments of education (SCDEs). Faculty at 45% of the responding SCDEs regularly use computers, televisions and VCRs as part of instruction. Similarly, 40% of the SCDEs reported requiring students to design and deliver instruction incorporating various technologies.

Nevertheless, a 1995 report from the Office of Technology Assessment (OTA) indicated that "technology is not central to the teacher preparation experience" and that educational technology instruction most often "is teaching about technology…not teaching with technology" (p.165). Further, the OTA (1995) found that faculty do not model the technology. In part, this lack of integration may be the result of faculty's perception of technology as a means to enhance teaching, rather than to change teaching (Perisot, 1997). Yet in 1996 the National Commission on Teaching & America's Future challenged schools of education to model how to teach in multicultural contexts and how to use technology in doing so. Notwithstanding, research indicates that few education faculty consistently model the use and integration of technology in their instruction (Lewallen, 1998; Chisholm, Carey and Hernandez, 1998). Indeed, many faculty continue to rely on the blackboard, overheads and, occasionally, slides and videos (Sammons, 1994). Others remain uncertain of technology's appropriate use and educational value and benefits. It is not surprising then, that the National Center for Education Statistics (NCES) in 1999 found that few teachers (20%) report feeling well prepared to integrate technology into classroom instruction.

Within the next decade, some 2 million new teachers will be hired (NCATE, 1997). If these future teachers are to integrate technology into their teaching, they must first feel competent and knowledgeable about its use and instructional integration. Yet students from traditionally underrepresented groups enrolling in teacher education often lack the personal and professional experiences with computers and interactive technology. These students need equitable access to that technology. However, access to technology is not simply a matter of availability of hardware and software; technology access also means opportunities to use varied applications, to develop technological competence, and to experience their use for authentic purposes. Given the number of nontraditional college students

with families and the many who work to support themselves while attending school, technology access is determined also by time. Teacher preparation programs need to find ways to not only provide the access, but also to model its educational applications.

Because teachers are central to the equitable and effective use of technology in our increasingly diverse classrooms, it is imperative that colleges of education not only graduate technologically competent teachers, but teachers who can skillfully integrate technology in culturally diverse classrooms. In preparing future teachers, we must remember that "today's teacher candidates will teach tomorrow as they are taught today" (NCATE, 1997, p. 4). Our preservice teachers will replicate in their own teaching what they observe teacher educators and classroom teachers doing.

Integrating Technology

Historically, colleges of education have endeavored to meet the technological challenge by *adding* a technology course to the teacher preparation curriculum. Typically such technology courses are taught by an expert technology faculty member in a specially equipped classroom or lab setting. Preservice teachers have acquired their computer competency in a manner that is disconnected from other education courses. This additive, nonintegrative approach has taught future teachers how to operate a personal computer, use specific software and, often, how to assess the educational value of software programs. Unfortunately, it has not taught them how to integrate technology into their teaching.

As more teacher educators become convinced of the need to integrate technology in preservice education, one common misconceptions continues to serve as a deterrent. Educational technology is frequently seen as an either-or proposition: teach asynchronous on-line courses or teach synchronous courses in a classroom. However, alternative and hybrid modes of instructional delivery are also possible and effective. Indeed, modeling technology integration for preservice teacher requires a hybrid approach that more closely mirrors the classroom reality found in most schools where technology and the WWW are used as one portion of learning activities, not as a total system of instructional delivery. Moreover, as we move into new ways of teaching, we must build on what the past has taught us about effective teaching practices and integrate these practices with our new resources.

Underlying Theoretical Principles

In developing this hybrid approach for preservice teacher education, the author applied an eclectic approach based on several theoretical constructs. The basic underlying principles stem from theories of experiential learning, constructivism, and social learning theory (see Kearsley, 1999 for summaries of these theories).

Experiential Learning

According to experiential learning theory, minimizing external threats maximizes assimilation of learning that is threatening to the self. The teacher's role here is to create a positive environment for learning. Since multicultural education by its nature evokes emotional responses, this principle served as a cornerstone for an undergraduate multicultural education courses taught by the author. From the beginning, the instructor conveyed and modeled the concept that a multicultural learning environment is one in which diversity is appreciated and differences are respected, including differences of opinion. In fact, evaluation of students' chat room dialogue was weighted for respect for different opinions.

Experiential learning theory also holds that learning occurs when the subject matter is relevant to the learner's interests, the learner actively participates in the learning process, and the student has control over its nature and direction (Kearsley, 1999). The instructor's role is to balance intellectual and emotional components of learning. The teacher shares feelings and thoughts with the learners, but avoids dominating or imposing ideas. One way to create relevancy and to give students control over their learning is by offering choices within a framework. Consequently, individual students selected readings based on their particular interest from lists of links centered on course topics. Students then actively participated in classroom dialogue and on-line discussions.

In addition, experiential learning sees the role of the teacher as a facilitator who organizes and makes available learning resources. In developing the course, the author created 28 web pages based on the major course themes:

The Nature of Diversity, Personal Identity, Classroom Culture, Teaching in Diverse Classrooms, Teaching Content Areas Multiculturally, and Collaborating with Parents. These web pages provided numerous links to a variety of on-line readings. The richness and currency of on-line multicultural materials led the author to choose this route rather than assign a commercial textbook. In addition, students could use a resource book of multicultural readings as an alternative in case technical problems prevented their accessing the on-line readings. Fortunately, there was only one instance of such problems during the semester.

Constructivism
One of the major concepts of constructivism is that learning is an active process in which learners build on current or past knowledge to construct new ideas or concepts. Learning takes place when students create their own knowledge in an environment where students and instructor engage in active dialogue. Throughout the course students were encouraged to relate their readings and class discussions to personal experiences and classroom observations. Following the constructivist approach, the instructor and students engaged in a lively, Socratic dialogue both in the chat rooms and in class. The instructor responded to all individual chat room postings by first affirming the students' views and then posing additional questions to expand and deepen their critical thinking. For example, when a student commented in the chat room that teachers needed to make all their students feel comfortable and accepted, the instructor responded by agreeing that this was truly important and then inquiring what specifically the student would do to achieve this in her own classroom. On another instance, a student commented that illegal Mexican immigrants are a drain on our economy as they pay no taxes and make use of various economic assistance programs. The instructor responded by indicating that illegal immigrants are indeed a problem in the United States and the asking the student what facts substantiated the claim that illegal immigrants had a negative effect on the economy. In turn the student responded by doing an Internet search on the topic. She then responded that she had found some articles that contradicted her original statement and made her think about how often misconceptions are based on opinions rather than facts.

Social Learning
Bandura's social learning theory emphasizes the importance of observing and modeling behavior. In recent years, Bandura has also focused on the concept of self-efficacy. The author's major goals in creating a technology-supported course were to model the integration of technology for learning and teaching, as well as to develop students' sense of competency in using computers. The instructor also modeled the integration of technology by creating in-class presentation materials as web pages that could be projected on a screen at the front of the room with an overhead projector. Thus students saw how PowerPoint presentations and web pages could be used to present topic outlines, pose discussion questions, and provide examples.

Course Format

A Multifaceted Approach
In teaching a three-credit undergraduate course in multicultural education, the author applied a multifaceted instructional approach that combined both synchronous, face-to-face instruction and asynchronous, on-line learning. The instructor addressed the issue of equitable access by providing two hours of face-to-face in-class discussion and instruction and one hour of on-line course readings and activities. The on-line work could be completed either on campus at a computing center, in the classroom lab where the course was offered, or at home for those with computers and a modem. In addition, the instructor remained in the computer lab during the third hour to provide technology support and one-on-one discussion of topics or assignments.

In creating this course, the author principally used three programs: (a) *CourseInfo*, a licensed course management tool which served as the structural framework and starting point for course work; (b) *FirstClass,* which provided email communication with the instructor and could be accessed through *CourseInfo*; and (c) *Netscape Communicator*, which provided access to the instructor-created web pages and on-line readings. All students received a free email account and free training in the use of *First Class,* the university-supported instructional email program.

At the first class meeting, students enrolled on line into *CourseInfo* and acquired their individual user name and password. Once enrolled, students could access the syllabus, read announcements from the instructor, read about the instructor, see classmates' photos and web pages, link to the instructor's web pages for each course topic and enter

their randomly-assigned chat group. Opening the instructor's web pages in *Netscape*, the students found links to a variety of readings focusing a course topic. These readings ranged from personal opinion pieces to scholarly journal articles and represented a variety of perspectives, such as differences in sexual orientation, special needs, race, ethnicity, language, and religion. The instructor's web pages also provided links to the chat rooms in *CourseInfo* and to *FirstClass* email. In addition, students could reference the instructor's in-class presentation materials that were placed in a lesson folder within *CourseInfo*.

Peer Learning
Collaborative learning was an integral a part of the on-line chat groups and in-class discussions. Students met in class with their chat group, visited the assigned instructor's web page and chose their readings for the following class session. Each member of the chat group chose different on-line readings. These readings were then shared with the other members in the chat room via a summary and reflection on its implications for teaching.
In class, the students read their group's chat room entries and then shared what they had learned from their readings with the entire class. The instructor provided guide questions for class discussion and opportunities for small group work. In addition, chat groups collaborated in developing and presenting multicultural teaching activities for content areas. These collaborative projects included in the evaluation rubric peer evaluation of members' contributions, timely work, degree of collaboration and respect for others' opinions and suggestions.

Limitations and Benefits

Although the author has taught this course over a seven-year period, this was her first comprehensive attempt to integrate technology. The results of this integration proved beneficial for students, but held several challenges and limitations for both the students and the instructor.

Limitations
Time. One of the major limitations to the development of this web-supported, hybrid course was the amount of time required. In addition to the usual time needed for the creation of a syllabus, lesson preparation and development of course materials, this combined format required additional preparation and on-line time commitment. This extra expanditure of time is one that not all institutions support, recognize or reward. Time is a crucial resource in identifying appropriate materials, organizing the on-line resources, creating course web pages and developing *CourseInfo* pages and links.

Rethinking of course delivery, course content and organization occurred during the Spring semester prior to the Fall offering of the course. Reconception and restructuring of course topics led to the new course format. Although the author had identified and bookmarked multicultural on-line resources over a span of several years, she needed to verify the continued existence of these pages and their current URLs. She also had to identify additional on-line resources to expand the available reading choices for students, include new topics, and offer multiple perspectives on every topic. Hence, she spent innumerable hours adding to her list of bookmarks for the course.

The creation of the web pages also required vast amounts of time. During the summer prior to offering the course, the author spent approximately 168 hours in creating the main web pages for the course and an additional 10 hours in setting up the *CourseInfo* pages.

Throughout the semester, the instructor spent an average of 5 hours per week reading chat room entries and responding to each student individually. In addition, the instructor also read and replied to individual students' email messages which averaged about three messages per week.

Computer competency and access. Though nearly 80% of the 24 students enrolled in the course owned a computer, the remaining students had access only on campus or at work. However, some of the students who owned a computer had low-end computers which did not allow them to access the on-line materials from home. Similarly students' self-reported computer competency varied considerably, from a student planning to become a computer design expert to several whose only occasional encounter with a computer was for word processing. One non-traditional student had such a high computer phobia, that she opted to drop after the first class session.

Accessing on-line materials became an issue for the first two class sessions. Some students enrolled late for the course and had to be registered into *CourseInfo* during the second week of classes. Others forgot their passwords or user names the first few times. These students had to re-register into CourseInfo during the second week of classes.

Of course, the instructor's own computer expertise and competency also comes into play in the development and delivery of a web-supported course. Although the author is comfortable using either a PC or a Mac platform, the majority of her work is done on a PC. Due to scheduling problems, the course was offered in a Mac computer lab and the instructor often had to learn by trial-and-error during the class session how to perform certain tasks on a Mac.

Benefits

Increased computer competency. Though most students had some level of computer competency, the majority had no experience in using chat rooms or using on-line course readings. By the end of the semester, many students commented on their learning how to use a chat room, their increased confidence in using a computer and their altered thinking about how they will use computers in teaching. Those who initially indicated little computer expertise stated that they had greatly improved their computers skills and felt comfortable navigating web pages.

At the same time, the instructor expanded her own computer competency by using *CourseInfo* for the first time and by working in a Mac environment. Her occasional learning of the Mac by trial-and-error in class also served as a way to model life-long learning and the continuous nature of computer competency development.

Student-Teacher Communication. One of the most beneficial outcomes of this multifaceted approach to teaching was increased student-teacher interaction and communication. Students readily emailed the instructor questions and concerns. Four sent their assignments as attachments to their email. All students received comments and questions from the instructor to all their chat room entries. As a result, the students and instructor engaged in some interesting, interactive email and chat room dialogues around multicultural issues. These on-line conversations often transferred into the classroom as students shared with the class what they had been discussing and thinking about in these two-way conversations.

Diversity awareness. The primary purpose of this course is to increase diversity awareness and develop multicultural teaching skills. The first half of the course was devoted to defining terms, identifying the nature of diversity and developing awareness of diversity issues. Students expressed feeling safe enough to voice their opinions. They also found topics relevant to their interests and experiences. For example, one young man indicated that he had had mixed feelings about dealing with gay and lesbian students, but after choosing to read all the on-line readings provided from this perspective, he now had changed his opinion and had a new perspective. Other students made such comments as "this really opened my eyes" and "I hadn't thought about this until we read and discussed it." This increased awareness resulted not from the instructor trying to change opinions, but through students' selection in readings, chat room conversations, in-class discussions of topic questions and the instructor's Socratic probing.

During the second half of the course, students used the on-line readings and resources to develop chat group presentations of multicultural teaching activities for language arts, mathematics, science and social studies. Chat group members planned their activities both on-line and face-to-face in the classroom. They integrated what they had learned about diverse populations, including children with special needs and language differences, and applied their knowledge of multicultural teaching strategies. Their presentations evidenced an awareness of the nature of multicultural education and provided for diverse learners.

Conclusion

The focus of this instructional experiment was to develop diversity awareness and multicultural teaching skills. A secondary purpose was to model technology integration and expand students' computer competency. Both these main goals were successfully achieved. Evidence that the students have come to value their experience is the fact that they requested access to the course pages after the conclusion of the course. Several students indicated that they would like other instructors to use this same approach. The vast majority expressed having learned a great deal,

changing their perspectives and acquiring multicultural teaching skills. The time and effort required both of the instructor and the students was well rewarded.

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"From Tatters to Tapestry": Technology and the Weaving of Cultural Education in the Mainstream Classroom

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Abstract: A basic tenet of multicultural education suggests that the learning, sharing, and integration of culture is necessary for the academic success of both majority and minority students. With the shifting demographics of the population, even small towns and rural areas are facing this challenge of the cultural education of the ESL student and the majority student in the mainstream classroom. However, the instructional use of print media alone is limiting and can inadvertently create reductionist cultural portrayals. With a theoretical grounding in cultural pluralist concepts, this paper suggests ways that teachers can move beyond print media alone, and use technology to develop and implement cultural activities in which both the majority and minority students participate in creating cultural portraits of different cultural groups represented in that classroom. In such cultural activities, technology may be used as a tool for tracing how our students' unique cultural threads weave together the larger, common tapestry of our multicultural classrooms.

Introduction

In the name of national unity, a pervasive notion in the United States has been that cultural and linguistic diversity should be harnessed through an assimilative process, into one culture and into one language. This assimilationist perspective of the teaching of culture has historically affected the education of English as a Second Language (ESL) students in the United States in that their heritage cultures and languages have been, at the very least, absent from the curriculum (Ovando and Collier, 1996). However, a basic tenet of multicultural education affirms that not only is it possible, but also necessary, to affirm heritage cultural and linguistic roots while simultaneously sharing a set of societal principals (Banks and Banks, 1997). Therefore, this basic tenet of multicultural education suggests that the learning, sharing, and integration of culture is necessary for both majority and minority students. The differing views of assimilationism and pluralism form the basis of the reciprocal roles of culture in education, and cultural education. And these differing views form critical foundations upon which teachers, of both majority and minority students, will base their curriculum. Therefore, it is necessary to examine these differing views and the implications for the teaching of culture in the majority, or mainstream classroom. This paper explores the theoretical foundation of this basic tenet of multicultural education. With this theoretical grounding in cultural pluralist concepts, this paper discusses how technology can be used to reveal the cultural tapestry that is our mainstream classroom.

What are the Assimilationist and Pluralist Views of Culture?

The assimilationist view of culture holds that it is necessary for all members of a society to share a set of cultural ideas and ideals in order to achieve "national unity." This national unity is desirable in order to maintain the nation's steadfastness against other, possibly threatening, nations of the world. The assimilationist view of culture has traditionally held high expectations for the schools: The schools have

been hailed as the purveyors of the mainstream society – the vehicle through which immigrants will learn the one, common culture; the one, common language; the one, common shared set of civic notions and ideals that are necessary to be considered "an American." – "one of us." In this light, the assimilationist view of culture has seen the schools as a unifying mechanism (Dewey 1916; Handlin 1951; Hechinger 1978). Since the idea is that cultural diversity will lead to differing, contrasting, and *opposing* views, the schools have been charged with the task of replacing heritage culture with that of the mainstream culture. What has occurred in the schools can be considered a "deculturalization" of immigrants. In contrast, a basic tenet of multicultural education is the concept of cultural pluralism. This basic tenet affirms that not only is it possible, but also necessary, to affirm heritage cultural and linguistic roots while simultaneously sharing a set of societal principals. In the cultural pluralist view, the differing groups can, and do, maintain unique values and ideals, while strengthening and adding to the mainstream group. Withiri the cultural pluralist view, schools therefore are, and can be, the instruments for discovering and valuing different cultures.

What May Be the Ramifications of the Assimilationist Perspective upon Majority and Minority Students?

Deculturalization has taken root by portraying the dominant culture in the classroom via texts, activities, teachers, and personnel. Deculturalization, at the least, simply does not include the minority cultures in the curriculum. At its worst, deculturalization has taken root by the inclusion of, but negative portrayal of, minority cultures in the curriculum. The result can be detrimental upon majority and minority group members. The majority student may not see that the minority group is, and probably has been, a constant influence on the majority culture. Instead, the majority student may only see the difference or the "otherness" of the minority student. This separateness and idea of seeming newness may cause the majority population to be perhaps fearful of the perceived economic, cultural, and linguistic impact that the minority group may have in the communities. Negative perceptions and in, extreme cases, hostility and/or violence may ensue.

These concepts also have, of course, negative impact upon minority students. Research indicates that the positive or negative perceptions of the mainstream population toward the minority population can affect the academic performance of language minority students as they internalize the perceptions of the mainstream population towards their minority culture (Ogbu, 1978; Skutnabb-Kangas & Cummins, 1988). Further, research indicates that another impact of cultural stereotyping is the negative influence upon self-esteem. As Ogbu 1992 has argued, lowered self-esteem can negatively affect the "locus of control", or the perceived control that one has over one's environment. Decreased self-esteem as a result of cultural stereotyping may therefore lead to the inability to see the relationship between one's actions and the response of the outer environment to those actions. The idea that "no matter what I do, it doesn't matter – the teacher will still not expect very much from me; the other kids still will not like me; even, my parents will not understand me etc., etc.," can lead to hopelessness, and abandonment of plans. Racial and cultural discrimination, whether it is real or perceived, examined or unexamined, is a reality in culturally pluralistic communities. And this reality of cultural and racial discrimination often *first becomes* a reality for the minority student *in the classroom* (Cummins 1986, Ogbu 1992). Considering the above points from the literature, it is necessary to integrate the teaching of culture in the mainstream classroom, for academic well being of both the majority and the minority students.

Why Should Technology be used in the Integration of Culture into the Mainstream Classroom?

There has been a great deal of literature, both research and theoretical literature, which offers advice on how teachers can integrate culture through print media and through published synopsis *about* the cultural minority group. However, as has been noted by Ovando and Collier (1996), often the necessity to present conclusions about a group can lead itself to a cultural reductionist view of that group – in effect, creating or perpetuating a stereotype. For example, there may be an emphasis and an oversimplification of historical

outlines, cultural traditions, foods, and dress. *This is one of the disadvantages with using print media alone.* This is one of the disadvantages to using, in particular, print media about a group that has been created largely by the dominant group for majority members. In addressing this problem, or we may think of it as a challenge – in addressing this challenge of taking a fresh look, of unburdening oneself of one's own preconceived notions, it is necessary to invite members of that community which we are examining to help construct cultural knowledge that is not static nor merely descriptive. In attempting to move away from prepared, published cultural synopses, we will, by necessity, begin to seek cultural information from our students and from our communities. By viewing our students and our community members as the "cultural experts," we will begin to focus upon the unique culture of our students and our communities, rather than focus upon generic cultural portrayals often presented in published synopsis. It is in this light, in the moving beyond print media alone, that technology can, and must, play a part.

How can Technology be used to Develop Cultural Activities?

First, it is necessary that as teacher educators, we encourage our teachers to expand their notion of technology. It is important that we encourage our teachers to think of technology in terms of mechanisms by which we communicate. As such, "technology" can include: Audio, Video, CD-ROM, WWW, Telephone, e-mail. An occupational hazard shared by many teacher educators is the often-heard sentiment: "But I don't have technology in my classroom, school, district." A lack of readily accessible "technology" is indeed a challenge. Therefore, while encouraging our teachers to expand their notion of "technology," it is important that we encourage teachers to *use the technology that they do have.* This shift in thinking can assist teachers to move beyond the concept of technology as "a computer" and being wistful for what they could accomplish "only if" -- toward thinking about technology as mechanisms by which we are already communicating. By expanding our notion of technology and using what is now accessible to us, we can begin to develop technology-based cultural activities that can, and possibly already do, have a meaningful role in our students' everyday lives. Secondly, it is necessary to consider who will be part of information gathering for cultural projects. Research literature abound with the importance of parental and community involvement for the academic well being of students. Therefore, it is necessary to consider the community members who can, and should, be included. There is no need to think of this as an overwhelming task – one need not try to reassemble the local chamber of commerce for one's classroom activity! Community members of that cultural group usually are present in the school and local community. These are community members with whom the children come into contact with during the normal course of the day: teachers, aides, lunch room attendants, janitors, neighbors, candy store owners, day care providers, those who run the video parlor, or the produce stand, or take tickets at the movie theatre. Of course, we will also add the members of the virtual community – all of them are the threads of the cultural tapestry that we will be tracing. Third, it is necessary to try to focus upon the information that is being gathered about that group. In contrast to the assimilationist perspective of culture, the pluralistic view contends that it is the accumulation of cultural, socioeconomic, and linguistic detail that is the basis for a realistic understanding. Pedagogical innovations using technology must, **and can,** focus upon rooting out such an accumulation.

When developing technology-based cultural activities that "root out" the cultural, socioeconomic and linguistic details of a particular group, one needs to begin with guiding questions that will help our students "dig" and "discover." Consistent with this paper's thesis of multicultural education, the guiding questions of our cultural activities need to open a path toward an understanding of the particular group itself -- by examining the group itself *in contrast with the other group – and also as a part of the other group.* Consistent with this paper's metaphor of the cultural tapestry, the guiding questions of our cultural activities need to open a path toward tracing the individual cultural thread – by examining it as a unique thread with its own color and texture that is unique – and also as a thread which is part of the larger design. Some guiding questions that teachers can use to develop cultural activities are suggested below:

1. How is ethnicity reflected in the immigrant or indigenous status of the group?
2. What is the socioeconomic role that the group plays in the dominant society?
3. How has the group historically influenced the history of the dominant group?
4. To what degree is the group a stable or mobile population?

5. How has minority status, or acculturation, or both affected the relationship between the younger and older generations?
6. How is wealth distributed in the community?
7. Which community members tend to have higher status in the group, and why?
8. What are the perceived socioeconomic rewards for literacy and school achievement?
9. What are the socioeconomic costs and benefits of membership in the particular group?
10. How is language viewed by the group?

(Ovando & Collier 1996)

These kinds of questions try to illicit information about the group's own concepts of power, economics and social strata. Because these questions prompt the information gatherers to move beyond preconceived notions, such questions can encourage our teachers to design cultural activities that move beyond pre-prepared print media alone. Because such questions prompt information gatherers to seek real-life community informants, such questions can encourage our teachers to design cultural activities that require that students make meaningful use of accessible technology.

How can Technology be Used to Implement Cultural Activities?

Research literature abounds with the idea that certain types of technology can best practice particular language skills. For example, it is well cited that the use of audio can develop listening skills; the use of word processing can develop writing skills, etc. However, often the use of technology coupled with cultural education is scarcely dealt with in the research literature. (Shrum & Glisan 1999) Therefore, it is further critical to remember that cultural activities, *with technology,* encourage the practicing of all the language skills: reading, writing, listening, speaking, presenting, viewing, critical thinking. Using technology in the development of cultural activities discussed here can be part of most of the content area classrooms: social studies, science, math, as well as language arts and ESL. Therefore, using technology in such cultural activities can be helpful for the academic progress of both the majority and the minority student.

When deciding upon the focus of the cultural discovery activity, as guided by the suggested questions above, specific technologies can prompt different means of accumulating cultural knowledge about a particular group, and hence, address the guiding questions. Table 1: Types of Technology-Based Cultural Discovery Activities delineates suggested activities with the appropriate technologies.

Technology	Activities
Audio	Personal Narratives Family Histories Stories from Home Interviews Songs In-person Interviews Telephone Interviews Answering Machine Recordings
Video	Cultural Events: Religious ceremonies, weddings, baptisms Typical Events: Homes, gardens, videos produced in native country, birthdays, dances On-the-Job Videos Neighborhood Scenes "A Day in the Life Of . . ."
E-Mail	Partnering Pen-Pals Partnering with students abroad or college students from native country Grandparent Partnering

WWW	Student Development of Class Web-Page, including personal histories School web-page with discussion corner Web-pages of minority businesses Web-pages of civic groups Home page of U.S. population and demographics with timelines

Table 1: Types of Technology-Based Cultural Discovery Activities

Consistent with the pluralist tenets discussed in this paper, the major purposes of these activities are 1) to involve the students with the community members in a meaningful and realistic way, and 2) to encourage the students to uncover how the minority group is distinct – yet how it is, and has been, and possibly will be, a part of the majority group.

Conclusion

Cultural stereotyping and misunderstanding, whether it is real or perceived, examined or unexamined, is a reality in culturally diverse communities. And this reality often *first becomes* a reality for the minority student *in the classroom* (Cummins 1986, Ogbu 1992). Mere inclusion of cultural portraits in the form of print media and published synopses alone can sometimes fortuitously create or perpetuate stereotypes. However, with accessible technology, teachers can develop meaningful cultural discovery activities that encourage our students to discover and share the various cultures alive in their own classrooms and communities. Technology-based cultural discovery activities can help our students to see that their own unique cultural threads are not tatters – rather, their unique cultural threads, together, weave the larger, common tapestry of our multicultural classrooms.

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Gender Representation in Visuals on School Web Pages Course For In-Service Teachers

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Abstract: This paper is based on the findings of a qualitative dissertation that examined K-12 school web sites in a large U.S. school district. The study used semiotic methods to examine web site visuals for evidence of differences in gender representation. Educators who design or oversee school web sites should be aware that visuals published on their pages may have more than one possible interpretation and that the school web site itself influences the viewer. The authority of the school, when published in public domain web pages, can be an impressive credential to the visuals on the school web site and the meanings that those visuals deliver to individual students. Based on semiotics, a concept entitled *cybiotics* explains how the context of visuals are changed on a web site, and a revised model of, What You See Isn't What I See (WYSIWIS), guides review of visuals to avoid gender stereotyping (Maboudian, 1999).

Introduction:

There are an increasing number of school web sites on the Internet. Entering the words: *school web site* can produce approximately nine million hits. Photos of children and animated gifs on the pages of school web sites represent what the school deems appropriate roles and behavior for the children who attend that school. Whether the web site is meant to be a brochure for prospective parents, or is actually accessed by the students, a message is intended by those responsible for authoring the web site. It is important to understand the nature of the web and the identity of the student viewer to fully understand the impact of visuals on gender.

The Power of the School Web Site

The introduction of computer technology in schools has been described in literature as promising students greater equity and opportunity to learn by its inclusiveness of gender (Kaufman, 1998; Wolf, 1998). However, for female students who see photos that sustain gender stereotypes, technology provides a new format for the familiar issue of inequity. There is a diachronic relationship of gender representation on school web sites and stereotypical illustrations in school textbooks (Apple, 1980; Apple, 1993). Just as gender stereotyping in textbooks has been denounced, computer magazines and games have also been criticized in recent literature (Weinstein, 1998). The visuals in school web pages have not received as much attention. Part of the reason may be that some of the photos are selected from what really occurs at school and are used as a journalistic format to illustrate events. Who would object to a photo of elementary school children in a garden project? If the photo shows the boys standing in the foreground with signs, shovels, and plants while the girls are standing in mixed groups behind them, possibly without tools or plants, then the photo may highlight a situation that, while a factual record, is less than equitable. One might say that this was a candid shot of the children. However, this particular photo was posed and, more importantly, the photo was singled out for a web page showcase. Consider the possible meanings that a student viewing the web site might interpret from the photograph. The representation of the event is more than a slice-of-life photo in a newspaper. The photo represents that which is valued by the school as an authority publishing onto the school web site. The web page is sent out beyond the school walls and is available for frequent access, symbolizing acceptable student behavior, not just an event during the past week. The question could be asked of the school web designer whether a different photo should be used.

This introduces the issue of selection and of determining the meaning of what is selected and the impact of the medium of the school web page.

The term *selection* is used because the appearance of visuals goes through a selection process. The arrangement and selection of visuals is an author's choice, limited by stakeholders who have a claim on the decision-making process of the web site appearance. Whether created specifically for the school web page, or selected because they represent an event or student behavior, web site visuals are meant to send a message to a world wide public. The selection of visuals and the authorization to publish them on a district's school web site, a new and highly respected technology, imbues these visuals with authority, as well as the meaning interpreted by the student who views them.

The school yearbook has visuals that represent the students' interactions in the arena of a school, yet it is generated once a year and is in paper format, which students take part in creating and use as a keepsake and autograph book. The textbook, which interjects visuals into the student's educational experience, is from a source external to the school and is not generated electronically at this time. The school newspaper is developed by students with faculty supervision. While it is a school publication, it is a student effort and a learning tool. The technology bringing the visuals to the student through the school web page is an adult enterprise. The selection of the visuals may be made by adults as well. The differences in the nature of the school web site indicate the need for educators to be aware of the impact of visuals through this medium. The visuals in the school web site at this time are often published by faculty or administration to represent the school's approved student activities and behaviors. If boys are in the forefront; if there are more boys represented in computer labs than girls; if the girls are seen chatting in the computer labs while the boys are *working* with the computers; or if the animated gifs depicting computers can be interpreted as male personifications, then the message that the visuals send may not be equitable. The caption might not indicate differences when one reads, *Computer Lab*, but the visuals may.

Cybiotics

An analysis of school web site visuals includes examining the medium itself. The PC monitor becomes a lens through which the individual views the school web site. Meaning derived from a visual is interpreted by the individual. The fact that the visual is seen through a monitor on a web site builds more meaning into the visual. The publishers of the official school web site are state or private institutional authorities. The visual represents the view of the educational authority, or logically, the visual would not be published. The selection of these visuals are, in a sense, academic engineering in that the visuals are brought into a new relationship to one another within the PC monitor. The computer club may be one click away from the home page representing the mission of a school. The sports activities may be represented on the home page itself. The absence or placement of other school activities can make a statement regarding their value.

Cybiotics (Maboudian, 1999) is the concentration of information on the web page of a web site, putting it into a different context of meaning because of the web site design. The familiar photos of students in school activities are concentrated and arranged via navigation and separate pages. They are labeled according to what the visuals represent to the school. The *cybiotic* design of limited numbers of visuals on the web page necessarily leaves some students out, and some activities out. Certain visuals are seen immediately and others are accessed beyond the home page, perhaps after scrolling or clicking through other material that was designed to be accessed or seen first. There may be, then, a rating of importance, embedded in the design of the Web page. In actual examples from the district studied, one high school showed an animated cheerleader (a real student), going through an abbreviated routine on the school home page. The same school had relatively few females depicted in the computer lab. The placement of these visuals sends a message.

One junior high school chose to select two photos on their home page: two girls in ethnic dance costumes in one photo and two boys who had designed a technology-based art project (a magazine with their own photo on the cover) in a photo next to the first. On another page in the same site, the language lab had computers populated by male students only. Another page had girls pointing to the door of an administration office, while still another page had a photo of girls in their cheerleading costumes sitting on hallway stairs. A student viewing these pages within their school web site may get an impression of the school activities that are not proportionate to the actual participation of students or academic value. This is the nature of the *cybiotics* (Maboudian, 1999) in web design.

Possible Interpretations of School Web Site Visuals by the Female Student

This section explores the possible interpretations of the messages in visuals based on student gender identity. Muffaletto (1994) explained that the visual is reproducing a pre-existing meaning, which communicates concepts to the viewer because there is a relationship between the concept and the way the viewer understands it. "It is through ideology, the relationship to the 'way' things are perceived to be, that the individual comes to know her/himself." (p. 300). This idea -- that the meaning of a visual is derived through the individual's relation to its concept based on ideology and identity -- is at the core of this paper and explains why the educator selecting visuals should attend to the *cybiotics* of the web environment, and, above all, to student identities.

An object, a visual, or any artifact we view holds a meaning that is pre-existing in society, but is also based on the way the individual views it in relation to self. The relationship is based on the social identity of the viewer. We have seen historical visuals depicting the female identity of other eras. It is often easier to comprehend the female identity through old photographs. The more common the meaning is in visuals, such as those which we see today, the more difficult it is to recognize the social construction of gender identities (Berger, 1998; Chandler, 1998). If we cannot recognize gender identities and stereotypical limitations of those identities, it is difficult to avoid those limitations. The acceptance of common inequities in gender differentiation in a school web site, can have far-reaching effects in other spheres and can become accepted as natural (Rakow, 1992; Simon, 1996).

Not only does the female identity exist, but it exists in diverse forms. "Within a picture, there are meanings assigned to colors, objects, relationships between objects, genders, races and ages." (Muffaletto, 1995, p.302). The interpretation of a visual depends on the social identity of the individual, which includes gender, and which directs behavior through a role-taking action that is culturally appropriate by groups within a society (Carspecken, 1996; Muffaletto, 1994; Simon, 1996; Wiley, 1994). The visual representation of female gender in the school web site needs to reflect multiple female identities. The identity of the female student may incorporate that of a cheerleader, or an *A* student...or it may not. The visuals in a school web site that do not address a variety of possible female identities limit students or exclude them. Visuals that present stereotypical representation of females are abundant in clipart and animated gifs (Knupfer, 1997). Photos that represent an absence of female students in an activity appear in web sites. The presence of stereotyping and the absence of female modeling in the area of computers both discourage female participation.

Semiotics, the system of signs (such as those in visuals) that have social meaning (Chandler, 1998), supports the examination of the social interpretation of the viewer. Awareness of semiotics when selecting a visual in a school web site can help the web designer understand the variations in student interpretations. According to Berger (1998) semiotic "Codes are highly complex patterns of associations that all members of a society learn. These codes or 'secret structures' in people's minds, affect the ways that individuals interpret the signs and symbols they find in the media and the ways they live." (p.26). Berger reminds us that codes can be so commonplace that they seem to be natural. The codes are not only the elements we see, but are the meanings we learn to give them.

According to Muffaletto (1995) these codes construct the identity of the reader. A juxtaposition of a male student at a computer working and a female student at a computer, turned in her chair, chatting, are meaningful outside of the context of the photographic moment and within the *cybiotics* of the school web site. The student reading a visual in the school web site will read not only what is there, but also what is not there. A male student sitting alone at a computer can mean the absence of a female counterpart. The absence of girls at computers may communicate an unspoken expectation of a behavior that literature describes as hidden curriculum (Apple, 1998; Carspecken, 1996; Noble, 1998). In this case, hidden curriculum can possibly prohibit females from using the computers in ways that the boys use them and, in a larger sense, could prevent female students from going into higher paying, prestigious jobs in computer technology fields.

What You See Isn't What I See (WYSIWIS): Semiotic Tools For Educators.

The information in Tables 1 and 2 is a variation of the model developed for the dissertation upon which this paper is based (Maboudian, 1999). The information within the grids is based on three sources on semiotic analysis, Van Zoonen (1994), Berger (1998), and Chandler (1998). These tools can help the educator examine visuals that are intended for a school web site. Using these grids as guidelines, the web

designer can observe the visual and ask a series of questions about possible meanings. While these matrices are not complete (more qualitative analysis should be done) they provide a start towards awareness of the possible interpretations female students may have regarding a visual.

The first step is to look carefully at the visual, viewing the elements as listed in Table 1 to become aware of the content of the visual. Possible codes exist in visuals that provide information about the meaning. Examine visuals for the following qualities:

Personal	Situation	Technical	Contextual
Posture	Background detail	Lighting	Composition on the page
Attitude	Props	Distance	Page format
Pose	Secondary characteristics in the shot	Definition	Relationship with Caption/Text
Gesture	Spatial relation between people	Contrast	
Activity	Clothing	Animation	
Eye contact with the reader			
Signs of social role or position			

Table 1. (Sources: Van Zoonen 1994; Chandler 1998)

As each element stands out, the next step is to ask questions about the elements and how they work to form meaning that can be understood, as seen in Table 2. Part of the process here is to identify what everyone would be able to see and determine how it fits into possible identities. Think about what various individuals with their own experiences might think of the visual. Don't be satisfied with one point of view. For instance, an old fashioned picture of a little girl in a schoolhouse raising her hand to answer a question could be interpreted in many ways. Her pose may be interpreted as being a good student. However, a student might see her as a teacher's pet. Another might see her as a sissy who can't play sports. Still another may find that the time frame of the forties presents a time when the female's role was limited.

Semiotic Analytic Structure
How do the visuals tell their story within the context of the web site? Think of the cybiotic elements related to the visual.
What are the physical attributes of the visual?
Commutative Test: Discover what the meaningful elements are by asking how the meaning would change if any element were altered in the visual.
How might the meaning of the visual tie in with stereotypical female identity?
What is the diachronic narrative of feminine identity across time?

Table 2. (Sources: Van Zoonen, 1994; Berger, 1998; and Chandler 1998)

Conclusion

The selection of visuals to be used in a medium that is an official representation of the school requires an understanding that a message sent is received and its meaning is then *interpreted.* The effect of visuals on behavior can be seen in something as common as our use of visual representation to decide which restroom to use. The unwritten sign on the door, marking it male or female, indicates the appropriate choice of restrooms based on gender. In a similar way, the visuals on the monitor screen influence the viewer.

As educators are learning how to create web pages, attention is given to the techniques of design and the technology of successful publication, with navigation and animation, "bells and whistles", and adherence to student privacy and to copyright laws. Is as much attention given to gender representation? While educators are aware that there is a lack of gender equity in computer technology, the use of the school Web page can possibly address the need for equity. The first step is to be aware that every picture tells a story and that the story may have a different ending for different viewers. The process for selecting the photos for publication on a school web site should be reviewed carefully. Photos of convenience, already in web-compatible format, or animated gifs that are "cute", should be examined for possible semiotic interpretations before putting them "up" for students to view.

More effective processes may be developed to select visuals that provide role models for equity, not simply to eliminate bias. Foucault (1984) described how architecture changes human behavior. Put a fireplace inside a home and the activities there change. The visuals in school web sites may also help engineer the role of the female student. Changes in stereotypes through visual representation on the school web site can engineer more choices that comprise the female student's identity. If not, then the continuance of stereotyping in the female student's representation can impede her progress in areas of computer use. Visuals can limit what the female student can and cannot do within the definitions of her identity (Knupfer, 1997).

By developing a process for the selection of visuals for school web pages that incorporates an awareness of student interpretation, and the effects of *cybiotics*, educators can avoid visuals that either stereotype students, or fail to provide an greater opportunity to expand student roles. While the selection of visuals for the development of a school web page is done with the good of the students in mind, there is more potential good to be done and potential harm to be avoided. The school web pages that comprise the site can promote female participation in computer-based activities by leading the way through visual representation.

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Within Student Comparison of ESL Acquisition-Through Content Between Virtual and F/F Seminar for ESL and Native Speakers' Negotiated Meaning

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Abstract: A comparison of virtual and F/F seminars for academic content and ESL acquisition by ESL and NS graduate students studied the nature of discourse analysis and negotiated meaning. On-line asynchronous WebCT bulletin boards allowed for recording and subsequent analysis of students contributions on-line. Tape-recordings of student live-seminar participation were analyzed and compared to virtual seminar participation by both NS and ESL students. Analysis of these negotiated meanings as well as formative and summative interviews and student diaries revealed a complementarity and synergistic relation between the on-line and F/F seminars. ESL and native speakers claimed efficient academic reading and writing improvement and that these gains transferred to their oral performance in the F/F seminar.

Introduction

Constructivist versions of academic content acquisition through a second language and second language acquisition through academic content learning place a strong emphasis on the opportunity for extensive utilization of all components of throughput (Carey, 1999a,b). These components of throughput include successive intake samplings from the input concurrent with successive interpretive attempts to assimilate the input in terms of their prior learning or schema and subsequently successive constructions of output in terms of interpretations of how that output will be received and perceived as appropriate output appropriate by the imagined audience and their interpretation of the output, Carey,(1999a,b). In my flow chart which conceptualizes this process, I propose that both ESL and native speakers of English may make successive attempts to interpret or assimilate the input or message in a seminar as provided by either an on-line bulletin board or a comment or question provided by a professor or student question in a seminar. Typically, in either case, the student will sample with successive intakes from the input to assimilate this information to existing linguistic and academic schema. An inadequacy in either linguistic or knowledge schema will result in disequilibrium causing successive iterations of this cycle of intake samplings in an attempt to comprehend the input.(assimilation) or modify the schema (accommodation) which constitutes learning. In this research, we tried to investigate and compare how ESL students and native speakers of English would negotiate meaning in either an on-line bulletin board communication or a Face to Face (F/F) mode of common course delivery. In particular, I wished to study the interaction of how inadequate academic language schema, which varied between ESL and native speakers, and inadequate academic content schema, which varied across students due of differing prior knowledge, would influence negotiated meaning by individual students and by collaborating students. I recognized that both variables constituted a continuum and a study of the interactions between these variables and on-line bulletin board activity or live face-to face seminars could provide insights on the role of negotiated meaning and language and content acquisition. The study of inadequate prior knowledge of language or content could also be represented as a continuum in terms of the degree of communication channel capacity that inadequate linguistic and academic schema might require. I also wished to further consider the continuum of automaticity of information processing that such diverse situations might entail. Carey,(1984).

A graduate seminar of 12 students engaged in graduate work on second language acquisition research (5 ESL and 7 native speakers) that had equal on-line and F/F required components allowed an opportunity to study how both ESL and native speakers would differ in their discourse between on-line bulletin board discourse and live F/F discourse and the interaction between the two. Students enrolled in the graduate seminar on Narrative as Inquiry were required to participate in both the on-line bulletin board virtual seminar (50% of course grade) and the live weekly F/F seminar (50% of course grade). Several of the ESL students were recent arrivals from Asia who had

minimal TOEFL scores of 580 and varied in their ESL communicative ability. Other ESL students included Europeans who had attained higher levels of ESL performance and had received their university education in English. The native English speakers all spoke a second language with considerable proficiency and taught that second language.

This design which I have used previously in research on other courses, Carey, (1999a,b; 1998); Carey & Crittenden, 1998 permitted a within-subject comparison of virtual seminar discourse and F/F seminar discourse for both ESL and native speakers of English. It also allowed between-subject comparisons of ESL speakers with native speakers in the virtual seminar as well as in the F/F seminar.

Method:

The 12 week graduate seminar on Narrative as Inquiry required that students engage in as much interaction and negotiated meaning on course content as possible in both the live seminar and the virtual seminar. Collaboration and co-operative learning rather than competition were promoted and joint projects were also encouraged.. Student readings included theories of learning flowing from the work of Piaget through to Rumelhart and other contemporaries who have borrowed so liberally from Piaget's genetic epistemology. In addition the course included detailed readings and discussion of second language immersion and language acquisition through content teaching. Students were encouraged to reflect on these readings to develop their own metacognition on their second language acquisition through academic content acquisition.

The virtual seminar which utilized WebCT asynchronous bulletin boards included activities to encourage students to engage in open discussion of the process of their second language process and how negotiated meaning and collaborative learning could contribute to a greater awareness of their second language acquisition process as well as their how their interactions and negotiated meanings facilitated their academic course content acquisition. All of these social cognition activities were recorded on the electronic bulletin board and submitted to detailed analyses. In addition, the live discussion and interchange was recorded in the live seminar and the nature and frequency of comments by ESL and native speakers interventions and participation were noted daily. In addition, informal interviews of both ESL and native speakers were conducted throughout the course and students were encouraged to write diaries and keep notes on the development of their awareness of their metacognition and how their acquisition of academic content and academic English were progressing as well as how they were differentially influenced by the two modes of seminars and their interactions with ESL and native speakers. All students were encouraged to work in a collaborative manner and to help each other in academic writing and gaining knowledge of the diverse cultures represented in the seminar.

Results:

Frequency of contributions:

Since the ESL graduate students were given strong incentives through grades and consistently encouraged to participate in both the virtual and live seminars it is instructive to compare their contributions in the two modes of seminar delivery. At the outset of the course the ESL students made many more contributions to the virtual seminar than they did in the F/F seminar. They also made far fewer contributions to the live seminar that the NS and the contributions they made were brief and in some cases they were either unable to make themselves understood or they were unable to understand the response by a NS to their contribution. In spite of he very positive and forgiving ambiance in the seminar, this inevitably led to some loss of face. In interviews they reported that contributing on the virtual seminar was far less anxiety inducing than contributing in the live seminar and unlike the live seminar it allowed them time to construct and verify their response to a message in a more productive way. This was also due to the "less embarrassing" situation in the virtual seminar which allowed them unlimited time to reflect on the question and to construct or choose an interpretation that seemed most probable. It also allowed them to reflect on the question and to consult other resources and then to construct and edit an appropriate response. These ESL students also found that this added time allowed them to function in a more optimal learning environment and to negotiate meaning and to collaborate with their colleagues and to engage in co-operative learning while improving their academic reading and writing in ESL. These students also claimed that this opportunity to negotiate the content in their ESL allowed for rapid ESL acquisition and that these learning transferred into the live F/F seminar.

They also claimed that the virtual seminar made it possible for them to acquire the idiom so that they could participate in the live seminar. Therefore, there was a noticeable increase in contributions by the ESL students such that by the end of the 12 week course, the ESL students contributions in the live seminar were at a level comparable to that of native speakers. This demonstration of how the virtual seminar allowed ESL students equality of access to learning on the virtual seminar and that this equality of participation facilitated their gradual increase in participation in the live seminar stands as a reminder of how technology can promote equality of education.

However, while this was most prevalent for the ESL students it was also true for all of the native speakers as well. They also found that the asynchronous discussions on the virtual seminar allowed them to be more thoughtful, less rushed and more conducive to expressing their well formed thoughts on issues and questions. Native speakers reported that their academic reading comprehension and writing also improved from activities in the virtual seminar. These students also claimed that this thoughtful discussions that was student centered allowed for the emergence of a certain sense of a community of scholars who claimed that they felt more autonomous and empowered to discuss important course content issues and this allowed them to get to know each other and their different perspectives on academic issues reflecting their diverse prior knowledge and cultural backgrounds. Moreover, this transferred to the live seminar so that it greatly improved their level of discussion in the live seminar. This spontaneous practicum in the socialization of language and learning was an added benefit of the on-line activity.

Other measures of change in the 12 week course revealed in the interviews.

In interviews all of the ESL students found that the virtual seminar was particularly conductive to facilitating both their ESL acquisition and academic content acquisition. They all claimed that SLA through content immersion was the most effective way to improve their academic reading and writing. They also claimed that the on-line writing greatly facilitated their oral contributions in the live seminar because they would be thinking and speaking outloud as they composed and recomposed their messages to post on the bulletin board. In addition, the responses they received to their communications greatly increased their self-confidence in their ability to both express the academic content and their second language. The ESL students also offered their opinions as to the superiority of this course in helping their learning compared to other graduate courses they were concurrently enrolled in. Two of the five ESL graduate students either dropped other conventional graduate courses or changed their registration to audit status. All ESL students claimed they acquired more ESL academic reading and writing as well as more academic content in this combined live-virtual graduate seminar.

In interviews of the native speakers there was a consensus that the virtual seminar greatly increased the opportunity for the students to work collaboratively and to negotiate meaning and to become more aware of their metacognitive skills. They also claimed that they learned more than in a conventional course because they were more actively involved and the participation in the socialization of learning both academic language and content greatly facilitated their progress. Several native speakers also claimed that working with and watching the progress of he ESL students helped hem to understand their own growth in academic reading and writing to a some degree.

All students agreed that the opportunity to post their term papers on the bulletin board so that all other students could collaborate and offer opinions on improving each term paper was highly useful for added learning and that the collaborative and interactive learning model promoted a higher level of learning for all students. Students also agreed that the flow chart model was a good representation of how they felt they processed t he information and that the constructivist orientation was a heuristic metaphor for explaining how they learned.

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VIRTUAL INTERACTIVE WORKSHOP: a pedagogical art education view into the computer lab

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Abstract

This paper deals with educational issues one faces while interacting in digital environments. The field of art education in these environments as well as the new concepts that involve the processes developed in their use are the main focus of this study. The main concern is to verify how and whether the digital environments can provide a practice that is strengthening and effective and whether they can make it possible a teaching-learning process with excellence. Knowing how these processes engender the cognitive development of the students concerning the possibilities that these computer based environments are able to offer is our challenge. Are these computer mediated environments able to help develop creation in a constructive sense? Cyberspace, multimedia, online are every day words in the contemporary world. How can educators grasp these meanings in order to develop ways to fully integrate them into their pedagogical issues without simply transposing old practices into new environments?

Introduction

Digital technology is being used more and more by contemporary artists. Web art, net art, electronic art and other new forms of artistic production are subject of discussion by art educators who are concerned with the use of this new technology in their classrooms.
This is a project which tries to articulate three areas of knowledge, integrating aspects of art-education, developmental psychology and computer science to make up a work plan based on the reference theories in each one of those areas. We are trying to answer some questionings that justify the insertion of the digital technologies as a work perspective in the pedagogical field. We are observing the educational processes in the construction of cognitive possibilities developed by the students during the interaction with the computerized environments.

Digital Technologies in Education

This study investigates how the insertion of the education professional can happen in a field that is new and that presents challenges in the construction of knowledge specific of its field. This occurs exactly due to the characteristic mobility of the telematic environments in order to place in this field the teacher's possibilities to help develop in the student the artistic knowledge, which brings about an aesthetic awareness.
This educator should be a competent critic for whom the artistic and aesthetic knowledge bring new possibilities which can be seen, according to *Axt*, as a "*possibility to recover the already organized in the paths that have been already planned, which can be always retaken by the thought that returns, and it is worth to say that it returns on itself in the construction of the stability*".
This path of construction of knowledge in the language described by *Axt*, will be retaken by us in issues that deal with the output of the mental activity regarding the transformations of the object in the construction of

the virtual/possibilities The meta reflection concerning the person's own work and the others' makes it possible to make a connection among the knowledges and practices resulting in output movements through the visibility of the transformations.

In The Virtual Interactive Workshop we intend:

To use the new technologies of the information and of the telecommunication aiming at an integration of a synchronous combined with an asynchronous pedagogical process that facilitates the development of a sensitive, imaginative, and critical individual.

To observe how the new technologies of the information and of the telecommunication are used by the students while interacting in them in the process of construction of cognitive possibilities, the invention and the creation.

To investigate the possibilities of the educational process in computerized environments, considering their specificity.

To investigate the reconstruction and development of a critical vision, and the possibility of the students to capture the conflict among the several solution alternatives in a computerized environment where hypertextual thinking allows multiple possibilities.

To investigate the new educational environments in relation to the opportunity of decision they offer to the student, which implies working with divergent answers.

To question and to identify the new computerized environments and the interaction possibilities in the construction of a practice that allows to develop the expression and the communication in the visual arts, the significant appreciation and the understanding of the visual arts as cultural and historical product under a contextualized and reflexive perspective.

To investigate these new computerized environments and the new approaches in art pedagogical projects, as well as the development of concepts concerning the real and the virtual when working in the cyberspace.

The Context

Cyber is one of the most used prefixes in the nineties. Those who want to transcend the use of the computer and travel into the cyberspace are the cybernauts, members of an emergent culture, the cyberculture.

How to assimilate these transformations and to work with these technologies, which are already integrated into the daily life of our students?

Litwin works on a focus of the computerized society in which the computer is already inserted in people's life, and consequently in the pedagogical action, as she states: "*It worries us seriously that a lot of proposed reforms don't consider the changes that were produced because of the technological developments, and think the innovation as the use of the technology especially done for the classroom, without realizing that it is already incorporated, that it is part of the culture of the classroom and that the information that derives from it should be first deconstructed as part of the ruptures that should be created to favor critical thinking*".

Litwin's idea finds reinforcement in the schematic differences between modernism and post modernism presented by the theorists where one sees a change in paradigms now facing dispersion, deconstruction, antithesis.

The change from the modern copper phone cable to the post modern optical fiber increases enormously the flow of information. The educator's role is in search of redefinitions in this world of amazing speeds.

On the other hand, the student is immerged in a culture of the imagery, in which the culture of the imitation (a such perfect clone whose difference between the original and the copy is almost impossible to notice) is itself the focus of innovation, and it is starting to suffer effects of some tendencies of its own phenomenon. One of these is the problem of the reproductivity in the era of the mass consumerism. The more an original is reproduced, the more the price of its original work goes up. This consumerist aura extends to all other things. It is the price of the nostalgia - memories of what was manufactured yesterday. There is an image consumerism and what is reproduced occupies the place of reality or it is substituted as a hyper reality. We live on what was already lived and of what is being reproduced.

How can an art educator deal with all these new concepts?

Pierre Lévy says that: "*In the digital world, in the distinction of the original, and of the copy there is a lot that has lost any pertinence. The cyberspace is mixing the notions of unity, of identity and of location....... we are at the same time here and there thanks to the communication techniques and of telepresence*".

One of the post modern world symptoms that can reflect on education it is what is called zapping, or the zero conscience. The remote control, the multiple TV cable channels, the satellite transmissions generate such an abundance of options that one goes through this continuous and impatient change of channels without going deep into anything, it is like making a collage of one's own life, transforming the creation of the post modern life into an endless amnesia, according to some authors.

Another phenomenon diagnosed in the virtual world is *lost in cyberspace*. The infinite clicking of the mouse in the search of information, resembles *zapping* in the search of other channels.

This study focus on the computerized environments and telematics due to the fact that research in this area demonstrates that the educators are concerned and want to know the possibilities of this technology that presents new developments every day, fostering and enlarging the possibilities of the traditional interactions in the educational environments.

Development:

Interactivity, the arts, and computer technologies seem to be reshaping the art class, the computer lab and education .

We are working at The Virtual Interactive Workshop challenging the students to look for their own answers to the questions. The activities developed by them in the project are interactions in the computerized environment. They use the Internet for their research.

The use of the electronic means of communication makes it possible to propose themes for discussion involving the visual reading of the own students' environment and of the ones that they interact with during the process.

Students dialogue with the researcher, they send their folios and their reflections about their own production, and they chat among themselves, too.

The data picked in the sessions of the students' interaction in these environments are registered and analyzed. They interact and use the ARTEDUC site as their electronic folio.

The site Arteduc http://www.penta.ufrgs.br/edu/telelab/arteduc/inicio.htm besides facilitating immediate access to several sites of interest for people involved with art teaching/learning has links that are specific about subjects to art teaching in a post-modern world and for the Virtual Interactive Workshop.

Students' interactions with the on-line material in electronic addresses (museums, digital artists, art schools, and others) that foster work in art education lead to a development of concepts favoring aesthetic perception.

Students' art production is done with softwares such as Corel Draw, Corel Photo Paint and the use of the available hardware in the laboratory including scanner, printer and plotter.

All students have their own individual directories in the hard disk. We use the process-folio approach, where all the student's work is saved and a part of the process to be evaluated. These folios are made up of graphic works they make, material they research on the Internet, reflections regarding their own production, projects they write and send to their peers. Students go through their production and make up their own personal folders and include a reflection about it.

Outcomes:

Some of the expected outcomes present some partial data up to now. It can be observed, starting from the production of the students that take part in the research group that:

There is an increase in the awareness processes related to the works of the universal culture which can be accessed in the world wide web - Internet.

The computerized telematic environment facilitates and helps, through its wide access, the analysis and the taking up of decision regarding the choice of works for the development of the art works.

Students appropriate with dexterity of the works on the net and they work on transformation processes, which includes deconstruction, construction and reconstruction of works. The students' own local cultural products are shown integrated in the reconstruction processes and outcomes.

These environments and the possibility they offer of exchanging information with students from other towns and countries seems to increase the feeling of citizenship.

Students seem to be able to grasp the new possibilities offered by the computerized means and of the processes that they make possible. This gives birth to what has been called the planetary hypersubject who transcends the mere technological system of connections.
The work accomplished by the students using the electronic mail and sites of the Internet shows that there is an understanding of the dimensions of the communicational neotechnologies.
The interaction in the computerized environment seems to favor the development of cognitive processes which engender creative thinking.

ALICE - *a case study:*

Girl - 12 years old - 6th grade. Public school. No experience with computers before starting classes in the Virtual Interactive Workshop Project.
In the 1st and 2nd classes she makes *scribbles* on the screen with the mouse and in the 3rd one she starts drawing a human figure.
In the 5th class the design of the human figure is getting to be more complete.
In the next classes she prints some pictures of Sandy Skoglund's work displayed on the Getty site.
As a next step, she makes interferences on these images on the screen changing the background and the form colors.
After a field trip to some of the town's landmarks, Alice designs a simple form of construction that she names: the Grape Festival Pavilions, (a traditional Fair in town) to which she applies resources of the software and obtains very interesting overlapping effects.
From the 38 to 40 classes, besides the gray scale of tones, she works on a whole set of images of the house which changes into different geometrical forms and she uses distortion.
In the 43 and 44 classes she goes back to the theme of the house, naming the file *Stone*, as a reference to the *Stone House*, a tourist attraction that she visited in her town and makes 7 works using the same theme. She applies effects and modifies her own work changing the color, the textures, the form, and so on.
This girl, who started in the project doing *computer scribblings*, a conduct which we have identified in our Master's dissertation: *The Graphic-Plastic Development of Children in Interaction with the Computer*, shows a new attitude facing her work in a real researcher manner. She accomplished, in the 63rd class, 8 works during the period of the class, always looking for new graphic solutions for the same work. These works show *the reconstruction and development of a critical vision, and the possibility of the students to live the conflict among the several solution alternatives in a computerized environment.*
At first, Alice's initial drawing of the house revealed a very simple front view form, not even going into any tridimensional perspective. Later on, this is reached through the effects that the software presents which she got to when looking for new possibilities.
This large number of attempts seeking for new solutions of problems leads us to believe that these digital environments favor the search for divergent answers.
We have also observed in this study the fact that to work on an image and try another way of representation from the same original work, without affecting its original form, which can be saved untouched, seems to help the processes and start a delightful and intense experimentation.
The hypertextual availability of the environment as well as the multiple choices of the graphic software allow students to take up their own decisions thus constructing new possibilities.

Conclusions:

New technologies bring about anthropologic changes. These can be identified in the re-presentation of objects, the simulation of something that does not exist, and in that new ways of communication that bring about change in the educational processes.
In which ways do these changes affect our object of study?
Will these processes be able to help develop potentialities such as perception, imagination, observation and sensitivity?

Will they foster new ways of knowing and new ways of constructing meaning?
Can the processes of imagery reconstruction, spatial re-organization be improved in the digital world?
Certainly we cannot think of a synchronous education without contact with the outside world anymore but we also cannot accept an asynchronous education in the traditional ways. Thus, research in this field must be continued.
We don't have answers to all these question yet., but we do have a lot of questionings to conclude.

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Fostering Equity in Pre-College Computing Classrooms

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Abstract: Project *FOCAL* Point is a multi-strand project designed to increase female participation in the computing sciences. The project targets two crucial groups: high school computing teachers and female high school students. Features include a two-week teacher workshop, where teacher participants are introduced to technology-related gender issues and collaborate to develop female friendly technology lessons, and a one-week Computer Camp for Young Women, during which teacher participants hone their gender equitable teaching skills. This paper focuses on the teacher participant responses and reactions to the two-week teacher workshop.

Few people doubt that technological skills will become increasingly important as our country enters the 21st century. In view of the high percentage of Caucasian males currently employed in the computing fields and ongoing concern with affirmative action, businesses continue to seek out qualified women and people of color. However, despite acknowledged career opportunities and known financial advantages, these groups continue to be under-represented in the professional work force and in technology-related post-secondary education. The nation suffers, too. Currently, there is a critical shortage of information systems professionals, a shortage that is expected to escalate in the near future at least. We simply cannot afford to have a major source of talent remain largely untapped.

Project *FOCAL* Point Implementation

Concerned educators must question the reasons for the continued gender imbalance in the computing fields and search out avenues for addressing the equity problem. Project ***FOCAL*** Point is one such avenue. The project seeks to get more females into the educational pipeline by working with two essential groups: pre-college computing teachers and adolescent girls. This paper focuses on the first group.

Specific project objectives as related to the teacher participants are to:
1. Acquaint teachers with gender issues as related to computing.
2. Help teachers become aware of unconscious biases they may possess regarding the culture of computing.
3. Introduce teachers to instructional practices known to appeal to women and girls.
4. Provide teachers with technology-related content knowledge and skills.

The detailed objectives were addressed mainly through a two-week summer workshop. Two cohorts of teachers participated in the summer workshop, 7 teachers (4 men and 3 women) in 1998 and 13 teachers (3 men and 10 women) in 1999. The first cohort was composed almost exclusively of senior high school teachers; the second cohort was composed almost exclusively of middle school teachers. All volunteered to participate in the project, and all reported that they taught technology-related education in their home schools.

The first goal of the workshop was to expand the teacher participants' computer comfort zone and to help them identify more positively with the computer culture, so that they might more effectively teach all their students. The second goal was to acquaint them with features that render a lesson more female-friendly, so that they might more effectively teach their female students.

The first week of the teacher workshop was a blend of training in gender issues, computer and information systems concepts, and computer and network applications—with some portion of each day devoted to each dimension. Workshop instructors incorporated a variety of active and constructive instructional strategies and delivery methods, modeling the teaching behaviors we hoped to inspire. During the second week of the workshop, teacher participants tested their female-friendly technology lessons with middle and high school girls attending a Summer Computer Camp for Young Women.

Activities designed to raise awareness of gender bias ranged from drawing a computer scientist to developing sensitivity to gender-biased language. The active learning experiences were designed to arouse awareness of gender issues as well as inform practice directly. Guest lectures, videos, and workshops rounded out the exposure to gender issues. A concrete models workshop (where groups work together to write directions for constructing a Tinkertoy machine) conducted by the authors, for example, has repeatedly revealed consistent (and disturbing) patterns of male-female interactions and role choices when mixed gender groups work to solve a technical problem.

As enhancing teacher participants' skill and knowledge of computer and network applications is a major project objective, the teacher participants early learned to navigate the university network. Next, they practiced with the university's e-mail software and basic Internet searching. Workshop instructors stressed the importance of locating gender-related web sites and evaluating sites and information relative to their appeal to girls or women. During the first summer, all teacher participants learned the basics of web page production. The second-summer curriculum was more varied; options included several programming languages, word processing, and presentation graphics as well as web page development.

Specifically, the evaluation study of Project ***FOCAL*** Point attempted to answer the following teacher-related questions:

- What changes in computer attitudes did teachers report as a result of their participation in Project *FOCAL* Point's two-week teacher workshop?
- What changes in computer skills did teachers report as a result of their participation in Project *FOCAL* Point's two-week teacher workshop?

The Computer Attitude Scale (CAS) was used to measure changes in computer attitudes. The 40-item CAS has been shown to be valid and reliable (Loyd & Gressard, 1984; Loyd & Loyd, 1985). The CAS is composed of four 10-question sub-scales designed to measure computer anxiety, confidence, liking, and perception of usefulness. The mean for each sub-scale could range from a low of 10 to a high of 40. Items on the CAS with negative wording were re-recorded so that for all items, a higher item score indicates a more favorable attitude. The teachers completed the CAS on the first day of their project participation and again on the last day of the summer program.

Changes in skill levels are based on self-report. Data for the skill-related questions were collected on a daily basis as the topics were covered during 1998 and on the last day of the two-week workshop in 1999. As the format of the teacher workshop changed dramatically from 1998 to 1999 (a product of our formative evaluation), the two samples cannot reasonably be combined. Moreover, the small sample size of each cohort precludes inferential statistical analysis. Hence, the cohorts are reported separately, and the analyses are limited to descriptive statistics.

Evaluation Study Results for Cohort One

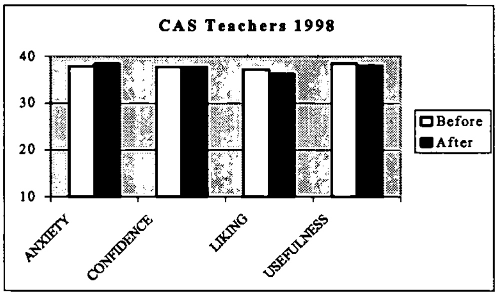

Figure 1. CAS Results Cohort One

The results for the cohort one CAS are shown in Figure 1. Given the high initial scores (means of 37-38) and the audience, we did not anticipate dramatic changes; that expectation was borne out. The mean for computer anxiety increased slightly and the mean for computer confidence remained constant. In contrast, the mean for computer liking and usefulness decreased slightly. The individual teacher results for the computer usefulness sub-scale are shown in Figure 2.

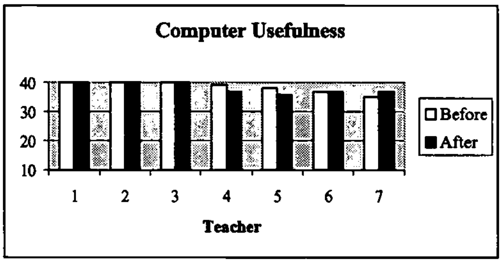

Figure 2. Individual Results—Usefulness Sub-scale

The declines, however slight, surprised us and prompted further analysis. Some of the decline (or lack of increase) might be attributed to the teachers' expressed difficulty in reading the negatively worded questions. For example, Teacher 4 strongly disagreed with the statement "Computers will not be important to me in my life's work." (a question in the usefulness sub-scale) on the pre-test and strongly agreed with the statement on the post-test. Although it is possible that the two-week workshop effected such a dramatic negative change, it seems unlikely. A more plausible explanation is that the participant misread the question.

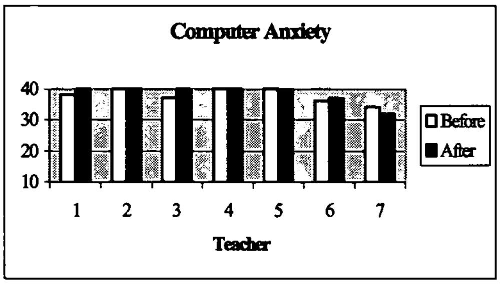

Figure 3. Individual Results—Anxiety Sub-scale

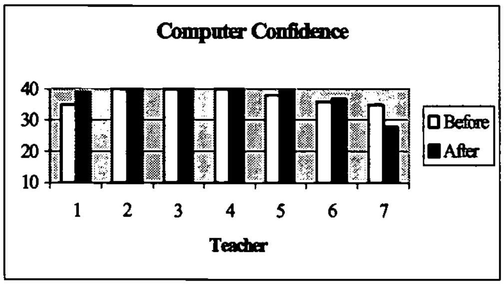

Figure 4. Individual Results—Confidence Sub-scale

The results of the anxiety and confidence sub-scales are shown in Figures 3 and 4. Examination of the data shows that six of the seven teachers uniformly responded positively on both sub-scales, with many scores placed at the maximum possible. The results for computer liking sub-scale are shown in figure 5. Note that other than the small dip for Teacher 4, the results are uniformly positive—again except for Teacher 7.

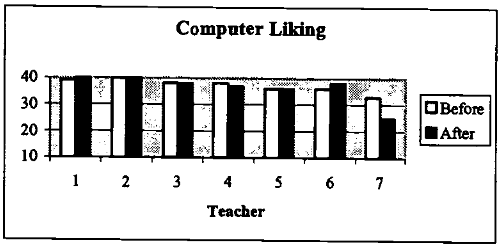

Figure 5. Individual Results—Liking Sub-scale

Teacher 7 was a Technology Education teacher, who by had done little with computers except for AutoCAD prior to his participation in the workshop. By his own admission, he found himself challenged with the content and the notion of teaching that content during the camper week. He, in fact, opted out of teaching web page development to the campers in his "class," teaching them instead to use AutoCAD. This teacher's experience prompted a change in the format of the second workshop. In 1999, teacher participants worked in teaching teams rather than each participant having his or her own "class" of two or three students.

The teachers were asked to complete a self-assessment of their computer experience on the first and on the last day of the two-week workshop. Figures 6 to 9 show the before/after difference in reported computing experience levels. A comparison of the before and after means show that perception of electronic mail and web

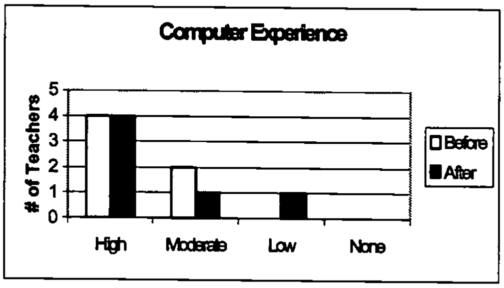

Figure 6. Computer Experience

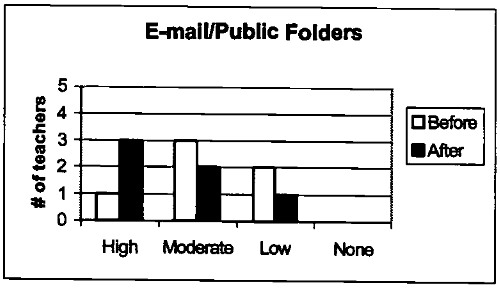

Figure 7. E-mail/Public Folders

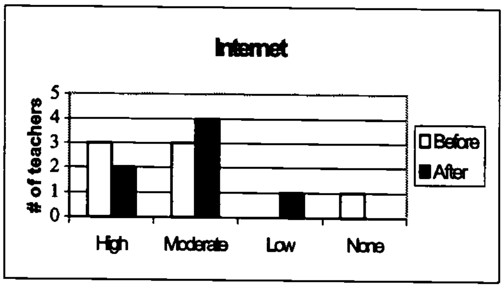

Figure 8. Internet

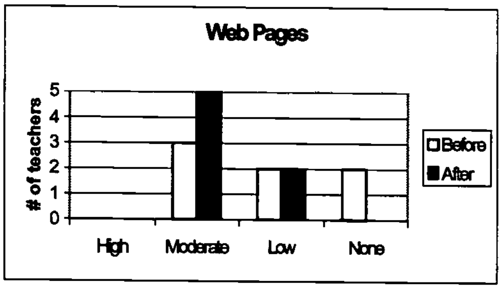

Figure 9. Web Pages

page development experience increased dramatically. The latter statistic is not surprising since five out of seven teachers (71%) had not constructed a web page prior to their participation in the summer workshop. Ability with Internet searching increased slightly, and assessment of general computer experience dropped slightly. Since perceptions of experience were (unnecessarily) tied to other project evaluations and therefore reported anonymously, it is not possible to definitively attribute the dip to Teacher 7. It is possible to hypothesize that he overestimated his experience level before he observed what others were doing.

Not surprisingly (given the audience), 83% (five out of six teachers) of the respondents agreed or agreed strongly to use e-mail in their teaching. More interesting would be the reasons for the lone respondent who responded in the negative. The teachers astutely observed that "some female students might not want to ask the

questions in person, but they would ask questions through the e-mail." The authors add that this observation is probably true for more reticent males, too. From these responses, it is possible to conclude that e-mail will play an important role in the future teaching of the respondents. Five out seven teachers, (71%) responded that they wanted to use Internet searching in their classroom.

Evaluation Study Results for Cohort Two

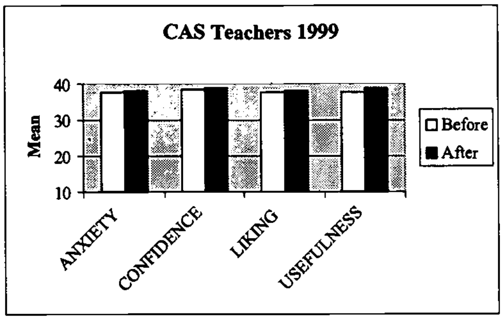

Figure 10. CAS Results Cohort Two

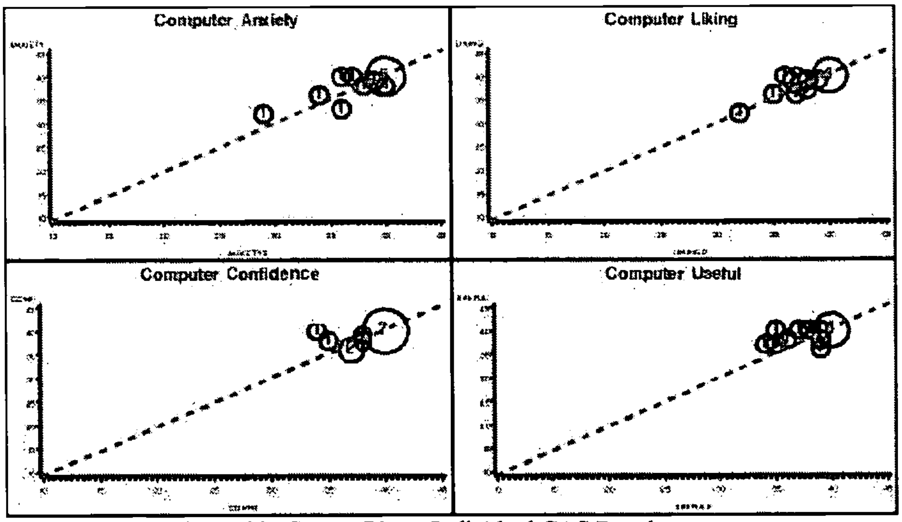

Figure 11. Scatter Plots–Individual CAS Results

Figure 10 shows the aggregate picture for the scores on the CAS. The high initial responses all increased over the two-week span of the workshop. The scatter plots of the individual responses suggest that a ceiling effect was in place, with the majority of the scores clustered near the maximum score of 40. Moreover, almost all scores fell above the reference line, indicating a higher post-test score than pre-test score.

As indicated earlier, the format of the 1999 workshop varied from that of 1998. During the inaugural year, all participants studied and taught the same topics (with the exception of the lone teacher who taught AutoCAD). In 1999, all teacher participants were introduced to the university network and email software during the introductory sessions. Thereafter, they worked in small groups; each teacher participant studied and taught two classes. The results for the small group instruction is reported in table form rather than charts as the small numbers render the data easy to interpret.

The level of email experience is shown in Figure 12 and the comfort level of teaching email is shown in Figure 13. The movement out of the "low" category is heartening, especially as reported in the participants' comfort level with teaching the topic. Moreover, eight participants strongly agreed and four moderately agreed with the statement that they would use email in their teaching.

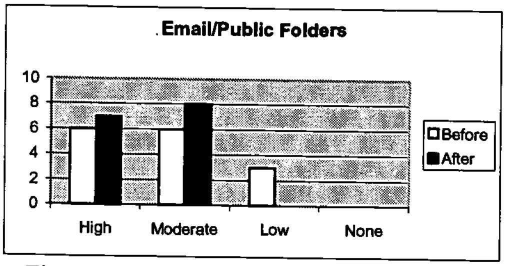

Figure 12. Email Experience

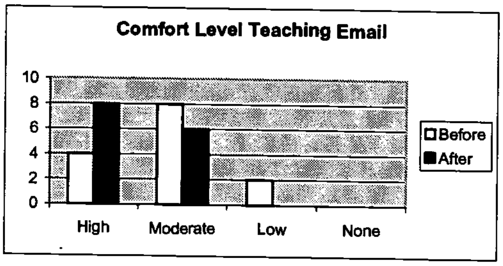

Figure 13. Comfort Level Teaching Email

Skill/ Experience Level	Before				After			
	High	Moderate	Low	None	High	Moderate	Low	None
C++		1			1			
HTML			2			2		
Visual Basic		2	1			3		
Word	2		2		3	1		
Internet	2	4			4	2		
Web Page	2	1	3	1	2	4	1	
Power Point		2	1			3		
LegoLogo	1	1			1	1		

Table 1. Level of Skill/Experience

Comfort Level Teaching	Before				After			
	High	Moderate	Low	None	High	Moderate	Low	None
C++		1			1			
HTML		2				2		
Visual Basic		1	2		1	2		
Word	1	1			2			
Internet	3		2		5			
Web Page		2	3	1	1	5		
Power Point		1	2		2	1		
LegoLogo	2				2			

Table 2. Comfort Level Teaching

The movement completely away from the "low" and "none" categories and into the "high" category is encouraging. Moreover, 19 respondents strongly agreed and 4 respondents moderately agreed that they would incorporate the topics they studied and taught in their instruction. In conclusion, we believe that the data support the hypothesis that the workshop enjoyed some success in accomplishing its objectives.

Major funding for Project ***FOCAL*** Point is provided by National Science Foundation Programs for Gender Equity grant HRD-9711023.

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EDUCATIONAL COMPUTING COURSE

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Many of the teacher education programs are facing great changes in what pre-service teachers are taught, how they are taught and what is expected of them. These changes are affecting all subject areas, but none more than the educational computing course. NCATE standards are leading the teacher education programs to an integration of the technology in the methods courses and the subject areas themselves, which would lead to the end of a separate computing course. During this transition period, though, many innovative approaches to the computing course are being implemented across our country, and others, as colleges search for effective models for restructuring the educational computing course.

In the NCATE report "Technology and the New Professional Teacher:

> Preparing for the 21st Century Classroom," (1997) available online at http://www.ncate.org/projects/tech/TECH.HTM, it is asserted that "teacher education programs should pay careful attention to the National Standards for Technology in Teacher Preparation, developed by the International Society for Technology in Education (ISTE). ISTE recommends that all teachers acquire competencies in basic computer/technology operations, in personal and professional uses of technology, and in the application of technology for instruction. Few, if any, teacher education programs are currently meeting all of these standards." The teachers of the future should be fully prepared professionals. "This will require new understandings, new approaches, new roles, new forms of professional growth, and new attitudes."

Several of the papers in this section reflect the changes that are being made in the teacher education programs and how they are impacting the educational computing course. The first paper by Wiencke and Ekhamel, "Insuring the Future: Development of an Exemption Exam for an Introductory Educational Technology Course", describes the streamlining of the certification process and integrating technology into the courses. By allowing the students the opportunity to take an exemption exam, additional options in their course of study can be provided.

The second paper by Ring and Foti, "How Can We Help Johnny Compute?", contends that students entering the computing course now are more advanced in their technology skills and that we are teaching them what they already know. Because of the students' more advanced skills, the educational computing class should be more context-based around conceptual themes so that the teachers can develop technology-rich lesson plans.

The next two papers speak of specific changes that need to be made to the educational computing course. In "Technology for Pre-Service Teachers: What is It?", Bailey tells of the required course in their program that was reduced to one hour and that the students were expected to have certain technology skills before entering the course. The first trial semester of this changed course allowed the college to confirm topic selections and identify "areas of refocus, better preparation, simplification, and, best of all, political tensions". In "Preparing Pre-Service Teachers to Use Technology to Teach the Content Areas in Elementary Schools," Bhattacharjee and Chen describe the technology component for their teacher education program as being composed of five three-hour workshops and a development of an instructional unit by each student. This approach provides "intensive hands-on practice with technology applications in the classroom".

The next two papers deal with the theory in the educational computing course. In "The Impact of Theory on Technology Use in the Classroom," Fulton, Couros, and Maeers describe a graduate class whose purpose was to create a "theoretical model that could drive and reflect appropriate ways for technology use in the classroom". This model delineated the characteristics of the role of the teacher, the role of the student, the subject matter and the environment. In "Constructing Technology-Based Constructivism: A New Approach to the Educational Computing Course," George and Sparrow tell of the drastic changes that were made in the course that allowed students to be much more responsible for constructing their own knowledge about technology and its uses in the classroom.

The next paper by Jin and Nasara "Collaborative Team Teaching Approach in a Technology Course", depicts an experimental team teaching experience in the educational

computing course. The purpose of this was to "reduce the frustration of students who had limited experience with technology, to enhance advanced students according to their level, and to provide better learning environments through access to various types of technological equipment and groups".

To wrap up this section on the restructuring of the educational computing course is the paper by Ropp and Brown, "Beyond Applications to the Essential Processes of Technology Integration: Designing an Educational Technology Course to Reflect ISTE Standards and to Model Best Practices for the Future". They restructured the course based on the ISTE recommended foundations in technology for all teachers. The course is based upon the three major themes with a macro-view, reflective papers, projects and discussions that all lead to a continued integration of technology based upon the best practices modeled in the course

The next paper by Swain and Ring, "Integrating Electronic Portfolios into Undergraduate and Graduate Educational Technology Courses at the University of Florida", asserts that use of portfolios will change the way we teach and how the students learn. "Students begin to realize that learning is an on-going process that does not necessarily conclude with a test or a course". Educational technology is about teaching and learning, not computer applications. Students have to reflect on creating portfolios as well as their learning processes and progress.

The next two papers, "Teachers' Comfort Level, Confidence, and Attitude toward Technology in a Technology Course" and "A Comparison of Student Teachers' Attitudes Toward Computers in On-Line and Traditional Computer Literacy Courses: A Case Study" both report findings comparing two different approaches to the educational computing course.

The next paper " What are we Talking About? The Impact of Computer-Mediated Communication on Student Learning" reports the results of a study done to see if on-line discussions can affect the learning outcomes for students involved in distant learning activities. And the last paper in this section, "Information System Design of Undergraduate Education: Combining Lectures with Practice", proposes that more hands-on experiential learning be provided to help students design and implement systems in the business world.

Insuring the Future: Development of an Exemption Exam for an Introductory Educational Technology Course

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Abstract: Colleges of Education are under pressure to make their programs more efficient while insuring that graduates are competent in an increasing number of areas. The College of Education at the State University of West Georgia established an introductory technology course for all teacher education majors to provide needed background in instructional technologies and classroom integration strategies. Although feeling the same pressures to streamline their curriculum as other teacher education programs, West Georgia decided to allow students familiar with technology to exempt the course and take alternative courses, rather than make the technology course optional. It was anticipated that a large number of students would take advantage of this opportunity. However, this has been far from the case. Although the test is well publicized, few sign up for it; of those that do, only a small percentage actually sit for and pass the exam.

Introduction

Colleges of Education are under pressure to make their programs more efficient and at the same time insure that their graduates are competent in more and more areas. This dichotomy of purpose is also apparent in many institutions' decision to eliminate the instructional technology courses to streamline their programs, while national studies show a woeful lack of technology competency in today's teachers (Solmon, 1998). The need for teachers to be proficient in computer skills has long been recognized. A 1986 National Assessment of Educational Progress (NAEP) study, *A Framework for Assessing Computer Competence: Defining Objectives* noted that "some students know more about computing than their classroom teachers" (NAEP, 1986). It is an accepted fact that proficiency in computer use is an increasingly necessary skill as our world becomes more technologically dependent. Thus the need for teachers to be computer proficient is greater than it was thirteen years ago and will be greater still for years to come.

The College of Education at the State University of West Georgia established an introductory technology course for all teacher education majors to meet the needs of our graduates. This survey course provides students with a background in various instructional technologies and classroom integration strategies. Feeling the same pressures to streamline their curriculum, West Georgia decided not to eliminate the course but to provide an opportunity for students familiar with technology to exempt it. Those exempting the course would be able to take additional classes in their content area. This presentation will provide an overview on how the course and the accompanying exemption exam was created and implemented, as well as its success in providing students additional options in their course of study.

Since early 1980s, the College of Education at State University of West Georgia had traditionally taught two technology courses, an introduction to computer utilization and a basic instructional technology course (both required)

Special Education programs. Like many states, Georgia began limiting the total number of credit hours in its undergraduate programs to a maximum of 120 hours. In addition, the Board of Regents, responding to both internal and

of content courses required for middle grades and secondary education majors. In response to these required

Educational Technology", and is required for all students entering a teacher education program.

Although combining the two courses reduced the total credit hours, there was a common perception that such a course probably was not really necessary because many students entering college had already acquired the necessary skills during their secondary education. There were further discussions between the College of Arts and Sciences and College of Education faculty and administrators to allow particularly the Arts and Sciences students taking secondary education certification courses in the College of Education the possibility of exempting the introductory course if they had the necessary skills. Students who obtained a satisfactory score on an exemption exam could reduce their total number of hours or replace the technology course with an additional course in their content area. Students in the College of Arts & Sciences would reduce their total course load by passing the exam. However, College of Education students would be required to take another course to replace the credits lost.

In addition, there were concerns by the College of Education faculty, particularly in the Middle Grades program that their students needed to have the necessary computer and presentation skills prior to taking their methods courses. They were convinced that only a few students entering their program would have the necessary technology skills. The faculty wanted to make sure that specific skills and knowledge were covered in an introduction to educational technology course and that students should only be released from the requirement if they proved their abilities through an evaluation procedure. Consensus was achieved on this need, and an exemption exam was developed based upon the topics covered in the course.

How the Course and Exam Were Developed

Media and instructional technology faculty teaching the technology courses were asked to develop the new introductory course and its exemption test. Meetings were held to review the new course objectives and content based on the International Society for Technology in Education (ISTE) Technology Standards for Students (ISTE, 1998). It was also agreed that the knowledge, skills, and attitudes to be conveyed in such a course not only should help the students to succeed in their future profession, but also would provide support in other courses in their teacher training program. Additional meetings were held to involve the faculty who teach the methods courses in the College of Education in the development of the course to insure that the needs of their programs were met.

Topics covered in the course include, Windows operating systems, email, list servers, online resources, word processing, data base development, spreadsheets, and presentation software. Although specific skills in the use of these technologies are covered, the integration of these technologies into the curriculum is also emphasized. Course assignments are primarily project based requiring the students to demonstrate their ability to use the programs.

Exam items were designed to emulate the projects assigned in the course. This was achieved in all areas except in the use of email, list servers, and curriculum integration strategies. Competency in these areas are evaluated through short essay questions that form the written portion of the word processing section. Examinees are given a time limit of four hours to complete the exam. The following are examples of how the competencies are evaluated in each of the topic areas:

- Operating Systems - Examinees are given two flexible disks. They must format the disks, create a folder (subdirectory) and copy specific files from the hard drive of their computer to specific areas of the flexible disk. All the remaining projects are saved to the disk. At the end of the exam, the examinee makes a backup copy using the second disk.
- Online resources - Examinees are given topics on which to obtain information through online resources such as ERIC, library catalogues, and the Internet.
- Word Processing - Examinees are given specific format requirements for margins, fonts, headers, and footers to evaluate their word processing skills while completing the short essay questions on email, list servers, and integration strategies.
- Data Base - Examinees are given a set of data and are required to create a data base with sufficient fields and records to hold the information. In addition, reports are generated to answer specific questions based on the data provided.
- Spreadsheet - Examinees are given a budget and a list of items to purchase. They must create a spreadsheet to itemize the expenses and show a running total and balance.

- Presentation - Examinees are given information about a specific topic. They must create a *PowerPoint* presentation covering the information provided. There are specific requirements for the design of the presentation and how the show should be displayed.

To confirm the validity of the exam, the final draft of the exemption test was reviewed by the dean of the College of Education, selected COE chairs and faculty representing the various departments, adjunct instructors teaching the course, and a professor of business education who teaches technology specific courses.

How the Exam is Administered

The exam is offered twice a semester during the Fall, Spring, and Summer terms. The selection of the dates corresponds with advisement periods to allow students to use the results when planning their schedules. It is always given on a Saturday to avoid conflicts with students' classes and courses that use the school's computer lab. The exam is widely publicized by posted flyers, advisement by student's consolers and announcements in classrooms. In addition, criteria for each section of the test is made available to potential test takers in the school's resource library.

Since the exam is entirely performance based, the number of students who can sit for the exam is limed by the number of computer stations in the lab. To insure that all examinees will have a workstation, students are required to register for the test with the Media & Instructional Technology department. The contact information is also used to remind prospective test takers of the date, time, and location of the exam.

How the Exam is Graded

The exam was designed to follow as closely as possible the projects assigned in the course. Each section is evaluated as a separate project and assigned a grade based on the number of correct responses and/or actions. The section grades are then averaged to establish a final grade.

The passing score for the exam was originally set at 85%. The rationale for this decision was that students needed more than a minimal score: a high "B", to show enough competence to exempt the course. After administering the exam twice, this minimal score was lowered to 80%. This was done to better reflect the passing rate of students in the course, than to increase the passing rate on the exam.

To date, approximately half (53%) of the students who sat for the exam have passed it. About a third of those who were not successful quit soon after the exam began when they saw the items to be covered.

Outcomes

At the outset, it was anticipated that a large number of students would take advantage of exempting the course. However, this has been far from the case. Although the test is well publicized, few sign up to sit for it, and of those that do only a small percentage actually show up. Typically, three students a session, six or seven a term, actually attempt the test. A survey at the beginning of the semester of students who enroll in the course has shown that many believe that they have the necessary skills in word processing and email but lack knowledge of the other areas covered in the course. There is a good possibility that the perception that students come of college already prepared with technology skills is false and that a course in technology should remain in the program of studies.

Feedback from those who signed up but failed to participate revealed that some, after reviewing the published criteria, decided that they did not have the necessary knowledge to pass the test. Others cite the inconvenience of spending four hours on a Saturday on such an endeavor. However, a more important factor for College of Education students seems to be the requirement that they take an additional course to replace the credit. They feel that knowledge of technology will be beneficial and if they have to take a course anyway, it should probably be in instructional technology.

Conclusions

The 53% passing rate indicates that the exam is sufficiently difficult to insure that those passing have an understanding of the subject matter and skills covered in the course. However, the exam is not providing the anticipated option for students to open their class schedule to take additional content area courses. It is unclear from the information we currently have if participation would increase if students who passed the exam would not have to take an additional course. Additional publicity is planned before the next administration in an attempt to obtain more participation.

The additional possibility, reflected from the survey results of students in the course, is that the students entering college do not have the necessary skills to exempt the class. The original perception of that students are acquiring a strong background in technology while in their secondary program is false. The tentative conclusion is that technology must not be lightly dismissed as an unnecessary component of a teacher preparation program in an attempt to balance the credit load scales. An exemption exam seems a viable alterative to omitting such courses.

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How Can We Help Johnny Compute?

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Abstract: Given the rapidly changing field of Educational Technology, it is difficult to maintain a course curriculum for very long. In this paper we use data gathered from our own experiences teaching introductory educational technology courses as well as the experiences of our colleagues. Although we are constantly updating and revising our courses, there is evidence that our efforts are falling short due to an overemphasis on "hot" technologies. This article reviews changes being made in college courseware and research related to the skills of entering students. In addition, we suggest an alternative way of addressing technology skills development.

Introduction

Students are entering our undergraduate classes with much more computer knowledge than ever before. In a recent study of preservice teachers enrolled in an introductory educational technology course 92-98% of college students reported word processing, sending email, and doing web research as simple tasks, while design and programming were rated as being more difficult tasks by at least 80% of the students. (Foti, & Ring, 1999) This study prompted additional questions such as: What are we teaching our college students? Are we (college professors) teaching our students what they already know? How are our courses changing to address the needs of a changing student population? Are these changes appropriate?

What are we teaching our students?

After completing an informal review of educational technology courses' syllabi on the world-wide web, conducting a survey of educational technology professors, examining proceedings from several educational technology conferences, and surveying undergraduates in our Introduction to Educational Technology course over a four year period, we have concluded that educators are duplicating their efforts in many K-12 curricular areas, while avoiding others. In other words, we are teaching our students what they already know (web-related skills), and overlooking topics such as progarmming, design, and issues related to the future. This means that students are entering college with a basic understanding of email and the internet, yet, lack a basic understanding of more difficult tasks such as data structures, databases, and design. Once reaching college, the problem continues. Whether it is because the web is on everyone's mind, or that it has a high "cool" factor, college instructors seem to be focusing on web-related skills that are often already embraced by their students. In addition, our education classes are not addressing 21st media-related issues that students may encounter in their classrooms such as cognitive overload, conceptual addiction, and issues related to privacy.

For example, it is quite clear that students know how to use a word processor, yet we continue to teach word processing. Databases seem to be taught superficially even though a deeper understanding of databases, and information manipulation will become an important 21st century skill. The Office of Technology Policy reports (1999) that the ability to access, manipulate, synthesize, and evaluate

information, is a necessary skill for the job market of the 21st century. Virtual representations are becoming more commonplace in schools and businesses, however, many educational technology courses are not attending to design skills.

According to Seymour Papert (1996) the content of the typical computer literacy curriculum is a grab bag of superficial knowledge about the parts of a computer and current office software selected primarily because it is easy to teach with very limited numbers of computers. Our research confirms his statement. It appears that most introductory courses are addressing skills development using productivity software, but that these courses are not concentrating on learner-centered goals. Although learning how to build a web page is important, our curriculum must include more than skills development.

Are we teaching our students what they already know?

"As millions of college students head back to campus, only 23 percent report using the Internet for games and/or chat while more than triple that many - 71 percent - use it to conduct research for academic or business needs" (Becker, H. & Reil, M, 1999). Yet, we continue to teach college students how to e-mail, type a letter, and use the Internet. In her 1998 study Janet Pollack reported that "Fully 75 percent of the males and 90.9 percent of the females in the sample reported logging on for e-mail at least once per week." According to Pollack: "a well-wired campus with clusters of discipline-dedicated computer labs, several public computer labs and fully-mediated auditoriums may mean that students who have spent three or four or even five years in the midst of this new technology may only be making the most rudimentary use of it" (1999). Our research confirms her findings, as Figures 1 and 2 below indicate. While technology educators must make sure that our courses evolve, we must also ensure a balance between fundamental productivity prowess, communication capability, and the development of vision in our students.

How are our courses changing to address the needs of a changing student population?

Over the past several semesters, we have made a number of changes to our introductory educational technology course. According to our research, ours is not the only educational technology curriculum that is undergoing change. Professors responding to our questionnaire confirm changes in their curriculum, commenting that: "we plan to drop instruction in the email system," and "we model both the Mac and Windows platforms." Many of the courses surveyed have an online component which supplements the course, while others have developed a distance introductory course taught almost entirely online. While many courses continue to teach word processing, a number of the courses have added a mail-merge segment which integrates databases into the word processing assignment.

Just two years ago many of the introductory educational technology courses surveyed taught students about the Internet, and how to surf for information. Now, 90 percent of the courses surveyed are requiring students to make personal webpages. Given the fact that many students have created web pages on their own, it would seem that a more profound change in curriculum is required. Courses must begin to address 21st century concepts such as context, collaboration, communication, and problem solving. (Clouse, 1997; Thornburg, 1997)

Why should our courses continue to change?

Our research shows that entering college students are showing little or no improvement in several key computational areas. Figure 1 compares the percentage of students finding the following activities difficult in Fall 1995 and in Fall 1998: designing a simple presentation, creating an interactive game, creating a interactive (non-linear) presentation, creating a digital video, and writing a computer program.

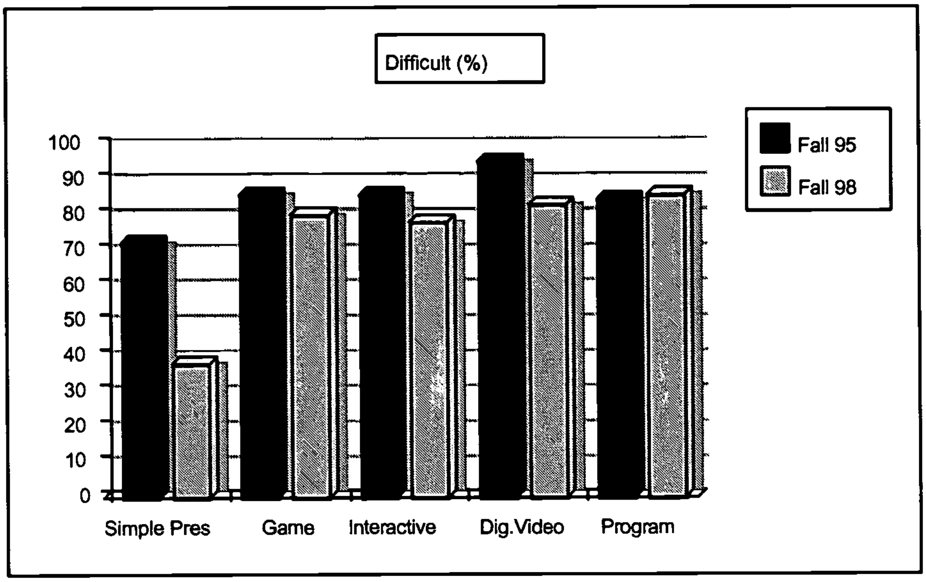

Figure 1: Percentage of entering students rating presentation and programing tasks difficult to perform

As can be seen, with the exception of creating a simple presentation, very little progress has been made. By comparison, consider the gains made in internet related topics: using the internet for reference, acessing information, shopping, finding music, and sending e-mail (See figure 2).

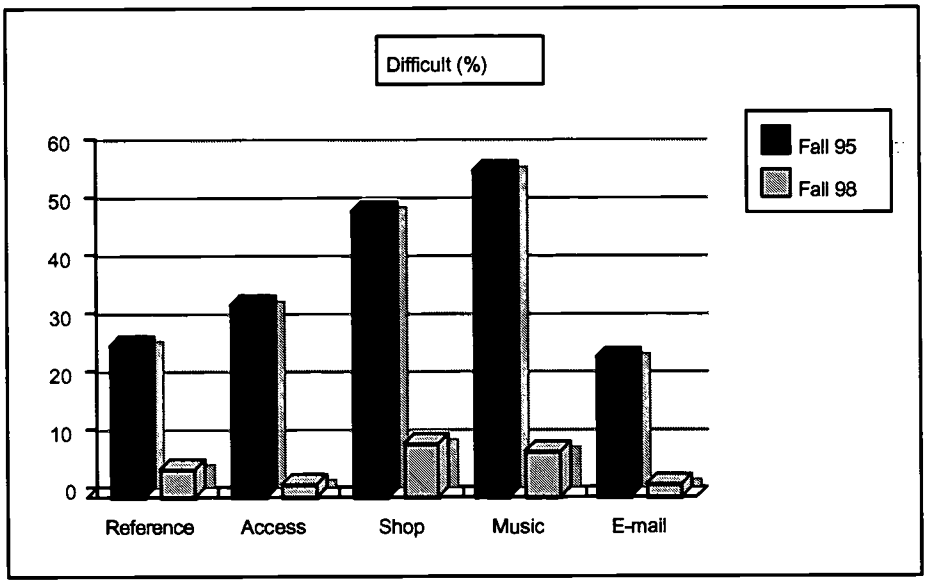

Figure 2: Percentage of entering students rating web-centric tasks difficult to perform

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How should our courses change?

Because students are entering our classes with more technological knowledge, we can begin to focus more on context-based scenarios. Current curricula in subject areas such as science and social studies frequently attempt to cover as much content as possible, regard all content as equal, and divide content into artificial categories that bear little relationship to how individuals use content in the work beyond school (Fennimore and Tinzmann, 1990). By working with conceptual themes drawn from under-represented areas of the curriculum, technology instructors can develop technology-rich lesson plans that support "the disciplines" and simultaneously focus on technology and media understanding.

By modeling teaching using technology-rich lessons, multiple perspectives, and ill-structured knowledge domains, we illustrate new approaches to teaching and classroom management. Students take part in activities which involve problem-solving in a real-world sense. Properly constructed, lessons illustrate that there are multiple solutions to problems, and that technology may provide unique pathways to some of those solutions. In addition, the lessons do not attempt to usurp other forms of knowledge acquisition or development.

Is it possible to teach technology skills, procedures, and applications in a highly contextual setting? We think so. While examining a single core concept, multiple investigations may be established which use varying methods of inquiry. Each perspective may pose a unique problem, or research question. The student must solve the problem, do the research, undertake the activity, or do whatever is appropriate to fulfill the requirements of the investigation. Appropriate methods might include interviews, reviewing literature, charting statistics, building a model, recreating a historical scenario, running a simulation, etc. Then, the student (or group of students) must decide how to communicate the findings to the class or larger group, using appropriate media strategies. Ample opportunities for applying databases, spreadsheets, drawing programs, animation programs, programming languages, and other software applications exist in this learning environment. By putting the education back into our technology courses, we can provide students with models of instruction that assume technology rather than targeting it. In other words, we can help our students understand how teaching with technology works, rather than teaching them only how technology works.

Summary

Agreement on an appropriate model for a K-16 curriculum seems to be escaping us. Technology teachers across the grades seem to be focusing on similar skills, rather than making sure that students are competent in many areas. In particular, design and programming skills seem to be poorly represented in our curricula, in favor of reference and communication skills which students may be learning on their own. School districts and colleges must attend to the skills and processes required to make students better problem solvers given the assist technology brings. We believe this can be accomplished by creating a dovetail between content and pedagogy in an environment where technology is assumed.

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Technology for Preservice Teachers: What is it?

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Abstract: One of the most exciting and rapidly changing fields in education is that of technology because obviously, technology itself is rapidly changing. For preservice teacher course and program designers, constant revision of the contents of the technology component is a necessity with choices hinging on range and availability as well as pedagogical congruencies. This paper reviews a current case of "technology refocus" in a preservice program resulting in choices including video and multimedia as well as assistive technologies for the special needs student.

Introduction

Having been caught up in a university-wide curriculum review, our School of Education found itself in the position of having to provide an approvable degree in less credits. When push came to shove, the technology component came under scrutiny, the credit allocation was cut in half and the course given the mandate to focus the contents of the new course more squarely on the needs of today's and tomorrow's schools. The ensuing review of what was relevant and available that would assist teachers in their future roles in the classrooms of the world and could be learned in a 1 credit course is the subject of this paper.

Review

A recent review of technology for preservice teachers (Higdon, 1995) follows the evolution of the concept "computer literacy" from computer construction and simple programming through to hypermedia, telecommunications, ending at multimedia. Not only is the technology changing but so also is the perspective with which technology is viewed. Technology as a computer which ran programs out in left field has now moved to the position of a vehicle which will with style, color and pizazz, deliver course content either as a main player or as a support player to the teacher.

Exemplary technology teacher education programs (Vagle, 1995), recommended and reviewed by 184 prominent individuals on the "computer mountain" in education, showed that while all programs required an introductory technology course and had available labs for hands-on experience, exemplary programs required their course to be taken in the third or fourth year as opposed to any year, and required students to do more computer graphics editing than video camera/player editing, more integration of components and more internet communication, more presentation software. Programming in BASIC or LOGO was reduced significantly as was the focus on productivity software ie wordprocessing, spreadsheets, databases and desktop publishers.

Since 1995 technology has flourished even more. The internet has become ubiquitous, omnipresent and is working on becoming omniscient. It is viewed as crucial to all meaningful preservice programs (Provenzo, 1999). Multimedia authoring has taken the form of Hyperstudio and has a multitude of instructional uses

(Wentworth & Breithaupt, 1999) while fieldbased components are being found in technology courses (Burson, 1999)(Stuhlmann, Taylor & LaHaye, 1999) because the technology is now more affordable and is found in schools. Some schools, which in the past used the US Postal Service as their prime delivery vehicle, now have moved to the internet as "distance education", such as the Virtual High School (Droste, 1999) found on the East coast of the USA and the "Link-to-Learn" project in the LeHigh Valley of Eastern Pennsylvania (Tuscher, Liu & Hung, 1999) to mention only two. We have moved from television and videotape to the internet and the CD as prime tools in the education field. The technology has changed!

Preservice teachers will need help in finding meaning in their struggle to capitalize on these resources in tomorrows classrooms (Schaffer, 1999; Weber, Schoon & Gonzalez, 1999; Scheuermann, Larsson & Toto, 1999). Wise (1997), President of NCATE, recommends that teachers be taught to adapt to technology changes by deepening their understanding of the impact of technology on our society, recognize new ways to access information, teach students to find, organize, and interpret information in a reflective and critical way, participate in formal and informal learning groups which use technology, and finally, demonstrate "an attitude that is fearless in the use of technology, that encourages them to take risks, and inspires them to become lifelong learners". He reasons further that preservice teacher programs fail in the area of technology because faculty don't understand the impact of technology themselves, they lack the technology for student use, and the faculty don't know how to incorporate technology into their teaching. The NCATE task force, whose work he is reporting, recommends that teacher education programs should create a vision in their students minds by their own use of technology, develop a program plan which implements technology program-wide, experiment fearlessly themselves, and provide for a technology infrastructure, faculty incentives, sufficient access and technical support, and networks with schools and funding groups.

In summary, technology has changed. It has simplified, moved down a generation, and teacher training programs are struggling to keep up with the play. There is much to be done because the community expects the teachers of the future to be technology literate. So here we were with an opportunity to put in place a meaningful program in a sliver of time.

What Happened

The solution to the School of Education need for a relevant and useful technology course in one credit began by the making a list of all possible applications of computer technology in education. Each faculty member checked the list for completeness and prioritized the topics as they saw the need each of the three program i.e. Elementary, Secondary and Special Education. Several topics once considered integral to Computer Litreracy are now expected to be learned elsewhere before entering the program. These topics included wordprocessing, spreadsheets, databases, desktop publishers, e-mail and internet searching. Other topics were felt best addressed by other faculty as components in their courses, some being demonstrated and others being assigned as student tasks. A large selection of the Special Education assistive technology topics were reserved to a second course required of their students only. This course is currently being used as the basis for an appropriation to place assistive technology in the library computer labs.

The final list of topics were gathered under the headings school survey, digital basics, video capturing and editing, presentation software, multimedia software, internet construction tools, and assistive technology. The school survey involves visiting and surveying of local schools, finding out what technology is on-site, how it is organized and how it is used, supported, funded, and how it fits into the overall school plan. Video capturing requires the students to film interviews and sites to create an edited video. Digital basics requires the students to digitize pictures and photographs, sounds, and video clips, as well as use clipart and video clips for use in the next three projects.

Presentation software requires the use of Powerpoint to create a serial slideshow. Multimedia involves Hyperstudio to create a multilinked slide presentations using the previously mentioned digital basics. Internet homepage construction using Frontpage or Visualpage involves one main page with five related linked other pages. Making the student themselves the subject of each of these projects provides for security and the guarantee that they have done most of the project albeit with help from lab assistants. Other topics demonstrated in the internet section include videoconferencing, webcams, and e-commerce.

The final topic, Assistive Technology, enables students to see demonstrated alternative input devices and alternative software for people with special needs.

Conclusion

The initial run of the course was most useful in confirming topic selections and identifying areas of refocus, better preparation, simplification and best of all, political tensions. Since we relied upon the facilities of the university for our labs, and they had previously provided a form of the course, it was a challenge to run with them but in a way in opposition to them. What they had previously deigned to prescribe as good for the academic divisions was being challenged and it tested the very meaning of the term "academic support". But true to their role, they supported.

The challenge in such a course as this is to provide the simplest but most complete task enabling the student in the minimum of time to gain the maximum experience with technology. This approach is based upon the elaboration theory model of task analysis proposed by Reigeluth and Merrill (1983).

With respect to the NCATE steps suggested to resolve the technology problem in teacher education programs, we have agreed as a faculty to be technology-"withit". Time has yet to prove us true to our word, however the university has built a multimedia classroom in the School of Education building to enable this to happen, while portable projection trolleys are available for other rooms. We have limited means to experiment but we do have a plan and there is access and support. Our network with surrounding schools has yet to develop and we see little chance for us to enter into a technology project funded by an external sponsor given the focus of our institution.

Our political concerns are abating now that we are partners with the library in the quest for assistive technology in the library labs. This technology will not only serve our Special Education students but also any student enrolled in the university who has a disability.

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Preparing Pre-Service Teachers to Use Technology to Teach the Content Areas in Elementary Schools

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Abstract: This paper describes the technology training and the implementation of this training. An example of the pre-service use of this training to prepare units, lessons, and activities for centers in the curriculum course will be provided.

The mission of the Department of Urban Education at the University of Houston Downtown(UHD) is to prepare future teachers who will enhance the chances of academic success for at-risk children and adolescents in urban schools. In order to provide its pre-service teacher with experience in using technology to enhance instruction, this department is integrating the educational computing component into its existing interdisciplinary block structure.

This paper describes the technology training and the implementation of this training. An example of the pre-service use of this training to prepare units, lessons, and activities for centers in the curriculum course will be provided, also.

The technology training is a one hour credit course which is held in the lab entitled: "The Way to Go: Integrating Instructional Technology Initiatives into a Teacher Education Program." As described in the syllabus for the course, the five technology sessions are integrated into the first block for the pre-service teachers at the Department of Urban Education (http://www.dt.uh.edu/degree/urbaned/home1.htm). The course is offered in the format of five workshops of three hours each, which are spread throughout the whole semester.

The titles and brief descriptions of the five workshops (3 hours each) currently offered are provided as follows:

Workshop I: E-mail & Internet Discussion:

The instructor starts with an introduction to the use of different professional teachers' forums over the WWW by showing pre-service teachers how to follow the threads, respond to interesting topics, and start their own subjects. This activity usually will raise students' interests and attention since they have heard of people talking about chat rooms and other related topics. After a short break, the instructor assists students in creating accounts with a web-based e-mail program such as Hotmail and Yahoo. The instructor then demonstrates the ways to check in-coming mail, compose out-going mail, send documents as attachments, forward and respond to mail, set up distribution lists to send to multiple recipients, set up automatic signature files, organize read e-mails into different folders.

Workshop II: WWW & Web Search

The instructor starts by demonstrating the CS1105 class web site created just for them (http://www.dt.uh.edu/~chen/cs1105.html). The web site consists of different of applications and examples of WWW uses in K-12 classrooms. Examples include: Spanish-English online translator, Webster's interactive dictionary, web site of the White House, lesson plan archives, askERIC archives, TEA (Texas Education Agency) homepage, TEKS (Texas Essential Knowledge and Skills) web site, etc. The choice of web sites to be included are customized to meet the needs of different groups of students. Examples might include a demonstration for the bilingual education groups which will emphasize Mexican culture and Spanish language arts; a demonstration for the secondary education groups will emphasize different content areas. Students also learn how to download texts and graphics from the Internet while sharpening their web search and web research skills at the same time.

Workshop III: Desktop Publishing & Graphic Organizers

The instructor starts with demonstrations of previous students' works including newsletters and flyers created for school activities or professional development. Pre-service students usually are amazed by the good jobs done by the previous students. They also are made aware of the high standard the instructor expects from the homework they are assigned. The instructor then guides the students with the creation of a simple flyer and a newsletter while allowing them the flexibility of applying clip art, word art, colors, and content to enhance their ownership of the product. After this, the instructor explains the different looks and uses of graphic organizers and demonstrates the creation of a thematic unit with the fundamental building blocks of graphic organizers such as text, circles, lines, and colors.

Workshop IV PowerPoint Presentation

The instructor starts with a demonstration of previous students' PowerPoint presentations, including some that need to be improved and several that resemble pieces of art. The instructor tries to evoke the students' higher order thinking skills by explaining the strengths and weakness of the slide shows and the rationales. Following an activity guide, the instructor leads the students in creating two simple slides with headings, text, graphics, and charts. The workshop ends with the showing of the more advanced functions of PowerPoint such as animation, sound, transitions.

Workshop V: Hardware & Software Evaluations

Since few pre-service teachers are aware of the different parts that make up a computer, the instructor brings in an old computer, takes it apart, and explains the different functions of the parts. By so doing, it is hoped that the students' anxiety level in using the computer will be lower. Students are then instructed in hardware evaluation. The hardware session ends with a twenty-minute activity called "The Price Is Right!" This activity is a search on the Internet for a brand new computer system with features that are comparable or better than those described in "The Price Is Right!" hand-out. The purpose is to equip the students with the skills required for them to do their own hardware search. The software evaluation session starts with software demonstrations including Story Book Weaver, Body Works, Amazon Trails, Just Grandma and Me, and Encarta. Students are then instructed in software evaluation. The workshop concludes with the students filling out software evaluation rubrics so that they will become comfortable judging educational software.

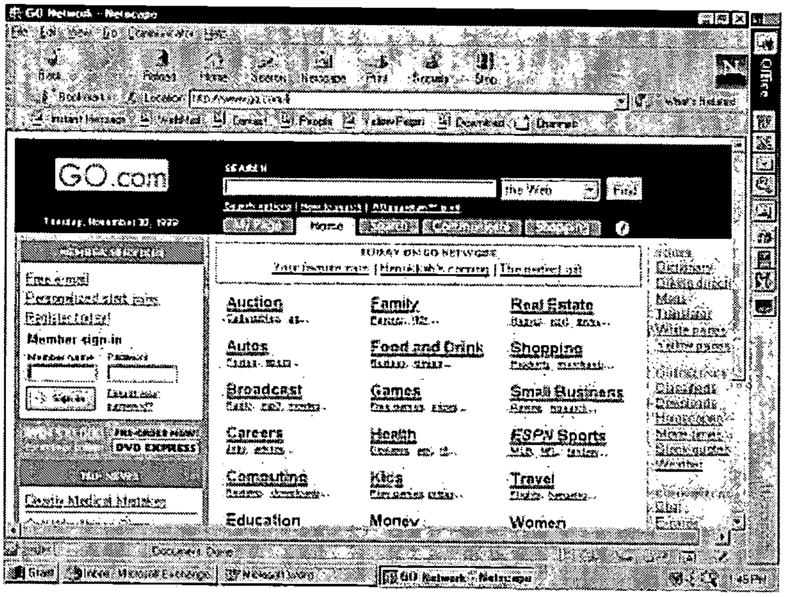
Technology is used as one more tool in today's classrooms, therefore; this training gives a strong base to pre-service teachers for planning and delivering instruction in the classrooms. Pre-service teachers plan units, lessons, and center activities in the areas of science, social studies, mathematics, language arts, and ESL. The procedures for planning and preparing a unit are explained as follow.

The pre-service teachers visit a selected classroom in the home school. They proceed to conduct a formal and an informal assessment of children's needs. They determine the interests of the students using a KWL (what the students know, want to know, and have learned) diagram. Based on this information, the pre-service teachers select the theme and areas of study for the unit. They access the Internet to find resources for the units. They have already acquired the basic Web search skills from Workshop II WWW &

Web Search. The general steps to finding information about Africa for example or any other specific topic are:

Step 1:

Log on to the www.go.com search engine. From the authors' observation, this search engine usually offers the best search results for education related topics.



Step 2:

Type in the search words "African Resources" and hit the FIND button. You may replace the search words with your own topic.

Step 3:

Browse through the "hits" or "results" to read the site descriptions and follow some interesting hyperlinks. Use your judgment to decide which are the most appropriate to use for your classroom. The go.com search engine has already applied its selection standard, which is indicated by the percentage number next to the web site description.

Another way to do a search is to access specific educational sites such as:

- http://www.yahooligans.com

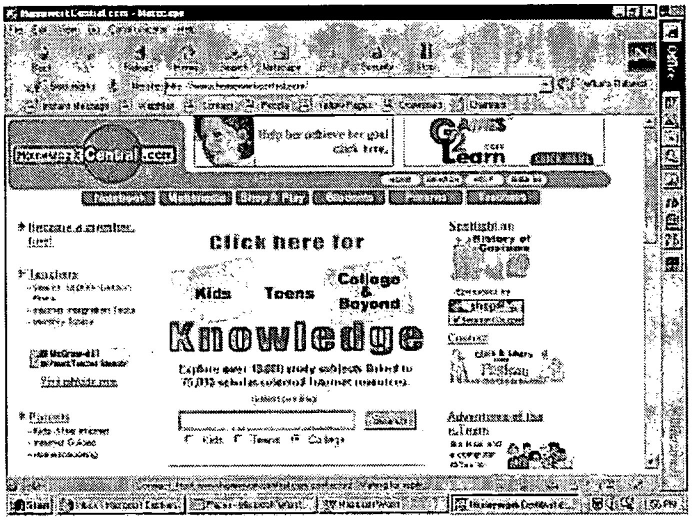
This site is very popular with young children. It has topics such Around the World (countries, food, and holidays); School Bell (Language Arts, Math, and Social Studies; Science and Nature (Space, Animals, and Dinosaurs); Arts and Entertainment; Computers and Games; Sports and Recreation.

- http://www.davilaelementary.org/

This is a school web site customized for visitors, students, and teachers. It offers visitors specific information about the school. It also shows resources for teachers and students by subject. It is an interesting site to see samples of students' work and lesson plans.

- http://www.homeworkcentral.com/

This is one of the most complete web sites for teachers and students' resources. The site is divided in three areas: kids, teen, and college & beyond. It has links to 75,000 scholar-selected Internet resources. It has more than 14,000 lesson plans, Internet integration ideas and monthly topic for teachers. This site has tutorials for students in various areas and grade levels. It is an invaluable resource for teachers.



All these ideas are an excellent beginning to survey the resources needed to plan a unit. Teachers, however, need to include in this planning the objectives also. In the state of Texas these objectives are called Texas Essential Knowledge and Skills (TEKS). The TEKS indicate the skills that teachers need to cover by subject and grade levels. The pre-service teachers have access to this information on line. The address is http://www.tea.state.tx.us/teks/#Grade. They also use the results of the TAAS (Texas Assessment of Academic Skills) scores in planning the unit. The pre-service teachers include in the unit several objectives where the children in the TAAS test did not performed at grade level. This information is also available on line by school district. In summary, the unit indicates the objectives that will be covered in a classroom for a specific period of time. The unit must be the result of formal and informal assessments conducted in the classroom where the unit will be implemented. To see some samples of the units developed by UHD bilingual pre-service teachers, please visit http://www.dt.uh.edu/bilingual_education/.

After the pre-service teachers have completed the planning of the unit, they are ready to design the lessons for that particular unit. The lessons have to include some type of technology for example software, encyclopedia or Internet. Again the training the students received in the technology class is used in the planning of the lessons and the use of technology to deliver instruction. The students are encouraged to do a search online to review different types of lesson plan. Some interesting addresses are:

- http://faldo.atmos.uiuc.edu/CLA/

  This collaborative archive has included lesson plans and activities from preschool through college. The viewer will first pick up a grade level and then follow the subjects. The contents are provided in a discussion listserv format, which allows people to respond and expand on the original ideas.

- http://ericir.syr.edu/Virtual/Lessons/

  The US Department of Education endorsed these collections of lesson plans. Users may select from a list of subjects that are followed by intradisciplinary content areas. The user can type keyword to search the entire AskEric Lesson Plans Collection for a specific lesson.

Pre-service teachers also use the objectives from the unit to plan the activities for the centers. It allows them to individualize instruction in the different content areas utilizing technology. Technology is a

major component to meet the individual needs of each student in a classroom. Activities are planned with children's different levels of ability in mind. The activities go from guided tutorial to created activities. Children have the freedom to work by themselves, with a partner, or in small groups to complete their selected activities. For examples of activities for centers see the following address (http://www.dt.uh.edu/bilingual_education/).

In conclusion, pre-service teachers need extensive training in technology to meet the challenge of educating children for the new millennium. Technology allows teachers to individualize instruction and meet the needs of each student in the classroom. However, for technology to be effective, teacher preparation programs need to provide not only extensive but also intensive hand-on practice with technology applications in the classroom.

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The Impact of Theory on Technology Use in the Classroom

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Abstract: This paper examines some aspects of a graduate course in educational technology at the University of Regina, Canada. The focus of the course (offered in the Fall 1999 semester) was to examine how aspects of learning theory can impact the use of technology in schools, and to develop a theoretical model that could drive and reflect appropriate ways for technology use in the classroom. In this paper we describe the course content, provide an overview of the processes involved in developing the theoretical model, and propose characteristics of a model for effective technology-curriculum integration.

Description of the Course

The course under discussion in this paper was designed for graduate students who are familiar with basic computer-related technology skills and concepts and their pedagogical appropriateness in the K-12 classroom. Specifically, the course was designed to explore the effective integration of the Internet into the curriculum. Students examined ways in which the Internet might be integrated into the curriculum, analyzed different learning theories to determine which (if any) related to the current (or future) use of the Internet in the classroom, and developed a working learning-theory model that could be used to influence the appropriate use of the Internet in the classroom. Modules on various topics were presented by groups of students who were expected to participate as *students* on WebCT by contributing to the chat room and Bulletin Board, and as *instructors*, by creating directories and pathways through which they posted the various course modules on WebCT. A WebCT course developer expert gave the class a summarized overview of how to create pathways and directories, and of how to upload documents. This was helpful for learning the technical aspects of WebCT. After the initial orientation to the course and WebCT, we began the process that would lead to the development of our theoretical model for technology integration.

The entire course is posted on WebCT at the University of Regina site [http://webct.uregina.ca:8080/ -- click on course listings, then on "Internet and Curriculum Integration" and then log in as a guest; (user id: *guest*; password: *guest*)].

The Importance of Theory

Richard Skemp stated, "There is nothing so practical as a good theory." (Personal correspondence, 1991). He states that "an essential feature of a theory is that it helps us to understand the invisible causes which lie

beyond the visible effects" (1989, p.46). The abstractness and generalities of theories gives them their power to be practical. In our class discussions, we were led to believe that a theoretical model for technology-curriculum integration could be general and practical and could be used to drive and reflect the effective use of technology in the classroom. We therefore embarked upon a quest to create a theoretical model for the effective use of technology in the classroom.

The Process of Developing a Learning Theory Model

We began the process of developing a theoretical model by examining how the provincial on-line curriculum is attempting to integrate technology into and across subject areas. The Evergreen Curriculum is located at http://www.sasked.gov.sk.ca/docs/evergrn.html. One of the on-line curriculum designers presented the class with an update of all the new features on the first night of class. The course instructor also led the class through some introductory theoretical work that was a review of different belief systems, and an overview of two different models of learning. Small groups of students choose topics that they would research, present in class, and post on WebCT. Topics selected for review by students were:

- Learning Theory.
- Virtual Architecture
- Filamentality
- Virtual Environments

The first of these topics examined current learning theory and the other three focused on some popular ways in which educators have organized Internet-related frameworks for technology-curriculum integration.

Using Schwab's (1973) Commonplaces as the heuristic, we compared the respective roles of the teacher, the student, the subject matter, and the environment as they apply to two belief systems or paradigms and two current learning theories. We then looked at some frameworks for integrating technology into the curriculum and attempted to analyze these to determine which theory of learning (if any) could be identified. We also compared articles by supporters and critics of technology and noted some of the issues related to the appropriate use of computers in the classroom. We also discussed what a classroom might look like where technology was being successfully integrated. We took into consideration what we believe to be the most essential, most appropriate, and most effective features of a technology-rich classroom environment, based on the presentations of the groups, the issues arising from the critics and our on-line and in-class discussions, and our own experiences as teachers. These considerations contributed to our theoretical model. The following is a summary of the topics presented in class.

Belief Systems

Although there are several philosophies concerning what and how students should learn, two beliefs systems or paradigms primarily influence our current teaching practices. The most widely influential has been the objectivist paradigm (frequently known by other names such as traditional, transmission, teacher-centered) where the teacher's role is to teach – that is to dispense or transmit knowledge. It is the teacher who determines what is to be taught and how it will be transmitted. The student follows the teacher's direction, learns the information and gives it back. The subject matter is generally pre-determined and is often developmental and specific. Evidence of knowledge acquisition is determined by observable outcomes and behaviors exhibited by the student. The learning environment is generally structured where students work independently.

The second paradigm that has had the most impact on teaching, though not as widely practiced as the former, is the constructivist (practical, interpretive) paradigm. It is based on the premise that students learn best when the subject matter is meaningful and related to their interests and experiences. The teacher's role in this orientation is one of a guide or facilitator who provides a stimulating learning environment that promotes hands-on experiences, intellectual risk-taking, and cooperation. The student's role is to be inquisitive, creative, collaborative, and reflective. The subject matter is holistic and customized to the needs, interests, and prior learning of the students. It is often divergent or open-ended with groups of students working in an area of interest. As students reflect on their experiences, they generate "rules" or "mental models" to make sense of their experiences. In other words, they construct

their own meaning from the experiences. In this context, learning is believed to be a process of continually adjusting the mental rules and models.

Two Theoretical Models of Learning

In this course, class members explored two current learning theory models: Barbara Rogoff's *Communities of Learners* (1994), and *Situated Cognition* (Brown, Collins, & Duguid, 1989). We believed these theories to be relevant to technology integration in the classroom.

In the *Communities of Learners* model (Rogoff, 1994) the author asserts that "learning occurs as people participate in shared endeavors with others, with all playing active but often asymmetrical roles in sociocultural activity" (p. 209). This view of learning contrasts with the one-sided learning models typical of European , American, and Asian schools where adults are in control of the learning. It also differs from child-run models that are "based on the assumption that learning is the product of discovery by oneself or *Community of Learners* theory, learning is a process of transforming participation where "both mature members of the community and less mature members are conceived as active; no role has all the responsibility for knowing or directing, and no role is by definition passive" (p. 210). In this view all members of the community are at some time both a teacher and a learner.

Situated Cognition, (Brown, et. al, 1989) has some similarities to the *Community of Learners* theory. Both models acknowledge that learning is best accomplished when it is authentic and related to the interests and experiences of the students. In the *Situated Cognition* model however, the adult serves as a mentor and the student is an apprentice. Learning is considered meaningful only if it is embedded within the social or physical context in which it will be used. One way to create authenticity in learning so that it more closely resembles what practitioners do, is to "enculturate students into authentic practices through activity and social interaction", based on the successful and traditional apprenticeship model (p. 37).

Herrington and Oliver (1997) note that the principal theorists (and critics) of situated learning have identified a number of important characteristics of the learning environment which have added to the evolving theory of situated learning. In attempting to identify those characteristics that are most applicable to the instructional design of interactive multimedia, Herrington and Oliver suggest that the learning environment should:

- Provide authentic contexts that reflect the way the knowledge will be used in real-life
- Provide authentic activities
- Provide access to expert performances and the modelling of processes
- Provide multiple roles and perspectives
- Support collaborative construction of knowledge
- Provide coaching and scaffolding at critical times
- Promote reflection to enable abstractions to be formed
- Promote articulation to enable tacit knowledge to be made explicit
- Provide for integrated assessment of learning within the tasks.

In the characteristics outlined in the cognitive apprenticeship and community of learners models we identified the roles of the teacher, student, subject matter, and environment. It is interesting to note that some of the roles have elements of both the objectivist and constructivist orientations. For a summary of the four commonplaces as they apply to the two paradigms and two learning-theory models see the following site: http://education.uregina.ca/courosa/site2000/overview.htm.

Organizational Frameworks

The next step in our theory development process was to examine the work of educators who have developed frameworks for organizing the Internet and curriculum-related activity. The works of Judi Harris (Virtual Architecture), Bernie Dodge and Tom March (Filamentality), and Chris Dede (Virtual Environments) were of particular interest because of the innovative ways these educators have discussed the use of the Internet and technology in classrooms. We also looked at the work of Cynthia Leshin (Internet Adventures,1998) who has developed an extensive list of Internet resources for teachers, and Seymour Papert (Mindstorms, 1980) , the developer of Logo, the first computer programming system for children.

Judi Harris (1998), and also see her website at http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/, uses the metaphor of a house to organize the ways teachers and students might use the

Internet to extend learning. She compares the rooms in a house to educational activities that can be structured to serve different purposes. And, just as rooms in different dwellings might have similar purposes but can function and look quite differently, so can "the same activity structures . . . be used to help students at different levels and with different curricula learn in differentiated ways that are best suited to their interests and needs" (p.42). Within the "house" are several areas where students can use computers in a variety of ways to accomplish different learning objectives. For example, the basement provides the foundation or rationale for the framework, the kitchen is for telecollaboration, the study for teleresearch, the bathroom for designing projects, and the yard for assessment. For an overview classroom activities that could be accomplished through telecollaboration, see http://rbe.sk.ca/webactivities.

Harris (1999) cautions however, that the activity structures for telecollaboration must be combined with seven action "c-quences" to help the students "plot the steps they will take as they use the activity's structure to engage in active learning" (p. 43).

Bernie Dodge and Tom March created filamentality, an interactive, fill-in-the-blank web site for guiding teachers though the process of designing Internet-based instruction. Teachers pick a topic, search the Web, identify good Internet sites, and turn the Web resources into activities appropriate for learners.

One currently popular aspect of *Filamentality* is the WebQuest. A WebQwest "is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well, to focus [learners] on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis, and evaluation" (Dodge & March), http://edweb.sdsu.edu/webquest/overview.htm). Also see http://www.ozline.com/.

WebQuest is only one instructional method within the Filamentality organizational framework. Other suggestions include creating a *hotlist* of good sites, developing a *scrapbook* with multimedia links and other resources, having the students gather information about a subject through a *treasure hunt*, and developing a *subject sampler* of a half-dozen intriguing sites organized around a main topic. Filamentality offers a variety of curriculum-based activities for all levels of Internet users.

Chris Dede of George Mason University has focused his work on how emerging technologies may reshape our views of distance education into an alternative instructional paradigm – distributed learning (1996, p. 1). He and his colleagues have also worked on the use of ScienceSpace Virtual Realities (VR) to help learners understand complex scientific concepts (Salzman, Dede, & Loftin, 1995). The work on distributed learning is of particular significance to educators as local and regional school governing bodies are looking for ways to reduce the costs of education. Dede believes distributed learning can provide opportunities for "learning by doing" and for interacting with virtual communities in ways that complement face-to-face interactions. He suggests, however, that if distributed learning is to fulfill its potential as an economically viable and pedagogically valuable way for students to learn, research is required on the following issues a) instructional design, b) knowledge webs, c) virtual communities and d) shared synthetic environments. He reminds us that as the new technologies become part of our everyday existence, it will be important to keep a balance between virtual interaction and face-to-face interaction and that the new media "need not eliminate choices or force us into high-tech, low-touch situations" (p. 24). More information on Virtual Environments can be found at http://www.virtual.gmu.edu/index1.htm.

Cynthia Leshin's work provides extensive and practical ideas for accessing web resources. She has also compiled lists of web sites that can be used for a variety of thematic units in a classroom. Her work will save teachers several hours of searching for appropriate web sites when developing WebQuests or other activities where children will be using Internet resources. One difficulty with Leshin's work, however, is that it will quickly become dated as the Internet grows. For more information see http://www.xplora.com/xplora.

Seymour Papert's creation, Logo, which allows children to learn the principles of computer programming by commanding the movements of a turtle on a computer screen, has greatly influenced the development of educational technology and our understanding of how children learn. In *Mindstorms* (1980), he discusses the importance of children being able to manipulate objects in order to increase cognitive development. He demonstrated that children can learn mathematical concepts with computers or 'objects-to-think-with', and that by articulating what they do as they create programs in Logo, they are learning to think about their own thinking. Papert developed the idea of a microworld - an authentic classroom environment created by the teacher, within which specific concepts could be learned, specific questions asked, and where students and teachers could interact and work together.

Each framework described above gave our class several ideas for a model classroom in which technology is successfully integrated. The frameworks also helped us to begin to formulate our own

theoretical model for using technology as a tool for curriculum integration in the classroom. The next step was to determine where the class participants were in their own theory development. We posted some questions to the bulletin board and asked our classmates to respond. We wanted to determine if they were aware of any belief system or learning theory that guided their use of technology in their classrooms. We also wanted to know if their thinking or practices had changed since they had started the course or began using technology in the classroom. Generally, we found that through taking this course or through integrating technology in the classroom, some participants were better able to articulate their teaching theories that had previously been unexamined. Some questioned their existing theories and for others, technology was the catalyst for transforming constructivist beliefs about teaching and learning into actual practice. A summary of the participants' responses can be found at http://education.uregina.ca/courosa/site2000/participants.htm.

Our Theoretical Model

Near the end of the course, a clearer understanding of our personal philosophies of teaching began to emerge. We felt we could finally describe the constructs of a learning theory model that would reflect what we believe to be the effective use of technology as a learning tool in the classroom. These constructs are derived from no single theory or belief. When we examined our working charts to determine the most appropriate constructs for our evolving theoretical model, we selected some from all the theories and beliefs that we studied. Although the model has a constructivist orientation, we were surprised to find that we had included some constructs that are more dominant in the objectivist paradigm. Again, we turned to the Commonplaces to provide the heuristic for our analysis. The chart below briefly summarizes the main characteristics of the model we called the Technology-Curriculum Integration Model.

Role of Teacher is to:	Role of Student is to:	The Subject Matter is:	The Environment is:
• Assess	• Assess	Authentic	• Freeing
• Be a mentor	• Be a mentor	• Dynamic	• Encouraging
• Be a teammate	• Be a teammate	• Evolving	• Collaborative
• Be accountable	• Be accountable	• Integrated	• Cooperative
• Collaborate	Collaborate	• Interactive	• Authentic
• Cooperate	• Cooperate	• Interests-based	• Relaxed
• Create	• Create	• Motivating	• Structured at times
• Learn	• Learn	• Problem-based	• Respectful
• Mediate	• Model	• Processes/ skills	• Supportive
• Model	• Organize	• Products	• Happy
• Organize	• Plan	• Project-based	
• Plan	• Provide support	• Purposeful	
• Provide support	• Share leadership	• Structured /Open ended	
• Share leadership	• Take risks	• Substantive	
• Take risks			

Figure 1 The Technology-Curriculum Integration Model

In our model the roles of the teacher and student are, for the most part, interchangeable. The teacher has primary responsibility for structuring the classroom environment, but students can also participate in the design. As well, the teacher is ultimately responsible for and accountable for the assessment of students, but students can play an active role in self and peer assessment. The subject matter is flexible and determined in collaboration with students and teachers, but again, the teacher must ensure that students are learning the skills and processes outlined in the curriculum. The learning environment might be characterized as 'freedom without license', where students have freedom to make curriculum and learning choices, and are free to choose where and how they work within the context of a structured, respectful, collaborative learning community.

Conclusion

Our intention in this course was to examine learning theory as it related to the effective use of technology in the classroom. In the process of examining theories, we discovered that no one theory is best for guiding technology and curriculum integration. We therefore developed a theoretical model that has components of other theoretical models and belief systems. We came to the conclusion that knowledge of the theory that informs our practice is absolutely crucial if we are to provide meaningful learning experiences for students. As well, theory is necessary if we are to justify our pedagogical decisions, and the importance of technology in classrooms, to those who see little value in using computers in schools. Knowledge of theory helps us to articulate and implement our beliefs about teaching and learning, and ensure that our practices are congruent with theory. Theory is a powerful and practical vehicle that can drive and reflect our practice.

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Constructing Technology-based Constructivism: A New Approach to the Educational Computing Course

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Abstract: This paper describes the experience of making wholesale changes to an introductory Educational Technology Course for teacher education programs at a state university in Florida, which has just completed developing brand new curricula for each initial teacher certification program it offers. Constructed from the ground up and based heavily on research and theory, the new curricula ensure that technology becomes a core element of every course offering in the new programs. The dramatic changes in the curricula called for, and even inspired, equally dramatic changes in the Educational Technology Course. Just completing the first semester of this new course, the authors discuss how the course evolved into its present form, cognizant of the unique mission of the University and the College.

Introduction

Florida Gulf Coast University's College of Education has just completed a complete curricular revision process in order to receive authorization from the State of Florida to certify teachers. This process has also helped the College ensure that the College will be prepared to work towards the NCATE 2000 standards over the next three years. As Florida's newest state university, FGCU opened in 1997 with a number of important objectives, including the appropriate use of technology throughout all curricula on campus. All of the initial Teacher Education programs were merged into the new campus from a former regional campus of the University of South Florida. Authorized by the state to continue using the USF courses for three years, FGCU has spent the last 18 months preparing for this dramatic change. Since technology is a key component of the campus, state, and national objectives for teacher education, the Educational Technology Course quickly became an important focal point for these upcoming changes.

Florida Gulf Coast University was proposed as a university for the 21st century, and has been built and operated with very high expectations for the use of information technology. A key element of the initial proposal, the strategic plan for technology indicates that FGCU "will constantly embrace information technology in creative, experimental, and practical ways to enhance and maximize the creation and delivery of instructional resources and to develop and strengthen its administrative support systems."

As an additional focus, the university planners established a structure to support Distance Learning as a central part of the university. In doing so, all campus classrooms are now fully connected to the network infrastructure, enabling two-way video to be broadcast to distant locations from virtually any location on campus. The side-benefit of all this "connectedness" is the universal availability of a variety of effective educational technologies to every instructor and every learner on campus.

In November 1999, a new academic building opened which included the first classrooms on campus designed specifically for the needs of Education courses. Modeled by the architects after classrooms they'd built for local middle schools, these classrooms allow teacher-education coursework to more accurately represent the environment graduates will face. Perhaps the most important component of

these new rooms is the inclusion of five-station mini-computer labs. The availability of these computers in almost every classroom where teacher-education courses are taught will enable a new level of technology integration to be realized within the College of Education degree program offerings.

From the outset of the university, Education embraced the wide availability of technology. The first and still only academic unit to operate its own Web and intranet servers, technology was quickly integrated into a wide variety of educational experiences for future educators. More importantly, the emphasis has always been on how technology can support learning, and not simply how to use technology for technology's sake.

Because a core goal of the faculty in the College is to grow towards achieving NCATE accreditation in as short a time as possible, deeply integrating technology into the curriculum has been perceived as essential by virtually everyone. The NCATE 2000 standards are much more stringent in their expectations of technology use, and also expect that technology related experiences are integrated into every course by every instructor. In a 1997 statement on technology, NCATE commented,

> It should be a goal to have every NCATE-accredited institution accessible through the World Wide Web. Web technology can be used to provide information about programs, faculty, courses, and the conceptual model for preparing teachers; to promote and enhance communication between and among faculty and students; to provide students with access to learning resources; and to facilitate the accreditation process, to name but a few uses. Education units at NCATE-accredited institutions should be leading the way in the multiple uses of web technology. Graduates of these institutions should be thoroughly skilled in professional and classroom applications of web technology. (NCATE, 1997)

Designing the Course

When the University opened in 1997, the Educational Computing Course was not an integral part of any degree program. Though it was a required course, it could be taken at any time during the four semesters of a student's degree program (Florida is a 2+2 state). This simple fact created significant problems because students in the classes ranged from entering students to students who had already completed their student teaching experiences. Fortunately, the state changed this required course to a pre-requisite course in 1998, and students are now required to complete this course prior to admission into any Education program.

In its initial format, the course taught David Jonassen's concept of "Mindtools," and used his book *Computers in the Classroom, Mindtools for Critical Thinking* as the core text. Mindtools is grounded in constructivist theory and encourages the use of technology to support active, reflective thinking, Through this type of technology use, students engage in critical thinking to an extent not easily possible without Mindtools, and very different from the traditional approach to the use of technology in learning situations.

Though a very successful course, one continuing problem was that it relied heavily on a text that has proven to be very difficult to access by learners with little or no professional experience in educational environments. Because of this, the course relied on a lecture format to teach the fundamental theory, while relying on a constructive approach to teach the essential computer-related skills like word processing, spreadsheets, databases, and e-mail.

The Need for Change

Near the end of virtually every semester, students would be understanding the idea of constructivist learning enough to ask a rather obvious question: "If the theoretical foundation of this course is to encourage a constructive approach to instruction, why is this course taught primarily in a direct instruction (lecture) format?" The only reasonable answer this author was able to provide was similar to this comment: "When I figure out how to teach constructivism constructively, I will."

These comments nagged this course continuously, more because of their obvious truth than because of any particular obligation to our programs. Teaching constructivism constructively would require that students "construct their understanding" of what the rather complex theory of constructivism means. Add to that, students would also need to add to that construction how computers could facilitate constructive experiences. The course had also always been responsible to teach basic computer skills to all future teachers.

The curriculum development process of the new College of Education focused the instructors on the research and the requirements of NCATE. With the new standards for accreditation, all courses in an Education degree program will be required to integrate technology more than ever before. For the new curriculum, this translated into the Mindtools-style use of technology to teach all of the education courses themselves. If every course in each degree program will implement extensive use of technology, the entire nature of an introductory course in Educational Technology changes. This realization forced the instructors to examine just exactly where this course now fit within the entire program, and what needs must now be filled by this course.

The Research Connection

All new curricula of the College of Education are deeply grounded in constructivist theory. A constructivist approach to learning can utilize technology, allowing students to construct and produce knowledge (Jonassen, 1996). Constructive learning is reflective, and inherently draws on prior knowledge (Duffy & Jonassen, 1992). Jonassen (1996) argues that software tools can help students to organize, reflect on, and assess what they know. "When learners actively construct knowledge, it is more meaningful, applicable, and memorable" (Jonassen, 1996, p. 13).

Piaget's cognitive and developmental perspectives and Bruner and Vygotsky's interactional and cultural perspectives provide the foundation for constructivist learning theory (Driscoll, 1994). Constructivism is rooted in the belief that people are active seekers and constructors of knowledge (Nicaise & Barnes, 1996). "Constructivism assumes that knowledge is built by individuals from within" (El-Hindi & Leu, 1998, p. 3). Jonassen (1996) argues that all learners mentally represent their own reality, and that constructivist instruction must allow learners to actively construct knowledge.

Technology in classrooms has traditionally been used with expensive software that uses repetitive drill to reinforce curriculum (Rice & Wilson, 1999). Computers with even basic software can be used for research, creative thinking activities, organizing ideas, problem solving, and information gathering. Research of any topic has become quick, streamlined, and essentially free for many students (El-Hindi & Leu, 1998). Jonassen (1996) describes the role of the teacher changing from information provider to coach, scaffolder, and problem presenter. Social collaboration is an essential part of the development of knowledge in constructivism as students work with peers to develop their interpretation of their environment. Additionally, students must engage in self-directed learning. The learner must have control over both the direction and content of their learning (Nicaise & Barnes, 1996).

Part of the process of creating an updated course including looking at what other courses are doing around the country. This was accomplished by looking at what others were teaching in similar courses, as reported in the SITE Annuals for 1998 and 1999. Many of the main ideas presented in these articles were similar to these comments:

- "Students were introduced to dozens of different software programs and the educational resources of the World Wide Web." (Gunter, Gunter, and Weins, 1998) - http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_gunt.htm
- "The course content at the four universities provides the education students with the computer concepts and skills which they are expected to know for their future teaching: word processing, spreadsheet, database, multimedia, presentation, e-mail, Netsearch, and integrating technology into instruction. An education student with these computer skills and knowledge will become a qualified teacher who can prepare the children in our nation to face the challenges of the modern world." (Leh, 1998) -http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_leh.htm
- "Several required activities are included in the curriculum that introduce students to word processing, draw, paint, desktop publishing, email, the world wide web, web page development, presentation software, and multimedia. Students are then required to do four projects that expand their knowledge about four of the technologies. The last requirement is a teaching unit in which at least three of the technologies have been integrated." (BUMP, 1998) - http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_bump.htm
- "The learning theory backbone of the class enables them to make decisions about how different types of computer programs can support different learning goals, how to select software that meets learner needs, and how to evaluate new educational technologies from a student learning perspective. The connections they make between learning theories, their own learning, and educational technology provide a solid experiential base that will serve them well in the teaching

profession." (Niederhauser, Salmen, and Fields, 1998) - http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_nied.htm

Only a very few courses, such as the last one, appeared to utilize a constructive approach. This was not a lot to go on, knowing that the new course needed to constructively teach both constructivism and the constructive use of technology to support instruction. Instead, the instructors took the best of what we knew about constructivist theory and Jonassen's interpretation of it for Mindtools, and went to work designing a new curriculum.

Establishing the Syllabus

Our first decision was to throw out the book - all books - at least for the first portion of the class. Instead, we decided to teach the course with two stated objectives: first, the course would be a "wash-out" course; and second, the course would have as its fundamental goal how computers can support the construction of knowledge in content areas. These two ideas were a significant departure from previous courses and from many of the courses offered elsewhere (as described above).

Becoming a "wash-out" course was certainly something we deliberated on carefully. We defined this as a course so fundamental to the goals of the larger program that students who failed to do well in this course would recognize that perhaps these particular programs were not a good fit with their skill-base. We believe that technology is simply too important of an element in the preparation of new teachers today to let weak students pass the class. While significant help and assistance is available, we decided to make it very clear at the beginning of the semester that we will not coddle students in the class. Every student is responsible to learn the bulk of the application learning outside of formal class - finding tutors if necessary (just like students in calculus or accounting might).

In the fall of 1999, we also believe that it is now a reasonable expectation that students *enter* our class with basic computer literacy skills. The title of the course clearly indicates that this is "Introduction to Computers *for Education*," not just "Introduction to Computers." Students who do not yet have basic word processing, e-mail, and web surfing skills are to be warned to acquire those skills prior to taking this class. It was important to make it clear that there is now an expectation that students enter the course with a minimal set of computer skills if they expect to be successful.

The sixteen-week semester was broken roughly in half, introducing databases, Inspiration, spreadsheets, and web pages during the first nine weeks, and then interpreting the experience and constructing understanding of the role of technology in education today during the last seven weeks. Most importantly, however, was the nature of the instruction during the first nine weeks. All instruction was designed to be consistent with the concepts outlined in Mindtools as being constructive in nature. That is, every computer experience that was to be provided would be done only though the use of constructivist methodology. A great deal of reflection was also to accompany this instruction.

It must be noted that the most important part of this new course is NOT the instruction of the skills. Rather, it is the modeling of constructive uses of technology to support content learning. At mid-semester students would begin reading a number of carefully chosen articles from a variety of Educational Computing Journals, and discussions would then help students begin to piece together not only the concept of constructivism, but also how technology today is a fundamental aspect of knowledge construction.

Deciding on the topics to be included was challenging. The heart of the course was to be constructivism and Mindtools. Jonassen introduces the Database application first in his coverage of the Mindtools concept, primarily due to its rigid structure and ease of use. We decided to start here as well, but to do so without also trying to introduce an actual computer application (Microsoft Works). Instead, we would utilize a locally programmed web site that provides the ability to manipulate a complete database in a manner very similar to working in an actual database application. Separating the higher-level, constructive nature of database manipulation from the lower-level, skill development process of learning a new program was important to us, and was the reason for leaving the database application out of the initial stages of the syllabus.

Continuing with constructive tools, we decided to introduce Inspiration next. Inspiration is a visual tool for semantic mapping, brainstorming, and many other applications, and Jonassen's text emphasizes the importance of using this type of tool to help students reflect on what they know, and how they know it. Providing more direct experience with this tool would be important since it is new to virtually all students. Nevertheless, students would still need to be responsible to utilize the help files and other resources to master the program. Constructive learning is student centered, not teacher directed.

Two additional tools would be introduced, spreadsheets and the web, and like the first two, would be taught only minimally, requiring the learners to seek out the help and advice necessary to be successful in the learning process. Finally, the course would conclude by using recent journal articles to tie these experiences together and facilitate the construction of the courses "big ideas."

Teaching the Course

We were prepared for resistance. Most of our students are choosing to enter teaching and report that they enjoyed school and how they were taught. Since most schools today still generally employ directed instruction methodologies, most of our students are actually reporting that they like being taught to in a directed instruction style. Our very first statements in class warned students of the rather dramatic change in instructional style from what they might be used to or comfortable with, and included a discussion of how most students preferred to learn. We were careful not to "give away" our philosophy, but helped students reflect on their learning experiences to date. Students were also warned about the need to have basic technology skills upon entering the course, and also about our approaching this class as a "wash-out" course. (We lost a handful of students from the first to the second sessions of each course section.)

Once we began covering the actual course topics, students experienced our methodology right away. Students were expected to set up their own e-mail accounts (on a university web page), and then to send e-mail the first night. They were given an assignment to "experiment" with the e-mail software. Although we briefly discussed what the email was capable of and what some of terms meant, specific instructions were not provided. The help files were introduced, as well as the concept of working with a partner, where to go for help (the computer lab), and how to find e-mail at home to do some of the same things that we encouraged them to explore (mailing lists, sending attachments, etc.)

Next we had the students begin exploring the databases. Our discussion of databases began before the actual use of one, which followed closely with the Jonassen text as to their uses, functions, etc. Later, we introduced the online database, and briefly introduced the concepts of sorting and filtering. Students were given time to "play" (experiment) with each of the tools, followed by a structured time to reflect on how a database could be useful to learning. Through this process, students were encouraged to make some statements (predictions) as to why the databases (and their tools) are useful, how could they be used with content, what conclusions learners could make from manipulating this data, and how students might use them to better understand information that they might be given or the might collect. During the third session, only after students were provided adequate time to process these "big ideas" about the constructive use of databases, a database management application was introduced (MS Works). The program was modeled extensively in the classroom, but only basic instructions on how to use this tool were provided (along with reminders where help was available).

Each major tool, Inspiration, Spreadsheets, and the Web, were introduced in a similar fashion. Very little direct instruction was provided, although extensive resources were made available and office hours were clearly identified.

Constructing Constructivism

Throughout the semester we faced students unhappy with the amount of "support" we provided. Conditioned to a direct instruction learning format, students expected to receive direct and specific instruction on skills needed for the class rather than guidance on how to gain these skills on their own. Weaning students from the expectation that all information and skills they needed would be provided to them caused the expected strife and yet also set up some interesting discussions among the students. However, conditioned also that learners only have to answer predictable questions in class, truly engaging discussions were difficult to start and sometimes even more difficult to continue. As might be expected, non-traditional students were typically the most responsive and the largest participators in class discussions. Students who reported that their high-school learning experiences involved little direct instruction (only a handful of students reported this) were also the most receptive to the ideas introduced.

The essence of the course, the whole purpose of its existence, was to be found in the students' ability to construct a conception of constructivism. We note here the difference between "getting it" and "buying it." Our goal at this early stage of their professional education program is to help students' "get it" so that we might initiate the *process* of "buying in" to the theoretical foundation that underlies the rest of

our curriculum. As noted earlier, we did expected resistance. In fact, we expected a lot of it. And resistance is just what we found. Interestingly, though, only late in the semester did resistance to the concept itself begin to develop. We perceive this as positive because in order to resist the underlying concept, the concept itself needs to be understood to some extent. Since understanding the concept was the primary goal at this point, we feel like we have achieved a level of success we had not achieved in prior semesters using the more directed approach.

Continuing the Course

As with any new program, there are kinks to be worked out. At the time this paper is being written, the semester has two weeks remaining. Final projects need to be negotiated and completed, and the entire semester reflected upon. Ongoing discussions with the students have pointed out a number of areas to work on for next semester, including the need to significantly modify the expectations for any spreadsheet projects and also the consideration of using Inspiration as the initial software application.

Other challenges exist for the upcoming semester, including a new instructor who comes to the course with limited experience in enabling constructivist learning in the classroom, and an increasingly older set of lab computers that are less able to support our growing needs. In addition, as a 2+2 state, we will begin working with our local community college to encourage a consistent approach to this common course for students completing this pre-requisite as part of their Associates Degree.

Conclusions

The Educational Technology Course has become a foundational course in the development of professional educators, but not in the way that many believe. Too many programs still approach this type of course as the one chance to be sure that prospective teachers acquire the majority of technology instruction they'll ever need. This approach is too narrow, and will simply fail to meet the requirements of NCATE 2000, not to mention the needs of the future teachers themselves. Teachers must acquire and continue to develop skill in computers and computer related technologies throughout their entire set of professional coursework. To do any less cheats not just these learners, but cheats every future student of each of our graduates.

This new recognition of the role that technology will play in every teacher education course places an entirely new set of expectations on the Educational Technology Course. Simply providing a core set of specific skills will not enable success in our new curriculum. Instead, this introductory course now serves the purpose of beginning a transformation in future teacher educators from a consumer of information to a constructor of understandings, and from a mere gatherer of facts to an active constructor of knowledge, all facilitated by the power of computers used as Mindtools.

Recently, the College of Education adopted a "Statement on the Use of Technology" which will appear in all future University Catalogs. In a few sentences, it captures the fundamental reason for redesigning the Educational Technology Course in the format that we have. It states, in part, that the College "does not treat the variety of technologies used in the education process as a separate subject or content. Instead, technology is merely one additional means of facilitating the educational process within the College and within the educational communities our programs serve. Because of this philosophy, we expect all learners to be proficient with education related technologies.... Technological proficiency is expected as a pre-requisite skill, similar to the expectation that all learners can write, use appropriate grammar, and access library resources."

The role of technology in learning has changed dramatically in the last few years. The role of the Educational Technology Course must change even more dramatically if we expect to be able to provide teachers prepared for the challenges of the 21st century learning environment.

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Collaborative Team Teaching Approach in a Technology Course

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Abstract: This paper describes the collaborative team teaching experience in a technology course. In this study, a collaborative team used a reflective approach from constructivist perspectives and involved students as well as two instructors in planning, conducting, and evaluating processes. The goals of team teaching were to provide each student with opportunities to choose from different instructional styles and formats, to enrich the learning experience by sharing and collaborating, and to facilitate a supportive and constructive environment through in-depth interaction with each student. The purpose of this study was to examine the effectiveness of this collaborative team teaching approach. The surveys, individual/small group interviews, observations, class notes, course evaluation, and students' feedback were used to find the students' satisfaction level, the effects of learning, and the significant factors in the team teaching approach.

In the beginning, when technologies were introduced in K-12 classrooms, most pre- and in-service teachers were at the starting level of learning technology and had minimal or no experience in using technology. With the growth of availability of technologies and teacher training programs, pre and in-service teachers have varied experiences from using word processing, spreadsheets, and the Internet to developing multimedia. Also, the usual pattern of students' technological capability in technology courses has been changed. Students who possess different knowledge, interests, and skills in different subject areas created a complex learning environment. The gap of technology skills between beginning and advanced students has been dramatically increased. Many students who have minimal prior experience with technology are overwhelmed by other advanced student's capabilities as well as information overload.

With the complex learning environment, we realized that instruction focused on one group is not appropriate in a multi-group classroom. To help each student achieve personalized learning goals and to minimize students' anxiety about other advanced student group, we tried a collaborative team teaching approach in an integrated technology course. The major goals of our collaborative team teaching were 1) to provide each student with opportunities to choose from different instructional styles and formats, 2) to enrich the learning experiences by sharing and collaborating, and 3) to facilitate a supportive and constructive environment through in-depth interaction with each student.

The purpose of this study was to examine the effectiveness of the collaborative team teaching approach. The surveys, individual/small group interviews, observations, class notes, course evaluation, and student's feedback were used to find the students' satisfaction level, the effects of learning, and the significant factors in the team teaching approach. In the team teaching approach, we tried many different formats such as whole class presentations/discussions, individual/small group activities, and tutorial sessions. Usually the classes started with the whole group session and then each student chose a learning activity according to her/his needs. Two instructors rotated their role from small group tutorial sessions to individual/small group activities. While one instructor took care of a tutorial session to beginning students, the other supported the exercise of students' own creative abilities. This paper describes the teaching strategies implemented in our collaborative team teaching approach, reports the results caused from our efforts in details, and suggests effective ways to implement team teaching for future courses.

The Study

Participants in Team Teaching

A technology course was taught by Cleveland State University (CSU) faculty during the 1999 fall semester on campus at Lorain County Community College (LCCC) as a course in the University Partnership program of CSU and LCCC. The course was offered for graduate students in the Partnership at LCCC just as if it was being taught at the CSU campus. 34 students enrolled in a technology course were divided into two sections. Initially 21 students in one section were assigned in the PowerMac lab that provides access to both Mac and PC environment, and 13 students in the other section were assigned in the IBM lab that provides only PC environment.

About 90% of students enrolled in this course were pre-service or in-service teachers in K-12 and higher education. The majority of students entered the program to receive a Master's degree in Computer Uses in Education or certification to teach technology in K-12 schools. There were few students who took the class to improve their professional development with technology in a Non-degree program. The whole group consisted of 29 female and 5 male students represented a diverse range in age and experience.

While traditional teaching in higher education requires one instructor to teach his/her students in a course, two instructors from CSU designed, planed, conducted, and evaluated the course with different styles and viewpoints as a collaborative effort. Although the instructors had common agreements on many educational philosophy, teaching area, and flexibility, they were different in gender, experience, and expertise. In this study collaborative team involved students as well as two instructors in the teaching process as much as possible. The students were expected and required to engage in collaboration of goal setting, presentations, discussions, in-class activities, and evaluations.

Course Design

This was a pilot study that implemented a team teaching approach in a technology course. The main purpose of this collaborative team approach was to reduce the frustration of students who had limited experience with technology, to enhance advanced students according to their level, and to provide better learning environment through access to various types of technological equipment and groups. Team teaching in this instance encouraged students to set their own goal of learning and to explore their own values, team teaching enhanced collaborative learning by sharing ideas, experiences, and viewpoints. Team teaching also provided a wonderful opportunity for team learning.

As we developed the course, we tried to provide students with opportunities to articulate their own beliefs, create their own knowledge, and evaluate their learning progress. The course requirements included in-class activities, reflecting on a reading, a comprehensive exam, four mini projects, and a final project that represents comprehensive understanding and skills. Usually each class began with a chapter presentation by instructors or a small student group and then the class topic was discussed in depth through sharing of experiences and perspectives. To incorporate student's knowledge constructed through class discussion and presentation into a real context such as their classrooms and work places, in-class activities were required in a small group or by individual. During the in-class activities, the students were given the option of practicing in-class activities, working on their own, or attending tutorial sessions based on their prior experiences, need, ability, and progress of learning. While one instructor conducted the tutorial session, the other guided students in the different group.

With a collaborative team teaching approach, we emphasized the student-centered instruction. Two instructors tried to change the fixed role transmitting knowledge toward the flexible role of a facilitator of student's activities. The students were involved intellectually in critical-thinking or higher-order thinking process instead of passively taking notes from instructors' lectures. For one semester, the students were engaged in four learning phases:

- exploring/inquiring,
- sharing,
- developing

- evaluation

Inquiring/Exploring

The students were required to review some articles to understand fundamental theories/practices and integration strategies for integrating technology into their teaching or professional practices, and to develop their own technology plan to be used in their classroom teaching and work. Two instructors introduced some useful examples and resources as a guided instruction. After the students reviewed information, they were expected to analyze the findings through critical thinking skills and to connect their knowledge to real life experiences.

Sharing

All students were required to participate in a presentation of at least one chapter to the whole class from the textbook, *Integrating Educational Technology into Teaching* (Roblyer, Edwards & Havriluk, 1999), through a collaborative effort in a small group. Each group was encouraged to incorporate presentation tools such as PowerPoint, HyperStudio, or Web site in a professional manner. The main focus of chapter presentation was on the creative ideas for applying knowledge and presentation strategies rather than the content itself of the chapter. It was essential that all team members contribute to organizing and presentation. To do this, each student took responsibility for participating in team discussions and planning process to develop a main frame and strategies for the group presentation.

Developing

The students were highly encouraged to integrate technology into their classroom teaching where possible when they develop instructional materials or projects. Many students selected students or parents in their classroom as a target user group when they develop instructional material or projects. In the developmental level, they developed problem-solving or critical thinking skills to design an effective material and to find practical solution when they encounter some problems. The students gained frequent feedback or input from the instructors, peers, and potential users to revise the prototype. When they were satisfied with their product, they were motivated to use their product in the real classroom. For examples, some students used the instructional material developed in the course for their classroom teaching, disseminated the classroom newsletter to inform parents with special events in their classroom, or presented the project in a parent-teacher conference.

Evaluating

In this course, two instructors assessed students in a constructivist manner instead of traditional type such as grading on a bell-curve. The focus of assessment was on learning progress of individual learner rather than achievement of predefined learning objectives. Students' projects were reviewed several times by peers as well as two instructors so as other to make improvement based on suggested ideas. Most assignments were evaluated by a recursive approach that focuses on revision processes rather than a final outcome. However, to provide general guideline for the assignment and to avoid student's confusion in the process of evaluation, the instructors provided minimal criteria for each aspect of the project. The final grade for each assignment was given by agreement of two instructors and recorded in the master grade sheet.

The Method

The effectiveness of team teaching was examined in six different ways: the 1) surveys, 2) individual/small group interviews, 3) observations, 4) instructors' notes, 5) course evaluation, and 6) student's

feedback. The purpose of this was to find the students' satisfaction level, the effects of learning, and the significant factors in the team teaching approach.

The surveys were conducted in the beginning and middle of the semester with a semi-structured format and open-ended question items. The first survey was conducted to examine the students' background information such as their teaching areas/grade level, prior skills/experiences with technology, and expectations of learning and answered by all 34 students. The second survey questionnaire provided multiple options from strongly disagree to strongly agree (1-5) in the first part and included open-ended questions in the second part. The second survey was conducted anonymously and responded by 24 out of 34 students. The survey examined the degree of

1) meaningful learning
2) suitability in graduate level
3) engagement of learning
4) interaction between instructors and students
5) recommendation for the next semester
6) willingness to apply what they have learned to their teaching.

Informal interviews with three individuals and three students in a small group were conducted in the end of semester to find the their satisfaction level of learning and the strengths/weaknesses of team teaching approach. Two instructors observed and reviewed each class to examine what worked, what did not, and what should be changed to provide meaning learning environment in the next sessions. Students' feedback and requests via e-mail and short conversations were reflected according to agreement with other students as well as two instructors.

The Findings

Interaction between Instructors and Students

Over 75 % of students indicated that team teaching approach enhanced students' meaningful learning through individualized comments and feedback and they had opportunities to see different styles of planning and organization, as well as methods of class presentation. There was more and faster interactions with instructors as indicated and preferred by most students. One student mentioned that trouble shooting took less time and handled in various ways. With team teaching approach, they could get double feedback from both instructors on their projects and presentations. As a result, the students acquired a greater depth of understanding of the subject matter and mastered skills to incorporate technology into their teaching from different strategies and viewpoints.

Suitability of Team Teaching Approach in Graduate Level

One of the main characteristics of most students in the graduate level program is self-motivation. With team teaching environment, the students collaborated with other students in many different aspects/various groups. They shared different models of presentation and discussion style and learned various strategies for problem solving and organizing information.

Student Attitudes

In the collaborative team teaching, the blending of each instructor's expertise strengthened the content of the lessons and the way they were presented. Most students reported that they learned to be more flexible, to focus on individual strengths, and to prioritize concepts. About 55% of students marked on the strongly agree or agree about intention level to apply team teaching approach in their classroom teaching and more than half of them recommended the team teaching approach for a technology course that will be taught in the next semester.

Disadvantages of Team Teaching

Speer and Ryan (1998) pointed out several common problems in collaborative team teaching. One of major problem is that teachers may feel insecure and tense while doing collaborative team teaching, due in part to different levels of experience and expertise in relation to the course and or different statuses. The second major problem with collaborative team teaching is its lack of institutional support.

In our case, these problems were handled very smoothly. Two instructors who are very flexible enough to try innovative teaching ways to improve the quality of teaching and had common understanding about teaching philosophy from constructivist perspectives that emphasize student-centered learning. In addition, this pilot study had a great support and encouragement from administrators that recognize the benefits of team teaching for professional development and for improving our courses.

Critical Factors in Collaborative Team Teaching

Major concerns in the collaborative team teaching were to set the course goal, to determine roles in each part, setting agendas, keeping records, setting procedures for evaluation, and scheduling class activities and assignments, etc. Through the collaboration work, we found several essential factors to successful team teaching.

Mutual respect and trust

As Cruz & Zaragoza (1998) mentioned, to establish mutual respect and trust between two instructors is critical for successful team teaching. Two instructors had a common understanding about instructional strategies and learning objectives from constructivist perspectives. The instructors also respect students' viewpoint and invited students to share their experiences with the whole class.

Communications

Some educators mentioned that in team teaching, you spend less time developing and teaching the course than was normally spent by the individual instructors (Morganti & Buckalew, 1991). However, we revealed that the collaborative team teaching in a constructivist way requires large amount of time and high level of energy in all processes. Our major concern in the team teaching was to improve the quality of teaching and learning from epistemological perspective that knowledge is constructed by social interaction among group (Austin & Baldwin, 1991). In practice, we spent huge amount of time preparing each class and evaluating our students' assignments. In the most cases, the initial plan by individual perspective was negotiated with other instructor and students.

Responsibilities

Before-class meetings, the instructors reviewed individual responsibilities on content coverage, preparing hand-outs, and their roles in the class. Some students worried about the evaluation of their assignment by two different instructors and record keeping of learning progress. To minimize students' common confusion by two instructors, we kept master database that recorded a track of students' learning progress. The instructors provided a guideline and criteria for each classroom exercise and assignment. Over all, in our collaborative team teaching, the responsibility of learning was shared with all students as well as with partner instructor.

Reflection

The instructors evaluated each class to review differences between what was planned and what the students are achieving and refocused on the subject matter. The evaluation was conducted right after each class for 30 to 40 minutes and recorded in instructors' log document for teaching in the next semester. In addition, reflective input or feedback by students was welcomed and encouraged to improve the collaborative teaching and learning environment.

Conclusions

Although many studies of team teaching approach indicated positive results such as reducing teacher isolation, and increasing students' satisfaction, much of team teaching efforts happened in primary or secondary school level (Walsh & Snyder, 1993; Solomon, 1994). In many higher education institutions, the typical pattern of teaching is still largely based on an individual instructor bearing responsibility for students in a course with limited interaction with colleagues. Although students may learn or discuss about the team teaching concepts, but this does not take the place of being a participant in such an activity.

Banks and Stave (1998) stress that preservice teachers need to observe, experience, and reflect on learning activities from both student and teacher perspectives during their preservice coursework. However, preservice teachers rarely encounter team teaching in their course experiences. As revealed by many studies on team teaching, team teaching makes effective use of existing human resources without additional requirements of expensive resources or equipment to implement this method. Only rearrangement of human resources and equipment and support from administrators are required to implement team teaching.

Even though few students expressed a negative impact on resources, especially class size and classroom space, our collaborative teaching was very successful because we had common understanding of the theories and common educational philosophy. The students and instructors had very positive experiences in this team teaching approach. With combined expertise and resources, the students were actively engaged for meaningful learning to achieve personalized goals. While advanced students were enriched a meaningful learning on their own direction, the inexperienced students with technology felt comfortable with less anxiety toward overloaded information and comparison with advanced students. In addition, the instructors' role as facilitators instead of having authority in the classroom made for an effective environment for collaborative teaching and learning.

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Beyond Applications to the Essential Processes of Technology Integration: Designing an Educational Technology Course to Reflect ISTE Standards and to Model Best Practices for the Future

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Abstract: This paper describes the evolution of an educational technology course for preservice teachers from an applications-based curriculum to a new framework that draws on the structure of the ISTE recommended foundations in technology for all teachers and expands upon the substance of the standards to meet the challenges of increasingly rapid technological innovation. The curriculum for this course was divided into the three main categories within the foundations: a) basic computer/technology operations and concepts, b) personal and professional use of technology, and c) application of technology in instruction. Connecting standards and curricular activities remains a creative and interpretive process and students were expected to produce projects that were authentic, meaningful, and intended for future student and professional use. All course activities were integrated within each of these conceptual sections thereby making explicit and modeling best practices in technology integration that many teacher candidates have never experienced as K-12 students.

Introduction

Traditionally, educational technology courses in teacher preparation programs have focused on preparing students to use a variety of software applications such as e-mail, the World Wide Web, spreadsheets, databases, and educational software. In light of the rapid pace of technological and information innovation in which new software applications are created daily and a growing frustration with impossibility of keeping pace with these changes, the faculty coordinator and instructors for the undergraduate-level educational technology course in the College of Education at the University of New Mexico have implemented changes in the vision and foundational structure of this course. The revised course now reflects this fundamental shift from applications-based instruction to a pedagogy that is conceptually and explicitly tied to the ISTE (International Society for Technology in Education) recommended foundations in technology for all teachers. This conceptual framework now focuses on the processes of curricular integration and the professional use of computers and information technologies. Course instructors also committed to model, clearly and continually, best practices in technology integration and thus engage students in the reflexive process of participating in technology activities as students and publicly reflecting upon these practices as future teachers.

Although many institutions and governing bodies at local, state, and national levels are actively developing technology competencies for teachers (Moore, Knuth, Borse, & Mitchell, 1999), the ISTE standards were chosen to provide the guiding framework for the educational technology course revisions for several reasons. The ISTE foundations for all teachers are the most widely recognized and comprehensive standards at the national level and many individual states have either adopted wholly or based their own standards on these foundations. New Mexico is among those states that have adopted the ISTE standards and added additional standards that support the multicultural nature of education in the

state. In addition, the College of Education at the University of New Mexico is expecting an NCATE accreditation review in the fall of 2000 and curricular alignment with ISTE foundations is becoming increasingly important although not yet required.

From Applications to Processes

Across the United States, many teacher preparation institutions are engaged in similar efforts to revise teacher preparation curricula to reflect and meet the ISTE and various state technology standards. Several of these programs have attempted to provide opportunities for teacher candidates to meet the ISTE standards in preparatory courses, content methods course, and student teaching experiences (Chen, 1999; Dempsey, Springer, & Holder, 1999). Strudler and Handler (1998) proposed a structured matrix for distributing the ISTE standards across the various teacher preparation courses in their article describing a systematic approach for implementing the revised ISTE foundations. In contrast, the structure of the educational technology course at the University of New Mexico reflects the unique representation of the ISTE standards *within* an individual course. This course serves as a foundation for methods courses and subsequent student teaching experiences in which the ISTE standards will be strengthened an enhanced through curricular revisions made possible by support from a Preparing Tomorrow's Teachers to Use Technology grant from the U.S. Department of Education.

The current ISTE foundation standards for all teachers are divided into three main categories: a) basic computer/technology operations and concepts, b) personal and professional use of technology, and c) application of technology in instruction. These categories of standards provide and elegant and simple view of the important *processes and uses* of technology in educational settings. Instead of framing a checklist of proficiencies to be attained in a variety of applications, the emphasis of the revised standards reflects an important shift to the more enduring categories of uses that have the potential to withstand the onslaught of educational applications that have yet to be invented. Although the sub-standards within each category are more detailed, making the connection between standards and specific curricular activities is still a creative and interpretive process. For these reasons, the curriculum for this three-credit semester-long technology education course was divided into these three main categories and all activities were integrated within each of these conceptual sections. Instructors believed that by making this three-part curriculum explicit to students, teacher candidates might become more aware of the curriculum, the goals of course, and their responsibility to direct their own continuing professional development within these three domains beyond the life of this course.

Making Processes and Uses Visible and Explicit

In their approach to implementing the foundations in teacher preparation courses, Strudler and Handler (1998) recommended that it is helpful to "unpack" or break down the standards into clear, manageable chunks rather than clustering them together (p. 17). The new structure of the educational technology course uses an innovative structure that includes this unpacking approach and wraps it within a recursive cycle of macro and micro views over time. Specifically, each of the three major themes or sections of the course (exploring applications, personal and professional use of technology, and application of technology in instruction) is introduced through a macro-view in which the major theme and the related activities, readings, and projects are described. During the theme-related weeks, students engage in project-based activities that provide opportunities to meet the foundations standards within each category. At the end of each thematic section, students demonstrate their projects, write a reflective paper, and engage in discussions that are intended to zoom back to the macro view that connects the standards met in authentic projects with the major theme once again. This cycle is repeated two more times for the other two themes within the semester. A major element of this recursive approach is to help students formally internalize the three-part framework that will guide their subsequent studies in methods courses and student teaching experiences. That is, this approach is intended to support metacognitive awareness in students so that their learning in the domain of teaching with technology may become intentional and authentic.

In addition to explicit instruction through the thematically structured section, the course Web site with weekly lesson plans provides a continuous opportunity to connect the conceptual framework with the

activities and projects in which students participate throughout the semester. The Web site also serves as an additional model for students of how teachers might use the Web to effectively guide teaching and learning in K-12 schools and is featured as such in the section on the application of technology in instruction.

Another significant and explicit aim of the course is the modeling of effective grouping strategies within each cycle that teachers can use with students from diverse populations. Students collaborate on projects in small groups of four to five students, as dyads, and participate in jigsaw-type distributed knowledge groups. Instructors model and discuss strategies for ensuring equity in grouping for technology-based activities so that teacher candidates are able to experience best practices in technology integration as students while learning the role of the technology-using teacher.

At the end of each thematic cycle, students present their final projects as a culminating activity and they write reflective learning process papers that are focused on making connections between theory and practice. This final reflective paper and the culminating activity complete each thematic cycle and provide closure to and reinforcement for the importance of the three featured processes and uses of technology in education.

Major Course Sections

Exploring Applications

In the first section of the course titled "Exploring Applications" (ISTE Standard 1), students participate in a multi-week activity in which members of small groups become "experts" with a software application such as word processing, painting, drawing, spreadsheets, multimedia presentations, and databases. These experts are then expected to share that specialized knowledge with other members of the group as they work collaboratively to complete a project that requires the use of all of those applications. In some sections of the course, for example, students completed a "Xeriscape" activity (water-conserving landscaping) in which they formed landscape companies and developed a proposal in response to a landscaping request for proposal. This proposal included a site map, irrigation plans, employee biographies, an analysis of community input, and the use of a xeriscape database to select plants according to the results of the surveys. When the activity was introduced, these preservice teachers participated in the authentic project-based application of software tools in their role as students. Toward the end of the project, instructors shared with students the entire activity plan that modeled technology integration with math, science, language arts, and visual arts curricula. These students experienced an authentic application of technology integration that not only increased their own proficiency as learners, but also provided a replicable model of best technology integration practices that they could use with their future students.

Application of Technology in Instruction

In the "Application of Technology in Instruction" section of the course (ISTE Standard 3), reading assignments and activities are centered on providing the best possible learning environments for K-12 students. Students critically evaluate publicly available lesson plans from the Internet and then learn to write their own lesson plans. These students complete two cycles of lesson planning, the first with a partner and the second independently. The lesson planning cycle includes research, alignment with standards, peer review, and finally, public demonstration. Throughout this section, instructors emphasize the quality of technology integration and students continually evaluate their own and others' lessons so that the inclusion of the computer and other information technologies is meaningful, enriching, and necessary to achieve curricular learning goals.

The course activities in this particular section provide authentic models of alternative assessment and peer assessment that future teachers would be able to use with their own students to document the effective integration of technology. One of the most difficult aspects of lesson planning for novice teachers is understanding and planning for the articulation of assessment artifacts with the content standards and benchmarks that frame the lesson. Therefore, students explore and develop rubrics that guide the peer review process as well as the demonstration of the thematic projects through the culminating activity. This culminating activity serves as a performance assessment of technology proficiency and is an example of the kind of competency that teachers must demonstrate in other states such as Idaho (Coleman, 1999).

Additionally, the course faculty coordinator decided to integrate performance assessments throughout the course in anticipation of the revised NCATE 2000 requirements.

Personal and Professional Use of Technology

The final section of the course focuses on the Personal and Professional Use of Technology (ISTE foundation standard 2). Activities in this portion culminate in the production of a "Teacher Toolkit" that serves not only as a professional portfolio, but also as a "living" set of resources that a future teacher can use to continue learning to teach with technology beyond the technology education course. During the first class of this section, students are able to explore Web publishing, PowerPoint, and HyperStudio applications. After working with each multimedia application, students then choose which application they wish to master and they use that application to create their Teacher Toolkit. Individual toolkits might include a current resume, technology enriched lesson plans, teaching philosophy, reflective process papers, images of classroom experiences, and links to personally useful professional development or educational Web sites. In addition to serving as a portfolio that documents students' work in technology integration, the Teacher Toolkit is intended to serve as a living and dynamic electronic document. Specifically, the toolkit will provide support to students as they continue to learn to use and teach with technology beyond the technology education course into their methods courses, student teaching experiences, and their future careers as teachers. The major vision of this course and an important outcome of instruction is to increase students' confidence in engaging the process of selecting and learning to use technologies that are changing so rapidly.

Implications for Education

The description and sharing of this new approach to designing a technology education course for preservice teachers contributes to the field in two important ways: a) by providing a model of course design that moves beyond teaching software applications to scaffolding the enduring processes of technology integration and b) making explicit and modeling best practices in technology integration that many teacher candidates have never experienced as K-12 students. This new course design shows promise for meeting the challenges of an ever-changing technology frontier in which teaching applications-based technology survey courses is increasingly untenable.

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Integrating Electronic Portfolios into Undergraduate and Graduate Educational Technology Courses at the University of Florida

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Abstract: The purpose of this paper is to examine the use of portfolios as a teaching tool for undergraduates and graduate education majors. We will discuss challenges faced by students when developing portfolios as part of the educational technology curriculum. Concepts such as reflection in education, collaboration among peers, ownership, and the selection of work will be addressed. A comparison of the implementation process used by undergraduate and graduate students is provided.

Introduction

The use of portfolios as an educational tool has the potential to change the way we teach as well as change what and how our students learn. Electronic portfolios afford students a method to express their strengths and demonstrate their understanding of numerous concepts in multiple formats using a wide array of media for expression purposes (Moersch & Fisher, 1995). Portfolios provide students with a richer way in which to present themselves, and encourage reflection and collaboration among peers (Paulson, Raulson, & Meyer, 1991; Hamm & Adams, 1991). This richer mode of expression not only changes students' work, but the quality of their work as well. Students begin to realize that learning is an on-going process that does not necessarily conclude with a test or course. The literature has shown that students also approach learning differently when they are not being evaluated, either formally or informally, in a traditional manner (Kent, 1997). Viewing students in this richer context enables colleges, graduate schools, and employers to learn more about the person than traditional resumes and transcripts.

The Need for Electronic Portfolios in Educational Technology

Teachers should create technology-rich learning environments that encourage the development and success of all students. The educational technology faculty at the University of Florida believes it is critical that students understand that educational technology is about teaching and learning, not simply the creation of computer projects. It is also important that students are given meaningful assignments that do not always conclude at the end of the course. Creating portfolios gives students the opportunity to create a learning environment which demonstrates what they learned, as well as providing students an opportunity to work on an open-ended project. An additional benefit of electronic portfolios is that students will leave their educational program with a product demonstrating their knowledge and abilities.

Another important aspect of students creating portfolios is the reflection that is involved in the developmental process. The creation of portfolios forces students to thinking about their work and the process of learning. Research (Paulson, Raulson, & Meyer, 1991; Hamm & Adams, 1991) regarding electronic portfolios has shown this mechanism allows students to be more reflective about their work. The

greatest advantage for students is the opportunity portfolios provide for reflecting on their learning process and progress (Ause & Nicastro, 1997). Portfolios can help teacher educators address one of the most challenging tasks they face: training new teachers to be what Donald Schon has called "reflective practitioners" (Yagelski, 1997). These factors convinced the educational technology faculty that electronic portfolios were the best method with which to accomplish their teaching goals.

The decision to use electronic portfolios in our educational technology courses was the catalyst that caused the College of Education to adopt use of electronic portfolios for all teacher education students. Consequently, the educational technology faculty has been able to provide the leadership necessary for successful strategy and implementation processes. Using Rogers' research on innovation diffusion theory (1995) enabled us to predict potential difficulties and aid in a smoother diffusion process. This paper will chronicle the experiences of the undergraduate and graduate educational technology students.

Undergraduate Portfolio Project

As mandated by the state of Florida, all students who declare education as their major must take the Introduction to Instructional Technology course. This course addresses computer skills as well as teaching and learning issues impacted by technology. Students enter this course with vastly different technical skills, and we want to challenge novice computer-users as well as more advanced computer-users. Previously, the course involved creating web documents, and a variety of multimedia projects that students submitted to their instructor electronically. In the spring of 1999, students began developing electronic portfolios as one of their requirement assignments. We believe that changing this course to include electronic portfolios encourages students to reflect on their work, what they learned, and how their work has evolved. Krause (1996) states, "Students' successful use of the portfolio is directly related to the variety of self-selected ongoing work, drafts, and final products, and provides numerous opportunities for the learner to think flexibly and nonlinearly about how and to what degree learning and change over time have occurred" (p.130).

The Internet was selected as the means of creation and presentation for these electronic portfolios. All students made a series of web pages containing a "Biography page," a "My Studies page," and a "Resume page." The biography page contained biographical information, links to their past (their high school, where they were born, etc). The studies page contained links to the classes they were currently taking, and their course work. Each student was required to select four projects from the 10 projects they completed over the course of the semester to include in their electronic portfolio. This meant converting some projects to HTML, or capturing screen shots of other projects to include as a graphic on their "Projects page." The actual selection and the means of presentation in the portfolio were left up to the student. Portfolios contribute to learning best when they are under-invented (Smith, 1997).

Creating the electronic portfolio helped students see that learning should not be disconnected across disciplines nor isolated within a given course, but to encourage them to make connections among and across their own learning experiences (Courts & McInerney, 1993). These pages were designed and constructed by each student in any manner they wished. For example, some of the more advanced students chose to use frames in their portfolios while the novice students simply mastered the basic skills of creating multiple web pages, linking, and providing navigational cues.

Applying the theory of perceived attributes as described by Rogers (1995) was extremely important for the undergraduates since the creation of portfolios was a required assignment. When the instructor gave the assignment, she discussed the ideas of a portfolio with students, and how this assignment would allow them to go beyond the status quo. At the beginning, students were unsure about the project and failed to see its relevance to their education. However, as they began to work on their portfolios they began to see its potential in ways previously overlooked. For example, students began experimenting with ways in which to present their work using graphics, sounds, and animation. They began to understand the limitations of a text-only interface. This is something that students understand it is still not completely understood by all faculty, as most assignments continue to revolve around text on paper. Some students also began to view their portfolio as a tool they could use to get a job, and began sending the URL to potential employers.

As students began to share ideas with each other the quality of their work improved. Novice computer users began to learn from the more advanced students, and became excited at the potential of the electronic portfolio. Frequently, the students went beyond the scope of the assignment to add scanned

pictures, animation, and reflection pieces. Students commented on how excited they were to create a product they would continue to use throughout their college career and beyond.

As the students began to change their individual portfolios, the assignment began to change. Finally, the students' knowledge and understanding of the portfolio and its contents contribute to the potential of the portfolio to inform learning (Krause, 1996). Some students created a reflection page, and because this proved to be such a powerful aspect of the portfolio the inclusion of a reflection page became a requirement for all portfolios.

As students begin to claim ownership of their work they will begin to take ownership of their education becoming better learners in the process. As students begin to reflect on their work and their experiences as learners they will become better teachers.

Graduate Portfolio Project

Graduate students in the Education Technology program reported similar experiences to the undergraduates with respect to the use of electronic portfolios, the impact of the electronic portfolios on their learning, and the uncertainty of their technical skills to accomplish the task. Upon acceptance into the Educational Technology graduate program, all students take Educational Technology and Teaching. This class provides a foundation in the field of educational technology, and strengthens the student's computer skills. Students in this graduate program have been required to create and maintain a portfolio throughout several semesters over the course of two years, however, the medium for the portfolio was determined by the student. The voluntary evolution from a physical medium (paper) to an electronic medium can be seen by comparing the number of students creating electronic portfolios in the fall semester of 1997 with those who created electronic portfolios in spring 1999. In the fall of 1997, a majority of students opted to create, produce, and maintain a physical portfolio instead of an electronic-based portfolio. Typically, the students used notebooks, folders, and included various types of storage mediums (zip disks, web pages, Hyperstudio projects, etc.) to showcase their computer products.

In an attempt to understand this reliance on the traditional physical medium, students were questioned about their choice in their oral final examination. Most of the graduate students reported that they felt more comfortable creating traditional documents, and did not have much confidence in their technical ability to create the complex learning environments required by an electronic portfolio. The insights gained from the oral exams allowed the instructor to alter demonstrations, explanations, and examples of portfolio elements. The instructor was also able to use Rogers' theory of perceived attributes (1995) with the graduate students. By demonstrating how electronic portfolios allowed students to express themselves in ways previously not possible greatly influenced students' perceptions of electronic portfolios. As students began to expand their concept of portfolios to include electronic versions, the number of students opting to create electronic portfolios dramatically increased. The graduate students also began to be more adventuresome with their technical skills in creating the portfolio. During the spring semester, students were gaining confidence and the traditional portfolio began to move toward electronic documents. Students were including video, databases, and series of technology-rich lessons containing PowerPoint presentations, HyperStudio stacks, and AppleWorks projects. By the spring of 1999, all students were creating electronic portfolios. Again, as students' concept of portfolios moved beyond traditional paper representation, the instructor was able to alter the requirement to an electronic portfolio. The educational technology graduate students' experience with electronic portfolios lends support to Rogers' (1995) theory that the diffusion of any innovation is a process and frequently a time-consuming one at that. Now that a majority of our graduate students have adopted the idea and use of electronic portfolios, it is considered a typical task. New graduate students in educational technology understand that the creation of an electronic portfolio is a normal component of the program.

Conclusions

As the project evolves we continue to learn a great deal about the process of integrating electronic portfolios into academic programs. Educational technology faculty continue to improve on presenting the use of electronic portfolios as a valuable learning experience, developing a database of examples of what

these electronic portfolios could look like, and their value in assisting students in obtaining a job after graduation. In addition, this experience has greatly benefited teacher education students since all are required to complete an electronic portfolios as demonstration of mastery of the Florida Accomplished Practices. With the use of electronic portfolios in our teacher education programs, we expect to gain a richer understanding of the depth of knowledge that students have regarding teaching and teaching practices. An exciting result of having graduate students create electronic portfolios is the impact that is being made in the local schools. Many of the masters and doctoral students in educational technology are classroom teachers. These teachers report that as the technology becomes available in their schools, they are teaching their students to create and maintain electronic portfolios. Thus, students at all levels are developing a philosophy of "show what you know as you go."

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Teachers' Comfort Level, Confidence, and Attitude toward Technology at a Technology Course

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Abstract: Currently many universities are offering a technology course. The study is intended to examine the impact of the technology course on in-service teachers. Teachers' comfort level, belief, confidence, and attitude toward the use of technology are investigated. The impact of the course with different degree of technology integration is also researched. The results indicate that the course increased students' comfort level, confidence, and attitude toward the use of technology. The findings also indicate that no significant difference was found on their comfort level, confidence, and attitude between the two groups who had different degree of emphasis on technology integration.

Introduction

In September of 1997, the National Council for Accreditation of Teacher Education (NCATE) released a report addressing the importance of teachers integrating technology into instruction. The new technology standards clearly state that teachers must be competent of using technology in their teaching. At present training teachers the use of technology has become a strong nation-wide movement.

Many universities are currently offering a technology course, often called "the technology course". Content of the course and attitude of teachers toward the use of technology have been studied. Research revealed that the course content is mostly skill-based and that technology integration should be emphasized in the course. Professionals also promoted technology infusion. In addition, research noted that teachers need technology training and that many of the teachers are anxious of the use of technology in the classroom.

Does the technology course reduce teachers' anxiety? Do teachers feel more comfortable and confident in the use of technology after they take the technology course? Does the course change their attitude toward technology? Do they believe that technology is useful for improving their teaching? Is the course content useful to teachers and applicable to their current and future teaching? Does the technology course with different emphasis on technology integration or technology infusion have different impact on teachers?

The present study is intended to examine the impact of the technology course on in-service teachers. Teachers' comfort level, belief, confidence, and attitude toward the use of technology are investigated. The impact of the course with different emphasis on technology integration or technology infusion is also researched.

Research Procedures and Methodology

Four classes, a total of 68 teachers who were taking the technology course in 1999 at a public university, were selected for the study. At this university, students who want to clear their teaching credential are required to take two educational technology courses, level I and level II. The level I course covers computer productivity tools such as word processing, spreadsheet, and database. The level II course involves multimedia, Internet, and technology integration. The course of this research study was a technology level II course. The majority of the students were full-time in-service teachers. The technology course lasted for ten weeks

Two professors taught this course to two classes each. Based on the professor's emphasis on the integration, two classes were categorized into "Integration A" classes while the other two classes fell into the " Integration B" category. The content, emphasis, and course projects will be introduced in the section "The two categories of the courses".

At the end of the quarter, the researcher went to the four classes and asked the students to fill in a survey. The survey contained ten Liker-scale questions related to the participants' perceptions of their comfort level, confidence, belief, and attitude toward the use of technology in classroom before and after the course. The internal reliability of the survey was checked by SAS computer program. The Cronbach Coefficient alpha value of the survey was 0.85. The value was high, and the items of the survey were reliable.

The means of the ten question items were used to determine how strong the students agreed with statements that the course was useful and applicable and that technology can improve teaching. Three question items were used to examine via t-test possible differences of the two categories of the courses.

The Two Categories of the Courses

The professor of the "Integration A" classes believed that students in the course needed to learn computer applications that were commonly used in schools and should practically explore how these applications could benefit and be integrated into their teaching. She taught students how to use a multimedia program (HyperStudio) and a webpage editor (Netscape Communicator). Students used these two applications to develop two course projects—a HyperStudio project and a webpage project. Examples of the HyperStudio project are: using the software to (1) create an instruction on a subject area like mathematics, (2) develop practice items, or (3) produce a test. Learners, especially remedial students, could review what they had learned by going through the instructional HyperStudio Stack. Students could also conduct self-examination using the practice items. Teachers could use the test to evaluate students. For the webpage project, students created a webpage with many links to websites pertaining to their teaching areas, such as science, language art, mathematics, or social studies. On their webpages, they also created questions that encouraged their students to search for the answers on the Internet. The other two course projects were a research paper and a lesson plan integrating technology into instruction.

The professor of the "Integration B" classes believed that students of the course needed to learn infusing technology into subject areas and hoped that after the infusion one could not distinguish technology components from subject components. The course projects involved writing a lesson plan, evaluating four pieces of educational software, using KidPix to create a slide show illustrating the use of subject areas, as well as writing a paper reviewing articles on technology integration. For the lesson plan project, students were encouraged to integrate technology like spreadsheet, videodisc, database, or CD-ROM into their content areas and grade levels. For the slide show project, students were required to include pictures, text, and sound in the project. For the paper, students should list three implications of technology integration.

Both professors required students to write lesson plans integrating technology into instruction. Both professors also required students to conduct research. The research of students in the professor A's classes was to investigate the availability of hardware and software of their schools and teachers' use of technology at the schools. The students needed to collect, analyze, and report data. The students in the professor B's classes conducted library research—reviewing literature related to technology integration. Professor A emphasized skills of using computer applications while professor B focused on technology infusion. The students of professor A's classes spent more time than the students of professor B's classes on learning computer applications, like HyperStudio and webpage development. The students of professor B's classes practiced much on technology infusion by writing lesson plans and evaluating software.

Results and Discussion

The results showed that the participants thought that the course was useful (M=4.2) and that they could apply what they learned from the course in their current instruction (M=3.7) as well as future classrooms (M=4.2). The results indicated that the course content was appropriate, and that the teacher training was on the right track. Some teachers expressed that they could not apply what they learned in their current teaching because computers at their schools were inadequate or not available in their classrooms.

The participants also believed that technology was useful for improving instruction (M=4.4). Since computers entered our classrooms, educators have been engaging in a constant debate whether technology or computers are useful in instruction. Educational technologists often advocate benefits of using technology in education. Some professionals voice their doubts because research indicates that technology does not have impact on students' learning. They argue that instructors do not need to use technology because it does not enhance students' learning. The results of the study revealed that field teachers and educational technologists are heading toward the same direction. Both of them considered technology to be useful for improving teaching.

Items	Means of A	Means of B	Means of A&B
What I learned from this class is useful to me.	4.2	4.2	4.2

I can apply what I learned from this class in my Current classroom.	3.7	3.7	3.7
I can apply what I learn from this class in my future classroom.	4.1	4.2	4.2
Before I took this class, I felt comfortable of using technology in my classroom.	3.4	2.9	3.2
This class increased my comfort level of using technology in my classroom.	3.8	3.9	3.9
Before I took this class, I felt confident of using technology in my classroom.	3.4	2.9	3.2
This class increased my confidence of using technology in my classroom.	3.8	3.7	3.8
Before I took this class, I had positive attitude toward using technology in education.	4.1	3.4	3.8
This class increased my positive attitude toward using technology in education.	4.1	4	4.1
I believe that technology is useful for improving my teaching.	4.4	4.4	4.4

Table 1. Means on the survey. Means of A = Means of the 34 participants of the professor A's classes. Means of B = Means of the 34 participants of the professor B's classes. Means of A & B = Means of all the 68 participants.

The results showed that the students were moderately comfortable (M=3.2) and confident (M=3.2) of using technology but had a comparatively positive attitude (M=3.8) before they took the course. This indicated that the teachers were willing to use technology although they were not proficient in using it. The course increased their comfort level (from 3.2 to 3.9), confidence (from 3.2 to 3.8), and positive attitude (from 3.8 to 4.1). As we know, technology is constantly changing, and the content of the technology course is being continually adjusted. Therefore, in the technology course helping teachers feel comfortable, confident, and positive is as important as teaching them specific technology content. If our teachers are comfortable and confident in using technology, they will be more likely to succeed in overcoming obstacles and using technology in their classrooms.

Professor A's class responses on comfort level, confidence, and attitude after the course were compared with those of professor B's classes. The obtained t-values were 0.12, 0.08, and 0.24. The values did not exceed the critical value 1.98 for $p=0.05$. The results indicated that there was no significant difference between the two groups of

different emphasis in the course. Due to the survey questions of the study being limited in scope, we need to conduct more studies to make conclusions on this issue.

Educators have been debating on what the course should emphasize: technology skills, technology integration, or technology infusion. Some educators think that the course should emphasize skills because one cannot integrate technology without having the skills. Some educators think that the course should focus on technology infusion because teachers must be able to use technology within their content areas and grade levels. Probably all instructors of the technology course have currently included technology skills and integration in their courses. Degrees of technology integration and ways of integrating technology into instruction might vary from one instructor to another. The findings of the study indicate that the difference is not significant on students' comfort level, confidence, and attitude toward using technology.

Conclusion

Studies on the technology course at Colleges of Education has been conducted by many researchers with the attempt to find the best way to train our teachers to be technology literate in order to enhance quality of education. The results showed that the course increased students' comfort level, confidence, and attitude toward the use of technology. No significant difference was found on students' comfort level, confidence, and attitude between the two groups who had different ways if integrating technology into instruction. More studies need to be conducted to evaluate the impact of the course on teachers. Well-trained teachers will help the coming generation to be successful learners in the Information Age.

A Comparison of Student-Teachers' Attitudes Toward Computers in On-Line And Traditional Computer Literacy Courses: A Case Study

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Abstract: This study examined the effect of two computer literacy courses (one was offered as on-line and the other one was offered through traditional methods). Two courses were compared in terms of their effectiveness on computer attitude of the student-teachers. This study also explored the other factors that contributed to changes in attitudes of the student-teachers. The study used data from 209 (147 female, 62 male) student-teachers of which 69 of them attended to the on-line computer literacy course, and 140 of them attended to the traditional computer literacy course. Findings indicate that there is a combined effect of gender, computer literacy course type (traditional vs. on-line), whether any computer related course taken before, previous computer attitude and possession of home computer on student-teachers' post-attitude toward computers. The follow-up study results were also supportive to the results of statistical analysis, and they investigated student teachers' perceptions about the computer literacy course they attended.

Introduction

One of the most dramatic changes in the last three decades has been the rapid development in technology, which has gradually found its way not only into business and industry but also into the classroom through computers and computer-related technologies. Many jobs in the 21st century will involve computers in some way, and members of the workforce who are not able to use them will be at a disadvantage. Therefore, it is critical for individuals to have the necessary education and skills to compete in the next information-intense century.

With the lower cost, wide usage, and increased capabilities of computers, the use of computers in education has grown rapidly. As computers became more widely available and used in schools, educators have adopted many different ways to use them. More importantly, educators have started questioning the meaning of "computer literacy". One of the basic definitions of "computer literacy" is the idea that there should be some basic familiarity with computers which all students need in order to compete in the job market, or to be well-educated citizens. The need for students to cope with daily problems in a dynamic world has led many educators to conclude that having microcomputers in education enriches the learning environment (Bitter, 1985; Fredricson, 1984; Pea and Kurland, 1984).

The new "Information Age" has brought new concepts and technologies for learning and education such as Internet, on-line learning, on-line education and some new technologies provided by development of the Internet. Today, on-line learning holds promises for both distance education and conventional learning environments. Nowadays, it is not surprising to see on-line courses and even the creation of 'virtual universities' based on the web. These circumstances led to the evolution of the idea that today each individual must become computer literate; must know how to deal with computers. Knowing how to use computers today is like learning how to read and write. Society imposes a great demand on teachers to prepare their children for the information era.

When the computer is considered as an educational tool, the most important thing is the role of the teacher. Many researchers suggests that if computers are to be integrated into education, then teachers need to be trained in computer use (Duckett and Wallet, 1994, Savenye *et.al* 1992). For computers to be used in the classroom, teachers must have necessary knowledge about computers. Because of this fact, pre-service and in-service programs for teachers and computer literacy courses for student-teachers were developed and offered. Computer literacy has been defined in many different ways because of the changes in computer technology. It is

recognized that the definition of computer literacy will be specific to the context in which the computer-literate individual must function. A certified public accountant, a doctor, an academician, and a secretary will all need different skills and knowledge to be comfortable and effective in their interaction with computers; each will need something different to become computer literate. This also applies to students and teachers. The interplay of many factors may be involved in the determination of computer literacy such as cognitive styles, mental models, prior experience, age and gender. As Randhawa and Hunt (1984) emphasized, all computer literacy programs must take into account the developmental and cognitive readiness of the learners. Curricula must be based upon the expected entry behaviors and characteristics of the students for optimal instructional impact (Woodrow, 1990).

The idea of integrating computer literacy courses into pre-service teacher education programs goes as far back as to the extension of basic education from 5 to 8 years in 1997 in Turkey. At present, the Ministry of National Education in Turkey is in the process of redesigning curricula and furnishing all basic education schools with Instructional Technology (IT) rooms. This reform has direct implications for teacher training institutions. For example, from 1998 onwards, a computer literacy course became a must course for all student-teachers to fulfill the requirements for teaching credential. Accordingly, all schools of education in Turkey have started offering computer literacy courses for their student-teachers to fulfill this requirement. The earlier attempts at preparing student-teachers to use computer technologies have been initialized by a few higher education institutions. One of these institutions is the Middle East Technical University.

The computer literacy course SCE300 "Computer Applications in Education" has been offered by traditional methods since 1994 at Middle East Technical University (METU), School of Education. This course is carried out through class sessions and laboratory sessions. The basic concepts and knowledge are introduced through class sessions in an electronic classrooms and applications are done through laboratory sessions in the computer laboratories.

Due to the need to provide computer literacy for students whose number has been increasing dramatically in the preparatory school at METU, the on-line computer literacy course IS100 "Introduction to Information Technology and Applications" was also added to the curricula in 1998. This course is designed to introduce basic computer skills, use of common computer applications and fundamentals of programming languages for computer literacy. To serve this goal, a few computer rooms were equipped around the campus with the application software by which learners are exposed to content and they can practice basic computer skills.

Offering an on-line computer literacy course has evoked another question for educators and administrators: which method is more effective to facilitate computer literacy? It is inevitable that reaching a rigid answer to this question will result from a number of studies concerning all the variables that influence efficiency. Even though the on-line computer literacy course is a new experience for the university, it is important to conduct early studies even considering a limited number of variables to understand the effectiveness of the new course. Such studies will yield a better allocation of scarce sources for pre-service teacher education.

The Study

The main purpose of this study is to investigate the effect of two computer literacy courses at METU (one is offered as on-line and the other is by traditional methods). These two courses are also compared in terms of their effectiveness on computer attitudes of the student-teachers with different demographics such as gender, whether any computer-related courses taken before, previous computer attitude and possession of home computer. The second purpose of the study is to explore the other factors that contributed to changes in attitudes of the student-teachers at METU.

The study is based upon a pretest-posttest none-experimental design and a follow-up qualitative study. Since there were no control group in the study it was not possible to conclude that the computer literacy course type was the prior factor that affect the attitude toward computer. There would be a possibility for the other factors affecting the attitude. Therefore, an additional follow-up qualitative study designed to survey student's perceptions about the treatment (computer literacy course), and "computer literacy" concept also to explore the other factors possibly affected participants' attitude toward computer.

There are five independent variables (gender, whether any computer-related courses taken previously, possession of home computer, the computer literacy course type, pre-attitude) and one dependent variable (Post Attitude) in the study.

The study used data from 209 (147 female, 62 male) student-teachers of which 69 of them attended to the on-line computer literacy course, and 140 of them attended the traditional computer literacy course.

To obtain relevant data for the variables, the questionnaire packet used for the pre-test which contained the "Computer Attitude Scale (CAS)" and a "Computer Competency Questionnaire (CCQ)". The Computer Attitude Scale was also used with a follow-up questionnaire as the post-test.

The Computer Attitude Scale(CAS) was originally developed by Loyd and Gressard (1984) and then, translated into Turkish and analyzed by Berberoglu and Calikoglu (1992). The CAS is a likert-type instrument consisting of 40 items. In CAS, there are four sub-scales: 1) computer anxiety or fear of computers, 2) liking of computers, 3) confidence in ability to use or learn about computers, 4) and usefulness (importance) of computers in life. Each sub-scale has 10 items and the items are rated on a Likert-type scale ranged from 1 (strongly disagree) to 4 (strongly agree). In the study the reliability coefficients for the Computer Attitude Scale (CAS) were obtained as 0.91 for pre-test and 0.93 for the post-test.

The Computer Competency Questionnaire was developed by the researcher to survey demographics of student-teachers. The CCQ included 14 items in the form of fill in the blank and alternative-response type questions in order to collect relevant data about demographics of the student. The CCQ focused on the following information: Gender, department name, the computer related courses taken previously, the programming languages that are known, previous computer experience, the places had computer access, purpose of computer use, possession of home computer, will on having a computer, interest of computer, confidence on success from the course.

The follow-up questionnaire was developed and distributed by the researcher to 124 (68 from on-line group, 56 from traditional group) student-teachers agreed to participate. The follow-up study included 9 open ended questions focused on the following areas:

1. Student's expectations from the course, and effectiveness of the course in terms of satisfying their expectations.
2. Effectiveness of the course in terms of its helping student-teachers to develop positive attitudes toward computers.
3. Excluding this course itself, the other factors that student-teachers believe contributed to the changes in their attitudes toward computers.
4. Effectiveness of teaching activities applied in the class that student-teachers believe most helped their learning about computers.
5. Effectiveness of the course in terms of student-teachers' professional development.
6. Student's perception of the definition of a computer literate person.
7. Student's perception of the qualification of the course itself as a computer literacy course based on
8. Student's self-evaluation on being computer literate after participating in the course.
9. Student's self-evaluation on being an efficient computer user on the basis of their skills and knowledge gained through the course.

Data collection and analysis

At the first class meetings, after a brief introduction to the class by the instructor, the researcher was introduced to the student-teachers. The volunteered student-teachers were asked to participate in the study and were given time to complete the CCQ to collect information about the participant and CAS to measure the participant's attitude toward computers before taking the course. At the end of the semester; CAS was distributed once again to measure the participants' attitude toward computer after taking the course and student-teachers were asked to participate in a follow-up study. The CAS and CCQ results were analyzed by using SPSS. The follow-up study results were analyzed by qualitative analysis methods.

The demographic information obtained was analyzed by using frequency distribution. Based on this information, an insight to the data was provided. Multiple Regression was performed to analyze effect of pre-attitude scale scores, type of course (traditional vs. on-line), gender, whether any computer related courses taken before, and possession of home computer on posttest attitude scores of student-teachers.

Results

Means and standard deviations of the pre and post-attitude scale scores and the frequency of males, females, whether the computer-related courses taken previously or not, and possession of home computer for the sample are presented in Table 1. The mean of the pre-attitude scale scores is higher than the post-attitude scale scores for on-line group. This indicated that the on-line computer literacy course does not have any effects on improving the student-teachers' attitudes toward computers. On the other hand, in traditional group, compared to pre-attitude scale scores, the post-attitude scale scores were higher, even though the difference was not significant. This indicated that the traditional computer literacy course has a mild effect on improving student-teachers' attitudes toward computers.

	Pre-test		Post-test		Gender		Computer related courses taken or not		Home computer	
	X	SD	X	SD	Male	Female	Yes	No	Yes	No
Traditional	131.59	14.67	131.93	21.53	41	99	27	113	20	120
On-line	131.86	17.02	126.71	17.95	21	48	14	55	10	59

Table 1. The summary of observed variables

Results of Multiple Regression Analysis (table 2) indicated that there is a combined effect of gender, computer literacy course type (traditional vs on-line), whether any computer related course taken before, previous computer attitude and possession of home computer on student-teachers' post-attitude toward computers.

	B	Std.Error	Beta	T	Sig.
Gender	4.282	2.704	0.096	1.583	0.115
Courses taken previously	3.380	3.129	0.066	1.080	0.281
Possession of home computer	-1.486	3.632	-0.025	-0.409	0.683
Computer literacy course type	5.474	2.615	0.126	2.093	0.038
Pre-attitude scale scores	0.668	0.082	0.503	8.135	0.000

Table 2. Multiple Regression Analysis

Analysis of the responses to each question in the follow-up study indicated as follows:

The responses to first sub-question demonstrated that prior computer experience and knowledge shaped student-teachers' expectations of the course.

The results for the responses to the second sub-question were different for two groups; majority of student-teachers in traditional group believed the course itself contributed to the changes in their attitudes toward computers even though those student-teachers who already had prior computer experience admitted that this contribution was supplemental since they always had positive views for computers in education. On the other hand, the results indicated that majority of student-teachers in on-line group believed that the course was not very effective on their attitudes. This is delineated by the given responses expressing the problems they were faced with. The student-teachers who attended the course IS 100 had difficulty with the level of English used in the program and also with on-line learning itself. They expressed that they were not ready for on-line learning and felt the lack of human support in the course. However, the majority of the participants from both groups reported that the course help them slightly to develop positive attitudes.

The responses to third sub-question verified that the most important factor for student-teachers that they believed affected their computer attitudes apart from the course was the necessity and the widespread use of computers. They felt that as a teacher they also had to be computer literate and help their students with their endeavors. Analysis of the responses also indicated that possession of home computer increased teachers' access to computers and willingness to learn more about them. Finally, given the fact that pre-service teachers were also students working on their teaching credential, they felt computers provided a great asset to them in their own education and thus, it helped them develop positive attitudes toward computers.

Current research suggests that computer literacy courses somehow affect attitudes toward computers by increasing computer experience of participants. However, the literature fails to explore which teaching activities are most effective in enhancing students' computer experience and developing their attitudes. The

fourth question, therefore, was asked to determine which were the most effective teaching activities that teachers believe helped them learn more about computers and gain positive attitudes. The findings supported the view that laboratory sessions and office applications, using Internet, preparation of homework and projects in SCE 300 were most effective teaching activities for the student-teachers. This conclusion is also consistent with the results of the study (Gurbuz, Eryilmaz and Bulut, 1999). In addition to these activities, on-line quizzes and exams were signified as effective factors by the student-teachers attended the on-line course, thus it confirmed the effective potential of the exams on learning.

The responses to fifth sub-question showed that the more new skills students gained from the course, the more they valued the course, and thus the more the course contributed to their professional development. Interestingly, regardless of their previous experience with computers, the student-teachers believed that a follow-up computer course would contribute more to their professional development. Finally, in both on-line and traditional group, some respondents agreed that the course was useful, but some of them reported that the course was not satisfactory. This finding paralleled with the results of the multiple regression analysis which indicated that after completing the course there was no combined effect of pre-attitude scale scores, gender, the computer-related courses taken previously, computer literacy course type (traditional versus on-line), and possession of home computer on the student-teachers' post-attitude.

The responses to the sixth question showed that majority of the participants in both on-line and traditional group described being computer literate as: "being an efficient computer user and being able to write programs and use different types of computers". In both on-line and traditional group, with slight differences, a computer literate person was perceived similarly: "the person who is able to know what to do with computers, to be able to use them efficiently and to have no fear of them".

The responses to the questions 7, 8, and 9 showed that Student-teachers in both on-line and traditional group pointed out that the course did not provide sufficient practice and the knowledge provided by the course was insufficient, or not up-to-date. On the other hand, some respondents monitored that the course could be considered as computer literacy course in spite of some insufficiencies pointed out. The majority of the respondents thought that the course they attended could be a beginning for them in terms of further studies on computer literacy.

Discussion

Participants argued that the course should be offered at least in two levels and then through the course, the difference between these levels should be minimized. Moreover, more laboratory session hours should be supplied since the participants emphasized the effectiveness of practicing with computer. This study indicated that basic computer literacy courses are most effective for those with no prior experience. The results also verified that in order for teachers to become fully capable of using technology in the classroom, a follow-up computer course is necessary. These conclusions are also consistent with the study (Gurbuz, Eryilmaz, Bulut, 1999).

This study contributes to a better understanding of how student-teachers' attitudes toward computers change due to the participation in a computer literacy course. The data from this study indicated that student-teachers developed somehow positive attitudes, their anxiety was lowered and confidence was increased with computers following the participation in a computer literacy course. The results of this study supported the view that participation in a computer literacy course affects pre-service and in-service teachers attitudes toward computers positively (Savenye, 1993).

It is a fact that the number of student teachers who demand technology education in their pre-service education has been increasing dramatically. Therefore, teacher education institutions should innovate and adapt new formats and medium for computer literacy courses to meet this demand. This study indicated that on-line computer literacy courses should not fail in providing face-to-face interaction and learning activities for participants. It should be recognized that learning is a social phenomenon that takes place within a social context. Therefore, it is crucial for on-line computer literacy courses to ensure this social context and provide interactivity among the participants. If face-to-face or real time communication is not available for on-line courses, then more advance technologies should be adopted to provide synchronous communication and interaction among the participants.

For traditional computer literacy courses, this study indicated that student teachers sought more up-to-date content and lab activities that parallel with their needs. Therefore, computer literacy courses offered in the traditional manner should provide lab sessions with activities that reflect student teachers' needs and up-to-date activities.

This study revealed the fact that although student teachers recognized the importance and role of technology in their lives, they failed to associate technology with their profession. Therefore, in their pre-service education, faculty members in their teaching methodology courses should demonstrate the importance and role of technology in teaching as well.

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What are we talking about?
The Impact of Computer-mediated Communication on Student Learning

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Abstract: Previous research on delivery modes in distance education and their correlation to student achievement outcomes has shown that students learn better via computer-based communication than face-to-face instruction. One explanation for this phenomenon is that the students must take more responsibility for, and be more active in, the learning process. This study looks at how the media used in one aspect of distance education, on-line discussion, can affect the learning outcomes for students involved in distance learning activities. On-line discussion within any learning environment can provide the opportunity for students to engage in thoughtful, content-based conversations about the topic under study, which may result in deeper understanding and greater learning gains. A content analysis of student discussion in listserv-based (electronic-mail) discussion, web-based threaded discussion, and chat discussion will be presented.

Introduction

In the world of distance education, one of the most important elements of a quality is course is that students are able to interact with the instructor and other students as they would in a traditional classroom, and, given the computer-based medium of distance education, this is done through computer-mediation communication. This goal can be met through a variety of methods, using e-mail based discussion groups (or Listserv discussion groups), web-based discussion threads, and chat rooms. Each of these methods has advantages and disadvantages, and may or may not fit with the instructional objectives of the course. In a 1986 study, Hiltz found that the use of electronic discussions not only could offer new educational options, but in some case could be *more* effective than the traditional classroom. Phillips and Santoro found that computer-mediated communication could offer students greater coherence, empower students to improve their communication skills, and enable students to engage in problem-solving activities. McComb found that computer-mediated communication can create a unique environment for discussion that avoids many of the conversational limitations posed by face-to-face communication.

The most common type of computer-mediated communication in higher education today is the use of the electronic mail-based discussion group, or Listserv. An electronic mail-based discussion group allows instructors and students to send e-mail to one another simply by entering one e-mail address in the "TO:" line of an e-mail message. Messages sent to the group may be moderated by the instructor of the course, or may be automatically sent to all members of the group. From a technical perspective, the advantage of e-mail based discussion is that students are sent the messages directly without having to remember to log-on to the internet and to check out the discussion. A common disadvantage is that when the student loses a note, or accidentally erases a note, then there is no record of what he or she has said. Also, an e-mail-based discussion group has the potential to "flood" the inbox of the student with an overwhelming amount of e-mail.

Web-based discussion, or threaded discussions, work similarly to the idea of Bulletin Board Systems (or BBS). The student posts a message to the bulletin board at a specific web-address, and others respond or reply to the message when they log-in to check the board. The advantage of web-based discussion is that one can see

exactly how the discussion or conversation has progressed. As with an e-mail discussion group, one can reply to a message at anytime, but it might be difficult to track the specific message that encouraged the student to respond. With threaded discussion, one can "see" exactly how the discussion progresses, with sub-headings of replies and main headings of new threads. A disadvantage is that the student might not remember to log-in and check the messages frequently (although some discussion groups do send out e-mail reminders when a new message is posted to the discussion board).

Chat-based discussions are synchronous, text-based discussions. All users must be logged in to the same chat session at the same time. The most obvious difference between this form of computer-mediated discussion and the other forms presented here is that all the users are logged on and talking at the same time. This may offer a more "natural" discussion to take place, with real-time interaction taking place. A disadvantage to chat-based discussion is that there is most often no documentation of what was said, and the pace of chat discussion with more than 10 students (where it seems everyone types at once) can be too overwhelming for most individuals.

Method

For the purposes of this study, all three types of computer-mediated discussions -- e-mail-based, web-based, and chat-based -- were used across two sections of an introductory education technology. Three main research questions guided the study:

1. What type of discussion takes place in each setting?
2. How much discussion takes place in each setting?
3. What is the quality of the discussions in each setting?

The computer course, entitled *Uses of Technology in Education,* utilizes hands-on instruction for the integration of computer-based technology in education settings. The course is taught in a computer lab at American University. Two sections were offered, in which a total of 42 undergraduate and graduate students were enrolled. Although the course is listed as a requirement for education majors, approximately 15% of the students enrolled in the course were non-education majors.

Findings

A total of 279 statements were posted during the spring 1998 semester. 108 of those postings were submitted via a an e-mail discussion group. 110 postings to the web-based discussion occurred, and 61 statements were made in the chat format. Participation varied among the different types of discussion formats. Each posting to the discussion forums were cataloged and evaluated at the end of the spring 1998 semester. Postings were then evaluated using content analysis with respect to each of the research questions listed above. Each posting to the discussion forums were cataloged and evaluated at the end of the spring 1998 semester.

Figure one illustrates the type and number of statements made in each type of computer-mediation communication. The first bar in each set represents procedural statements, such as questions about when and assignment is due or where the class might be meeting. The second bar represents content-related statements, those statements directly related to the course content. represents content-related statements, those statements directly related to the course content.

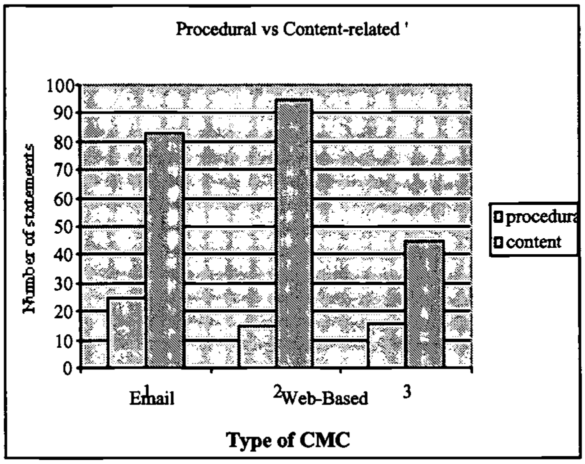

Figure 1: Number of procedural or content related statements in each discussion format

Figure two illustrates the number of statements or posting by the instructor or by the students in each type of Computer-mediation communication. The first bar in each set represents instructor statements, the second bar illustrates student statements.

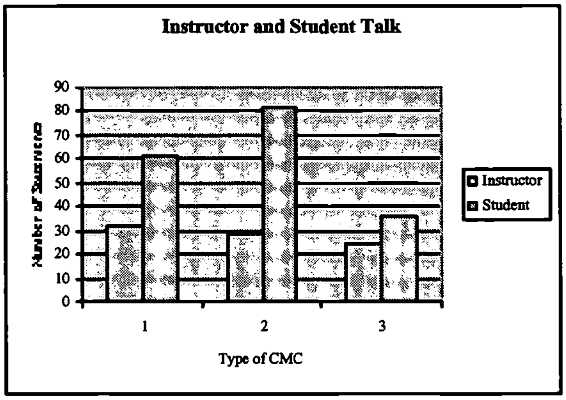

Figure 2: Instructor and student talk in each type of Computer-mediation communication

In the e-mail and web-based discussion formats, students were more likely to post statements that were at least four sentences in length. In the chat-based discussion, most statements were about one sentence in length. In addition, in e-mail and web-based discussion, students were more likely to provide quotes from the textbook, cite example problems, or provide links to other resources. In the chat-based discussions, students were less likely to post this type of connection to outside readings or the textbook. In the email and web-based discussion formats, students were also more likely to make direct reference to another student's statements or comments.

In a follow up survey conducted at the end of the semester to assess the effectiveness of the discussions in terms of their understanding and perceptions of the course content, students were asked what they found most valuable about the discussion forums. Some sample responses (from both classes) were:

- "I became aware of different points of views. In addition, sometimes I didn't have any idea on the subject so discussions were a good start for me!"
- "I got a chance to hear many different perspectives on important issues."
- "It provided the chance to do research on the web and share others perspectives."
- "I enjoyed reading people's responses because it helped me to understand the concepts and the questions in the homework."

- "I was able to see aspects of a concept I might not have thought about when answering a question."
- "That people are interested in the class and therefore interested in giving their opinions about the topics discussed."
- "I found that others have the same questions as I. I found that looking at other responses helped me to answer the question I had because there were often more than one answer or way to solve the problem."

On the survey, 85% of the students who participated in the discussion indicated that the topics discussed changed or influenced their opinions, and 100% indicated that their knowledge of the content improved. In the educational technology course, 72% of the students indicated that they would use a discussion group in their own teaching, for such reasons as:

- "To get my students to actively research a specific issue or topic."
- "To allow students to express their ideas without worry of immediate backlash."
- "To help them learn how to use email!"

The survey included a question that queried students' opinion of the fairness of the assessment in the online discussion. 100% of the students responded that they felt the assessment was fair. Comments to this question included:

- "We were graded according to content and apparent effort."
- "I think it's very hard to assess a tool like this. Assessment was fair."
- "Because you could not just say anything and get away with it. You had to think a refer to a site or reference."

Overall, the results of this survey suggest that students found the on-line discussion beneficial and useful to them. Many students felt that the on-line discussion format should be continued in future classes. However, some of students in the course felt that participation in the discussion should remain voluntary. The most common rationale supporting voluntary participation was that students felt there was already sufficient activities (i.e. homework, labs, folders, etc.) required in the course. Other students simply felt that students should be allowed to choose whether or not they want to participate in the discussions. In addition, students felt that there were benefits to active as well as passive participants on the list.

Conclusions

The findings indicate that computer-mediated discussions can be a valuable component to any traditional technology course. Students were able to actively participate in an activity that allowed them to extend the ideas of the course outside the traditional confines of the classroom. In particular for this educational technology course, students were able to think more deeply about the information presented in class in a different format. The focus of the educational technology course is generally on the technical components of "using computers" and the use of computer-mediated communication allowed students to discuss the implications of content as it relates to real-world applications.

Requiring students to participate in class discussion, be it in person or on-line, can be a formidable task. Most faculty hope that students will participate in class discussions simply because they are interested in the course content, and external reinforcement (such as giving points for attendance) can interfere with students internal motivation for participating in class. However, using a rubric can serve as a guide to help students structure their comments, and often can help facilitate discussions that are grounded in research and practice. In the online environment, students have a greater amount of time to prepare their comments, and using a rubric can assist them in preparing and reflecting on what they are going to say.

Web-based and Listserv discussion seem to generate much more thought and deeper consideration than either face-to-face or chat. During the early phase of chat, a lot of time is used up on procedure. In the first chat session of the semester, it can take more than an hour for students to stop focusing on the medium. In a two hour class period, only in the last 45 minutes is there any real discussion. In chat, much as in face-to-face discussions, students did not give much consideration to the views of others. They simply used them as cues to propound their own beliefs. There was more talking, but we did not notice more listening.

A much larger portion of the class did participate during chat. Even those who never speak in class could eventually be prodded into participating. Participation has been at 100% in web-based discussion. It was fairly

close to that during chat. In face-to-face discussion in class, it can be more often in the 50-60% range. The ability to send private message during the chat discussion can prompt shy students into participating. One would not have had the same opportunity for private, personal contact in a classroom. In all but face-to-face, the instructor loses most of their ability to guide the discussion. The chance to ask further probing questions diminishes.

Technology, such as on-line discussions, must be carefully evaluated before being implemented into any curriculum. As with other types of technologies, from video simulations to computer-based tutorials, the instructor must be comfortable with not only the medium, but also the message sent through the medium to the students. In an on-line discussion format, the instructor must carefully monitor students' statements about concepts and redirect them as necessary. Monitoring the discussions requires time and commitment on the part of the instructor, as well as a desire to assist the student to come to a deeper understanding of the concept itself. It is our opinion that this is time well spent. As seen with the discussion of weightlessness in the physics example above, the instructor's role is often to not only provide the opportunity for in-depth investigation into a topic, but also to provide constructive feedback as it develops. In this way, the instructor can better integrate electronic discussions to help students come to a deeper and broader understanding of concepts from networking to equity in education.

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Information System Design of Undergraduate Education: Combining Lectures with Practice

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Abstract: *This paper describes the basic knowledge necessary to promote the ability that students can analysis, design, and construct information systems. The curricula and the practical teaching material are proposed, with which students can experience information system development by applying the basic knowledge of lectures. The subjects of the basic knowledge are programming, software design, information system development, database, and network. "Retail management" is taken up one of the practical teaching material for students to learn the relationship between basic subjects. Up to now students have stayed in the fragmentary knowledge of lectures. Yet, with this teaching material, they can acquire practicing ability doing voluntarily concrete analysis, design, and construction in practice.*

Introduction

The use of the computer is ubiquitous in today's business communities, and is becoming so in education. However, concerning the information system design, there are few practice teaching materials which organically tie to the lecture in order to teach the latest content. Engineering skills demanded today require the ability to synthesize basic subjects into design and to be able to analyze design solution to points, ultimately leading to a high quality product which can compete economically in the marketplace. The development of this type of knowledge in our students requires us to provide them with more hands-on experiential learning.

The basic subjects of lectures are programming, software design, information system development, database, and network. Figure 1 illustrates a location of subjects by information system design. The center of the Figure 1 is a nucleus of information system design. This part corresponds to a nucleus of a computer and its nearest seeds. The technological innovation of these seeds is aggressive. On the other hand, the outside represents human society and the basis of needs for the computer. The change in needs of human society is slower than the technological innovation of seeds. The center of Figure 1 contains seeds. The display of Figure 1 becomes near needs while facing from this center towards the outside.

On the other hand, this practice teaching material starts from the information system development methodology by which the information system is defined based on users' needs and restrictions. This assists us in making programming through the software design and the database design. If the concept of object-oriented methodology (Booch, 1994) is applied, it is thought that the abstracted lecture is a class, and the practice corresponds to an object in the world of the information and computer science education.

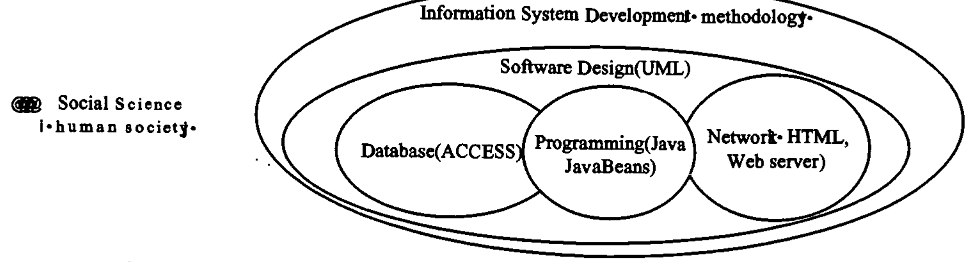

Figure 1: A relation between the basic subjects about information system design

Basic subjects

1)Programming; We choose JAVA in our practice classes. There are three reasons for this: JAVA is congenial with the Web browser of the Internet; JAVA is compatible as an object-oriented language; and teaching the concept of structuralization and abstraction is easy.

2)Network; HTML and Web-server are taken up in the practice. The server is constructed to acquire the basis of a decentralized system which improves the performance, and the network is studied by expanding the function and operating systems.

3)Database; The relational database is widely used today. ACCESS database is congenial with WindowsNT, and for this reason, we use it (Fujio, 1996).

4)Software design; It is necessary for students to use the methodology properly according to an object area, and to know various methodologies well (Saeki, 1998). It is preferable to exercise various methodologies in practice. However, if we condense it to one methodology, recent object-oriented analysis and design is the best approach. In the case of this situation, we model an object area by using the UML (Quantrani, 1998), which is the latest unified modeling language. By using the UML, students design a use case, an object diagram, a sequence diagram, and a status diagram of the object area.

5)Information system development; We use the methodology in practice but we do not use tools. Students should interview users, operators, and managers in the object area based on methodology and examine the present situation. They research the problems, and draw an ideal system image that can solve these problems. They should also settle on the system image which can be developed actually in outline books considering: policies; social and technical constrained conditions; and the cost performance. Students should experience this process as practice and teachers should evaluate the achievement.

Practice teaching material

Retail management is taken up as a practice teaching material. Students take new requirements to the current system of a wholesale shop, and design a new system. First of all, students start with a grasp of the current business of the wholesale shop (IPA, Asupa Co., 1993), which is the object system, and they investigate it to understand the flow of information, money, and commodities between sections.

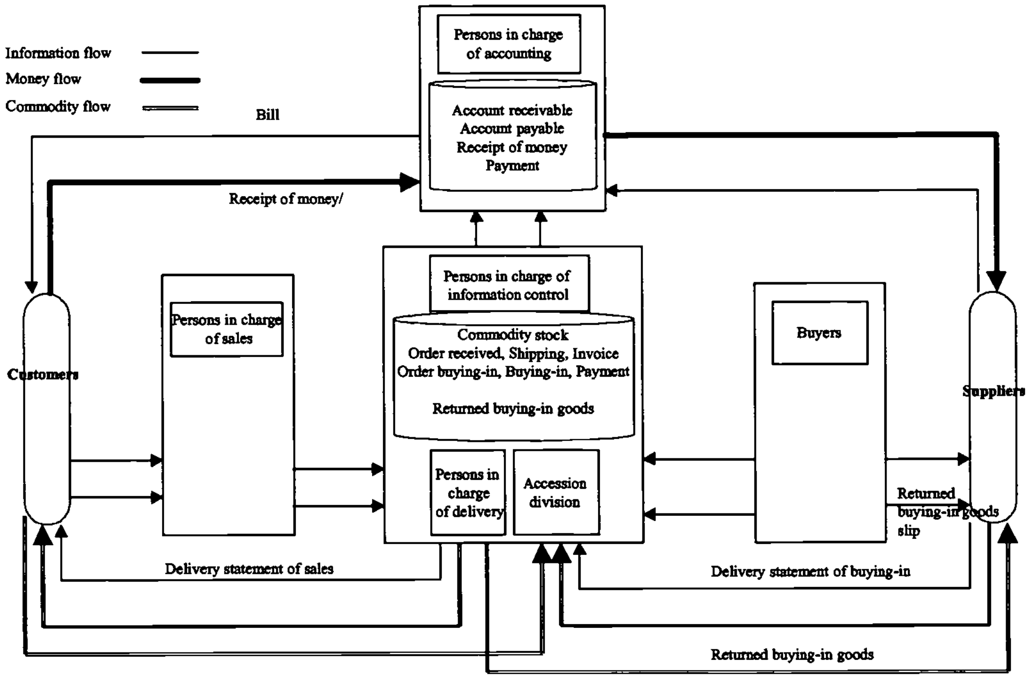

Figure 2: Flow of information and organization of the wholesale shop; new system

Students make a plan for the wholesale shop to develop the new system that includes the following

requirements for the current system:

1) The wholesale shop connects the commodity headquarters, the offices, and the warehouses with the network, and makes paper transactions electronic. The commodity headquarters consists of buyers, persons in charge of accounting and commodity control. The office means persons in charge of sales. The warehouse consists of persons who handle accepting and delivering the commodity.
2) To give the system generality and to build it cheaply, they construct the information system by using client-server systems and Intranet.
3) They make the system which corresponds easily to its evolution, expansion, and maintenance using object-oriented methodology.
4) A database system is used to accumulate a large amount of data and to process it. Figure 2 shows the new system that realizes the achievement of the plan.

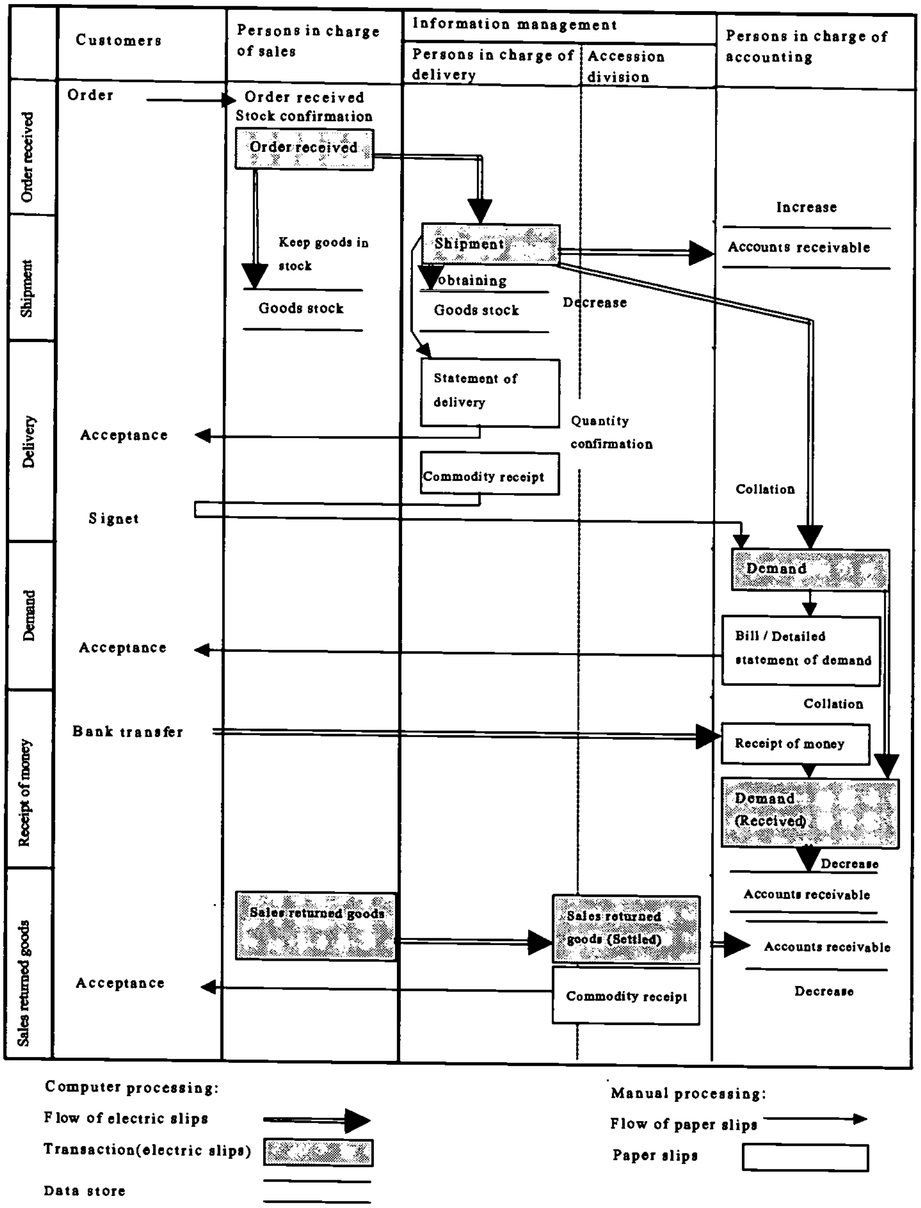

Figure 3: Flow of information and slips concerning sales business

After the business reformation, Figure 3 shows the flow of information, slips, money, and goods

between the sections: persons in charge of sales; information control; accounting; and buyers. Thereafter, the design is advanced according to the procedure of the sales business in Figure 3. The architecture of this system is composed of three elements, which are human interfaces (screen), databases, and business processes (business procedure). At the stage of the framework design, it is decided how to characterize and design the outline of three elements. They must consider overall network, computer and OS, programming language and components, and databases, what is more, a trend of the industry and the business. They bring the whole system together while making these three elements detailed.

Human interface

The slips are human interfaces in the current system. The input and output items needed in the new system are added, and the I/O screen which is the new human interface, is designed. Figure 4 is the example of the order received processing screen.

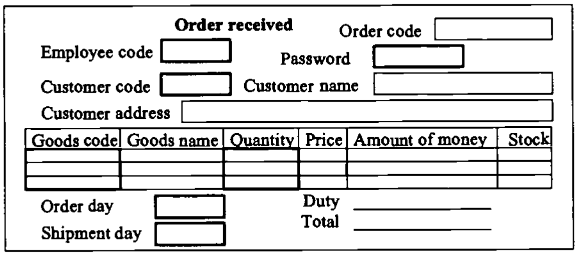

Figure 4: Screen of order received

Database

First of all, all necessary data is dug up based on this screen in the new system. Next, in order to remove a repetition of data, they normalize the data and make the table, that is to say, design the database. .

Business process

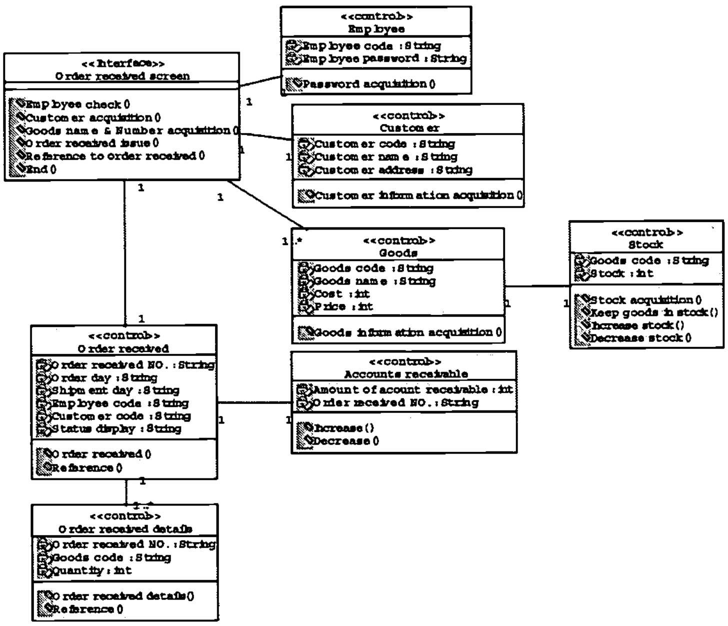

Figure 5: Class diagram of sales business

Using the UML description (Eriksson, Penker, 1998), the class diagram (Figure 5) which concerns

the sales business is made by extracting CLASS/OBJECT. The order received processing procedure between the screen and the database is shown in the sequence diagram based on this class diagram. In addition, the status diagram, which expresses status transition of the order received slip, is made. Its order received slips (electric slips) are the main information in the sales processing. They are the ones taking the place of the paper slips, which are transmitted between the sections in the current system.

Program design using components

The system configuration is a client/server. Applet made by JAVA and database is arranged in the server's machine. After this Applet was called from the server to the client by World Wide Web, the commodity code and the quantity of goods are inputted into the screen of the Applet, that is to say, the retrieval and the update of the commodity data are directed. Because this Applet is connected through pure Java driver (Imprise 1998) with the database on the server, the commodity data on the database is retrieved according to the retrieval instruction of persons in charge of sales, as it turned out, the commodity data is displayed in the Applet on the client's machine. Moreover, the contents of the database on the server can be updated in the instruction of the update. JavaBeans; components made by JAVA, are used to design. It seems reasonable to use JavaBeans to design the screen and database so that making and maintaining the software becomes simple compared to programming with JAVA. Figure 6 constitutes one example of the programming code added to JavaBeans for the customer information retrieval.

```
void customerField_keyPressed(KeyEvent e) {
    //[enter] When the key is pressed
    if (e.getKeyCode() = = KeyEvent.VK_ENTER){
       try {
            parameterRow2.setString("CUSTOMER",customerField.getText());
      //The customer code is set in the parameter
          queryDataSet2.refresh(); //The record of customer code is retrieved
          String x = queryDataSet2.getString(0);//Retrieved customer code
          String y = customerField.getText();//Customer code inputted to screen
          if (x.equals(y)){
                    customerNameField.setText(queryDataSet2.getString(1));
               // The customer name is displayed
                    addressField.setText(queryDataSet2.getString(2));
               // The customer address is displayed
          }
          else
                    statusBar1.setText("The customer code is wrong");
     }
     catch (Exception ex){
          ex.printStackTrace(); }
  }
}
```

Figure 6: Retrieval of customer information based on customer code

Conclusion

Students plan the new system, after they understand the whole elements (seeds) which compose information systems, an industry trend, and new requirements (needs) of business. At the stage where the object system is analyzed, the requirements are analyzed and defined using the similar diagram (Figure 3) to a business flow. This diagram is more specialized for business than use-case used (Schneider, Winters 1998) by the object-oriented analysis-design. As for systems annalists skilled in the business, in order to analyze and design a novel system in a short term based on their general situation judgments, they often use

the diagram specialized on the business. As for the design of the screen, the database, and the business process in the framework of a new system, it is necessary to decide the priority, that is, which should be designed emphatically at the object system. This method is a realistic technique with which top down and bottom up are combined. The entire systems are integrated while designing each outline, and are broken down.

HTML used in the screen design, ACCESS used by database, and JavaBeans and JAVA used by business process design are an individual design element group, students must study those subjects through lectures previous to this practice. As a result, they will understand relations between the subjects through this practice. The programming, which uses JAVA, is indispensable for understanding the concept of object-oriented methodology. However, the use of common components (JavaBeans) composed of JAVA is effective to develop actual information systems if object systems are complex. Therefore, students should be skilled in usage of common components. After designing rough specifications of the screen and database, they design components, and mount components being combined, and what is more, program undefined parts of details using JAVA.

Considering students for departments of social science, this teaching material steps into the area which affects the society. Moreover, because it is possible to design from the user requirement definition to the programming consistently, students will be able to understand each position of basic subjects from experience. A basic technology of Internet and the latest object-oriented analysis-design can be experienced at the same time. In conclusion, I should note that the knowledge obtained by the lecture could be improved even to practical ability through the substantial practice.

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EDUCATIONAL LEADERSHIP

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Seven articles in this section are grouped in the following way: (a) a response to state, regional and national technology standards and their implication for leadership training; (b) the challenge of national reform through changes in university graduate degree programs; (c) grant initiatives to promote partnerships among universities and schools; and (d) the results of a pilot training model. All of these articles are valuable reports to increase ones knowledge of the challenges encountered while leading reform efforts, training reform agents, or developing university/school partnerships.

The first article compares the standards promulgated by state and educational organizations for technology in the classroom and the necessary educational leadership training to embrace these standards. Warren Hope, Bernadette Kelley, and Janet Guyden of Florida A&M University presents as the "key component" the administrators' level of expertise and associated abilities for utilizing educational technology. The article provides suggestions for incorporating these standards into university leadership training programs.

The second group of two articles highlight new and radically different graduate degree programs as necessary to meet technology reform initiatives. Ian Gibson asserts that upon completion of the Wichita Sate University's Educational Doctorate program students become "visionary leaders of schools of the future" through an "immersion" in various technologies. Students participate in variety of classroom settings and roles. Perry Rettig, Penny Garcia, and Scherie Lampe describe in their article a new Master's of Education degree at the University of Wisconsin Oshkosh. The program, called the Caring Intellectual Leader Model, focuses on the problem-based learning while incorporating technology throughout all levels of instruction and assessment. Two degree strands are described. One prepares teachers to use technology in their classrooms efficiently and the other prepares educators to certify as district technology coordinators.

The third group of articles report results from specific grants having in common university and school district partnerships. Steven Best, Ronald Marx, and Barry Fishman of the University of Michigan, and Deborah Peek-Brown of the Detroit Public Schools report their findings from a National Science Foundation grant to provide systemic reform to middle school science. Challenges of a large-scale undertaking are presented. Carolyn Rude-Parkins presents the design of the Technology Leadership Institute (TLI), a project initiated through the BellSouth Foundation's Recreating Colleges of Teacher Education. A partnership between the University of Louisville and the Jefferson County Public School District, the TLI is a collaborative effort to provide new levels of technology expertise for teachers and leaders. Steven Jackson, Delores Brzycki and Mary Ann Cessna of the Indiana University of Pennsylvania reports successes and failures from their project called Advancing the Development of Educators in Pennsylvania through Technology Training (ADEPTT). Their project, funded by Bell Atlantic and Microsoft Corporation, is a collaboration of three institutions of higher learning and fifty-three school districts. Suggestions are provided for such a large project to be successful.

The final article, Reg North presents an evaluation of a multimedia CD-ROM based training program conducted by the University of Ulster in Northern Ireland to senior secondary staff in four school sites. Valuable lessons from the training design were learned and reported.

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Technology Standards for School Administrators: Implications for Administrator Preparation Programs

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Abstract: As technology continues to have a significant role in schools, it becomes increasingly important for educators to acquire knowledge about understanding its power and capabilities and skill to use its features. Although school administrators are busy people, they are not exempt from knowing about technology's power and capabilities. As instructional leaders, it is important for them to demonstrate understanding and familiarity with the features and capabilities of technological devices. In the thrust to integrate technology into schooling, school administrators' level of expertise and ability to facilitate technology's integration into the curriculum emerges as a key component. Recently, technology standards depicting what teachers and students should know and be able to do with technology have been promulgated by states and educational organizations. Technology standards are also being advanced for school administrators. This paper identifies technology standards for school administrators and relates some of the implications those standards have for administrator preparation programs.

Background

Technology is reshaping work environments in virtually every enterprise in American society. Technology enables a more efficient method to accomplish tasks and communicate information. Technology can influence the teaching and learning processes that occur in schools. Electronic devices are being used to deliver subject matter and assist students to acquire technology competencies. Technology has also influenced administrative processes that are necessary for a school to function. Budget preparation, information storage and retrieval, reporting, and communicating with stakeholders have been made more efficient by using technology.

Electronic devices and software applications that tell them what to do can perform more efficiently and in less time many tasks previously accomplished with paper and pencil. And, the versatility, that is, the many different tasks that can be accomplished efficiently, makes using technology a realistic advantage. Technology is being used to word process documents, manipulate numbers in a spreadsheet, sort information in a database, and retrieve information from other computers. It can also be applied to other productivity and problem solving situations. Technology also supports dynamic and interactive presentations, and professional development can be facilitated via video-conferencing negating the need to travel long distances.

Given technology's complexity, its various configurations, and the many tasks it can accomplish, it is safe to say that it is impossible for one person to be proficient in all that technology can be applied to. So, a question is asked, "Are there some basics guidelines that specify a minimum level of skill in using technology"? This question is best answered in the context of the role or profession of the individual.

Recently, in education, there have been efforts by some states, namely, Nebraska and Virginia, and some educational organizations, the International Society for Technology in Education, to develop technology standards, which are in effect guidelines describing what teachers should be able to accomplish using technology. Right now, the technology standards movement seems to concentrate primarily on students and teachers. Much of the literature on technology standards specifies what students should be able to do using technology at various grade levels and what teachers should be able to do with technology.

Although it is established and well publicized that principals are key actors in the process of integrating technology into schools and facilitating teachers' adoption and use of it (Cooley & Reitz, 1997), they have

remained on the fringe of technology professional development (training). This is evident in schools' and districts' professional development (training) for the use of technology where the concentration is on teachers. The technology professional development needs of school administrators (principals) have received less attention (Hope, Kelley, & Kinard, 1999). And, it appears as though school administrators (principals) are also being neglected in the technology standards movement.

Technology Standards for School Administrators

There are a few organizations that have proposed technology standards for school administrators. The Interstate School Leaders Licensure Consortium (ISLLC), the National Council for Accreditation of Teacher Education (NCATE), and most recently, the Southern Regional Education Board, Each organization has identified standards that it believes school leaders should have in their arsenal of abilities. The ISLLC identifies two performance standards directly related to principals' ability to use technology. ISLLC standards list performance indicators that state that the administrator facilitates processes and engages in activities ensuring that technologies are used in teaching and learning (Standard 2) and that there is effective use of technology to manage school operations (Standard 3).

NCATE Program Standards for Educational Leadership address what a program should prepare the school administrator to do. Standard 9 focuses specifically on Technology and Information Systems and relates that programs should prepare school leaders who demonstrate an understanding of and the capability to use technology, telecommunications and information systems to enrich curriculum and instructions; apply and assess current technologies for school management and business procedures; and develop and monitor long range plans for school and district technology and information systems, making informed decisions about computer hardware and software, and about staff development, keeping in mind the impact of technologies on student outcomes and school operations.

The Southern Regional Educational Board (SREB) proposes an extensive standards model for school administrators to provide effective leadership in their schools. The standards in the proposed model cover a range of school administrator roles and responsibilities. According to the SREB, school administrators would be expected to:

1. Understand the elements and characteristics of long-range planning for the use of current and emerging technology—infrastructure, budgeting, staff development, technical support, personnel, and upgrades;
2. Demonstrates ability to analyze and react to technology issues, concepts, and proposals—community and corporate pressures;
3. Possesses a "big picture" vision of technology in education and schools—reform movement, competency-based education, standards, time allocation;
4. Uses technology to efficiently communicate with stakeholders—voice mail, e-mail, newsletters;
5. Uses technology to collect and analyze data and other information to improve decision making and other management functions—student academic achievement tests, gather data on variables not previously gathered, access to global information;
6. Understands how current and available technologies can be effectively integrated into all aspects of the teaching and learning process—application of software and connectivity to each instructional area, access to research information, multi-media presentations;
7. Understands the legal and ethical issues related to technology licensing and usage—purchasing agreements, safety and security issues;
8. Uses technology appropriately to fulfill their roles of coordinator and communicator of school programs and activities—manage the school enterprise efficiently, present information effectively to stakeholders, improve decision-making and consultation processes.

Administrator Preparation

The ISLLC, NCATE, and SREB's standards are broad and quite general. It is therefore necessary for college and university administrator preparation program faculty members to interpret and translate these standards into discrete activities and experiences in course offerings. To deliver a program that provides aspiring administrators with opportunities to acquire and demonstrate the skills specified in the technology standards require professors who are familiar with numerous electronic devices and are knowledgeable about

administrative and instructional technology applications. It is also essential that they have access to state-of-the-art hardware and appropriate software applications that enable them to engage students in experiences that coincide with the administrative, managerial, and instructional leadership tasks practicing school administrators are performing in schools.

Much has been said and written regarding the perceived disconnect between what takes place in college and university classrooms and what is actually transpiring in k-12 schools. Often, it is noted, the learning being offered students at the college and university level is inconsistent with what occurs daily in k-12 classrooms. Incorporating technology standards into administrator preparation courses can be an intervention that ameliorates the discontinuity between college and university preparation and realities in k-12 schools.

Avenues for school administrators to acquire technology expertise are college and university preparation programs, through their own efforts to improve in the area of technology, and through school and district sponsored professional development activities. It is not known how well college and university preparation programs actually prepare aspiring school administrators to demonstrate the technology standards set forth by ISLLC, NCATE, and SREB. There can, however, be an equating of technology standards with the life cycle of an innovation, a new policy, or a new curriculum program. The comparison is that they are all conceived, initiated in an environment with some staff development, and then left to individuals to implement.

Often, a minimal amount of information is fed back to the initiators about how well an innovation, a policy, or program implementation is taking place and the extent of impact on the intended target. How well are administrator preparation programs meeting the intent of technology standards through course work? Are aspiring administrators prepared through course work experiences to demonstrate the competencies and skills designated by technology standards when they exit administrator preparation programs? Research needs to be done that shows how well colleges and universities are preparing aspiring school leaders with the technology skills specified by the aforementioned organizations.

There is a need for colleges and universities to do follow-up with graduates who become school administrators. This follow-up can provide information on graduates' perceptions of how well the program prepared them to assume the technology leadership role in their present capacity as a school leader. A challenge to administrator preparation programs is to be able to provide high quality learning experiences that approximate what school leaders will likely experience in their districts of employment. It must be mentioned also that administrator preparation programs can do a good job in providing aspiring school administrators with necessary technology skills, however, once an individual is in a district and at a school, the technology facilities and availability of professional development opportunities may not lend to the continuing development of the individuals technology skills.

Faculty, Facilities, and Technologies

Faculty

As with all programs, who delivers the training is as important as the content to be delivered. College and university administrator preparation programs should have a commitment to students achieving the technology standards promulgated by ILLSC, NCATE, and SREB. Furthermore, professors should be aware of the technology standards and possess an advanced level of expertise in understanding and using technology. It is inappropriate to expect students to acquire certain technology skills and hold them accountable for demonstrating technology standards when those who are presenting the content and facilitating skill acquisition do not possess the expertise to provide the appropriate instruction in technology. It is important for administrator preparation programs to have professors who are knowledgeable of and can use technology to teach how it can be used to support (a) administrative and managerial task accomplishment, (b) personal productivity, (c) achievement of curriculum objectives and students' learning outcomes, and (d) teachers' integration of technology into their practice. Moreover, professors should have working relationships with k-12 schools and possess an awareness of how technology is being used in instruction and administration. This relationship can address several key issues. One, it becomes an intervention for the perceived inconsistency in teaching and learning in colleges and universities and the realities of k-12 schools. Two, it enhances the probability that aspiring school administrators will receive training that resembles what is actually occurring in schools. And three, the college, university and k-12 school relationships achieves the intent of ILLSC, NCATE, and SREB technology standards.

Facilities and Technologies

An academic program that effectively prepares students to fulfill school leadership roles begins with excellent facilities. This is especially true considering preparation to become technology leaders in schools. To provide instruction that leads to students' acquisition of ILLSC, NCATE, and SREB technology standards, administrator preparation programs should have access to facilities that have up-to-date technologies—computers in sufficient quantity, writeable CD-ROMS, scanners, printers, telecommunications capabilities, projectors, and a variety of software.

Technology rich environments are spacious, well designed, and provide various stations that focus specific technological devices on their administrative and instructional uses. Activities in administrator preparation programs should approximate what school administrators are actually doing in schools. For instance, if aspiring school administrators are learning about instructional uses of technology, and in particular, an Integrated Learning System (ILS), then students should have access to an operational ILS in order to experience its design and capabilities. If the learning to take place concerns an administrative task such as accessing a database for information, then students should have access to a database of information and practice accessing and retrieving specific data. It is important also, that aspiring school leaders practice with hardware and applications that are currently used in their district's schools. This may entail arranging a partnership with school districts so that students have an opportunity to acquire knowledge and familiarity with the district's Management Information System and other technology applications.

If instruction focuses on using technology for productivity purposes, then students should have access to a computer system, necessary peripherals and software. It is unlikely that school districts will use the same hardware and software. This presents another challenge to administrator preparation programs. Today, a majority of schools use technologies based on Windows 95 and 98 and the Macintosh operating systems. This becomes an opportunity for students to assist the program by informing professors of the various software and platforms being used in a district. Program coordinators using this information can plan for hardware and software acquisitions to enhance program delivery.

In a final analysis, preparing aspiring school administrators with technology competencies require programs to provide students with engagements that assists them in understanding technology's role in teaching and learning and in accomplishing administrative tasks. These experiences ought to include practice in planning for technology, integrating technology into the curriculum, aligning software with curriculum objectives, understanding of the elements and characteristics of long-range planning for the use of current and emerging technology; staff development; technical support; security, maintenance, and upgrading existing technology.

What Administrator Preparation Programs Should Prepare School Administrators to Know and Do

Technology is viewed by many, as a catalyst that can assist in transforming schools into highly productive organizations. Even though there is little definitive evidence linking computer technology to student achievement, a significant number of people believe that technology positively influences teaching and learning. School administrators are indispensable in the process of transforming schools through technology. This transformation requires school administrators who (a) understand technology terminology, (b) are knowledgeable about the power, features, and capabilities of technology, (c) understand technology's role in schools, (d) act as role models and encourage technology use, (e) can provide problem solving and technical assistance, (f) are change agents that facilitate technology's integration into teaching and learning. To fulfill these roles require extensive experiences and considerable expertise in the area of technology. Administrator preparation programs should provide aspiring school administrators with fundamental skills in each of the aforementioned areas.

Technology leadership entails both understanding technologies and how they can be applied to accomplishing tasks. We propose that administrator preparation programs should prepare aspiring school leaders through engagements that enable them to move beyond routine use of technology to a level of proficiency. At the basic level we agree with Kearsley (1990/1995), that school leaders should be able to explain basic computer terms and concepts, describe major hardware and software components, and understand the elements involved in evaluating and selecting hardware and software. We also suggest that school administrators be able to use technology to accomplish those things that teachers and students are expected to do. Beyond these, school leaders should be prepared to use technology to complete administrative tasks,

facilitate teachers' integration of technology into the curriculum, and understand how technology influences the teaching and learning environment to accomplish instructional objectives.

Administrator preparation programs should provide many engagements that allow students' to use technology in real world leadership situations. It is important for aspiring school administrators to have experiences with productivity tools such as word processors, databases, and spreadsheets. Beyond these, opportunities to use presentation software, access on-line databases for research purposes, and exchange information via electronic communication should be extensive. Although not an exhaustive listing, the following are some fundamental outcomes for individuals in administrator preparation programs and are representative of what aspiring school leaders should know and be able to:

1. Use a spreadsheet to prepare a school budget.
2. Communicate with school stakeholders using various technologies.
3. Access the districts database for numerical and demographic data.
4. Understand the legal and ethical issues related to technology licensing and usage.
5. Purchase up-to-date hardware and software.
6. Evaluate software for administrative use and instructional use.
7. Plan for the purchase, support, and security of acquired technology.
8. Understand how current technologies can be effectively integrated into teaching and learning.
9. Evaluate software for instructional use by teachers.
10. Assist teachers to integrate technology into classroom instruction.
11. Provide basic technical assistance.
12. Understand on-line filtering and its purpose in teaching and learning environment.
13. Facilitate teachers' professional development to use technology.
14. Use presentation software to enhance communication skills.
15. Research school improvement using the World Wide Web.
16. Select hardware that is configured with the most recent technology advances.
17. Use word processor, spreadsheet, database, and communications applications.
18. Desktop publishing.

Conclusion

The purpose for technology standards, and their application to school leaders, is the belief that administrators should possess a vision of what technology can accomplish in schools, be able to use technology for specific tasks and facilitate teachers and students' use of technology in the school environment. Competence in understanding the roles of technology in schools and being familiar with technology's power and capabilities requires experiences across the technological spectrum. Given this reality and what we know about administrator preparation programs, we believe that one course in technology at the masters level is insufficient to provide aspiring school leaders with the technology engagements necessary to prepare them to be technology leaders in schools. There is simply too much in the area of technology and its applications in schools to cover in a semester course. We suggest two courses specific to using technology at the master's level to adequately prepare school administrators to be instructional and technology leaders. Moreover, opportunities to use technology should be integrated in all courses that prepare aspiring administrators.

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Information Technology and the Transformation of Leadership Preparation Programs: A Response to Calls for Reform in Educational Practice.

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Abstract: This paper describes information technology usage in a radically different school leader preparation program. Ed.D students at Wichita State University are immersed in a variety of technologies from the first day of class. A collaborative, situated, problem-based learning approach to instruction requires acquisition of high levels of personal comfort and expertise with program technologies, sufficient to allow students to be efficient in their own studies, and to mentor others in various aspects of advanced information technology usage. Students incorporate technology in their roles as participant, collaborator, colleague, leader and follower in a variety of contexts: seminar, field study, content presentation, data manipulation, research reporting, group/individual comprehensive examinations, dissertation. Program graduates acquire, among other things, an understanding of the impact of information technology on their roles as visionary leaders of schools of the future and experience the transformational potential of technology on their own learning process.

Introduction

This paper focuses on the description of a doctoral program designed to prepare effective leaders for schools while emphasizing the transformational role of technology in the process. Three significant educational trends provide the background for this paper. The trends providing the foundation for this dramatic change in approach to the process of graduate education are represented by:

- increasing evidence of the change possible in the way that learning can occur in schools and in the workplace as a result of the presence of information technology;
- repeated calls for reform in educational and school based practices; and
- recognition that preparation programs for school leaders are in urgent need of reform.

In recognizing these trends, faculty from the College of Education at Wichita State University in Kansas, have demonstrated the positive impact of significant changes in philosophy and approach to the organization of graduate preparation programs for school leaders. Informal data gathered from current doctoral students and from graduates of the program indicate that the changes are positive and well supported. Responses from the field demonstrate that graduates of the program compete successfully for coveted leadership positions and are sought after by school districts in need of thoughtful, visionary and effective leaders.

Following the discussion of background information taken from the literature, the process and impact of integrating technology into the mainstream of daily practice within a radically different school leader preparation program will be described. The objectives of the program will be discussed in terms of technology-related practice. The belief that faculty must model technology integration (Blomeyer & Clemente 1997) will gain credibility through a description of faculty and student learning behavior. Further, a description of the technology infrastructure of the program, the smorgasbord of technology offerings available to students and incorporated into daily practice, and the impact of such practice on student behavior and learning will be presented. Throughout this paper, insights into a variety of program objectives and practices will be provided. These insights relate to:

- the philosophical underpinnings of the program;
- objectives of this graduate leadership preparation program including collaboration, teaming, use of authentic problems of practice, situated learning, reflective practice, cohort teams etc.;

• the smorgasbord of technology options forming the integrated technology infrastructure of the program: required laptop use, access to server, communication hubs, file-sharing, e-mail, projection devices, internet access, database usage, discussion lists, chat facilities, interactive technologies;
• the importance of group maintenance
• on-going technology training and
• the practical aspects related to the planning, administration, and management of technological and pedagogical innovations in graduate leadership programs.

Literature

In their book, The monster under the bed, Davis & Botkin (1994) claim that the knowledge business is transforming the way we learn (P.15). Their treatise on the place of knowledge-based enterprises of the future begins with the following story.

> Megan was five years old and worried about a monster that lived under her bed. She told a story about how the monster scared her, how she wanted it to go away, and how she solved the problem-now the monster lives under her brother's bed. She also drew pictures to accompany the story. They look like the kind displayed by parents on refrigerator doors. Only Megan drew these pictures on her computer and used the computer to record her telling of the tale ... Megan didn't stop there. She wanted to share her story, so she sent it by phone to an electronic bulletin board club, where other kids her age could watch and hear it.... Here was a five-year-old child who had accomplished all the major tasks of moviemaking. She was the star, wrote the screenplay, created the visuals, did the editing, was producer and director, and even did her own distribution. Her learning was integrated into the realities of her life. (P.14-15)

Elsewhere, a great debate ensues regarding the need for extensive reform in educational practice (Boyer 1985; Carnegie Task Force 1986; Holmes Group 1986; National Commission on Excellence in Education 1983; National Council for Accreditation of Teacher Education-NCATE 1997). In the United States, it is claimed that the "nation is committed to a course of fundamental change to improve ... educational Mojkowski 1991). Mojkowski suggests that the existing system of schooling does not adequately serve many children and is failing to keep pace with the revolutions in learning and work taking place in the rest of society. While this report goes to some length in describing the goals that should drive this massive restructuring process, there is recognition that while the goals themselves are "clear, comprehensive and oriented to results, ... they are beyond attainment unless sweeping changes are made in our education P.iii). Many of the changes endorsed by this report focus upon the belief that both technology and leadership are crucial components in the educational change process.

The process of integrating computer technology into classroom practice has been underway for twenty years. Some have reported that technologies appropriate for classroom practice have become an integral component of instructional processes (OTA, 1995). Others have suggested that the effective use of these same technologies enhances the performance of both teachers and learners (Jonassen 1996; Kauchak & Eggen 1998) and contributes to motivation levels apparent in technology based classrooms (Kauchak & Eggen 1998). In recognizing that such beliefs are not widespread, The Office of Technology Assessment (1985b) and NCATE (1997) have both stressed the need to incorporate instruction in technology into programs of teacher education in order to encourage more appropriate integration of technology use into school practices. Roden (1997) has indicated another area requiring attention if support for technology use in schools is to be optimized. He suggests that it would be inconceivable for school leaders to declare a lack of knowledge about mathematics or reading, but that many make a similar declaration about computers and the role of technology in classrooms. While it appears that most of these writers are describing what may be the beginnings of a revolution in learning occurring in schools based on the role of technology as change agent, it does seems strange that in the field of leadership preparation, discussions of reform have rarely focused upon the potential impact of technology on the thinking or the practice of school leaders.

In the field of leader preparation, undeniable conclusions have been reached regarding the need for reform. Since an agenda for the reform of school administrator preparation programs was first published by the National Policy Board for Educational Administration in 1989, others writers have agreed to the need for massive change in the preparation of school leaders (Leithwood, Begley & Cousins 1994; Murphy 1992). The fundamental underpinning of this reform movement was the firm belief that change in schools could not occur

without a change in the thinking of school leaders. Radically different schools needed radically different leaders. It followed, then, that the development and sustenance of these leaders would require a radically different conceptualization of pre-service and in-service education and training (Mojkowski 1991). Some writers have postulated that the predominance of traditional instructional paradigms in leader preparation programs agitated against the reform of such programs (Hallinger & Murphy 1991). Creighton and Yates (1999) claimed that administrators learnt skills on-site, in context and integrated with real-life applications. As though in summary, Mojkowski (1991) suggested that the process of leader preparation should integrate learning and work, emphasize action-oriented, problem solving approaches to training, focus on the development of teams and be comprehensive, coherent and continuous. In related studies conducted by The Office of Technology Assessment (1988; 1989; 1995), it was found that those administrators who were themselves, informed, comfortable and competent with technology use in their own jobs also became key players in leading and supporting the use of technology in schools.

A Radical Approach to Leader Preparation

Seven years after its inaugural intake of doctoral students, the leader preparation program at Wichita State University boasts a 100% completion rate for candidates completing the coursework component of the program. Further, students of this program have won national scholarships, have been recognized nationally as recipients of dissertation awards, and have been selected for coveted school and district leadership positions in Kansas school districts. The program itself has been described in detail elsewhere (Furtwengler & Furtwengler 1998; Furtwengler, Furtwengler, Hurst, Turk & Holcomb 1996) and will be featured in an upcoming issue of the Journal of Critical Inquiry into Curriculum and Instruction which publishes exemplary research products of graduate students in professional study. Notwithstanding this national and international exposure, the unique features of this clinically oriented, field-based, applied inquiry program in educational administration are worthy of further mention. The program distinguishes itself from traditional administrator preparation programs through a design that emphasizes: (a) rigorous admission requirements and low enrollment, (b) release time from district employment for prospective students, (c) integration and contextualization of the curriculum, (d) incorporation of field-based research studies, (e) a collaborative, team-based approach to teaching and faculty load distribution, and (f) a cohort-based student support structure. These program design features correspond to those calls for specific reform measures in preparation programs for school administrators outlined above.

In addition, this program design is supported by a confirmed philosophical belief related to the process of teaching and learning within the program. Based upon a theoretical framework derived from problem-based learning (PBL) (Boud 1985; Boud & Feletti 1991; Bridges 1992), this program functions with the belief that authentic problems of practice, explored in collaborative team settings lead to learner-directed and setting-enhanced learning. Faculty attached to this program believe that these problem situations raise the important concepts and principles associated with the content domain and that they are perceived by graduate students as real problems of practice (Savery & Duffy 1995). In the dynamic and situated learning environment that is representative of daily life within this leader preparation program, meta-cognitive scaffolding is provided by faculty and peers (Savery & Duffy 1995). The underlying propositions of constructivism (Savery & Duffy 1995), including the ideas of cognitive dissonance and negotiation of meaning, are core program components. Studies of student thinking during the initial problem analysis phase of PBL (De Grave, Boshuizen, & Schmidt 1996) corroborate the belief, clearly in evidence within this program, that exposure to different ideas in a group leads to conceptual change and that group interactions serve to encourage activation and elaboration of existing knowledge and integration of alternative views. Further, this program epitomizes the growing trend recognized by Heath (1997) for models of education which accommodate a constructivist view of learning incorporating the use of emerging technologies (Hannafin & Land 1997).

Using Technology in the Transformation of a Leadership Preparation Program

In this leader preparation program, two applications of technology can be distinguished. The first is that used as part of program functioning and required for daily use and program effectiveness. The second relates to technology usage that is experimental and evolutionary. This second type of usage refers to the incorporation of technologies new to the program, and new information technology applications designed to meet program needs and expectations for growth and expansion.

Program Expectations for Technology Use

The pre-dissertation stage of this doctoral program requires students to attend one full day of class time per week over a two year period. Class time is divided between seminar and field study time. During seminar, students meet in cohort groups along with two or three professors and explore an extensive array of topics as presented by an exhaustive reading list of books on the cutting edge of leadership thought. Field study time comprises the research-based exploration of authentic, contextualized problems derived from discussion with school board members, and district administrators from local school districts. Site selection for research studies are contingent upon the acceptance of a school district administrator as a student into the doctoral program.

Class-based interactions begin with setting up a small classroom in a conference room format with a communications hub sufficient to connect all students and professors to a department server via ethernet connections. These connections provide further access to the internet and associated data-bases, libraries and search facilities. A data projector is connected to a lap top computer, the purchase of which is a condition of acceptance into the program. An elongated power strip provides a power source for up to six students and three professors. Unrestricted access to a telephone, a fax machine, and a photocopier is nearby. Both color and black ink printers are accessible via the local network. Students and professors each have personal email addresses (another program expectation) and are provided passwords for remote access to the departmental server. When completed, this daily ritual has converted a most un-noteworthy small conference room into a high-powered research and analysis laboratory.

Software requirements mirror hardware configurations and program objectives. An integrated office productivity program incorporating word processing, data-base, spreadsheet and projection software is mandatory. A bibliographic database, and an appropriate internet browser are also required. Access to other software provided by the department includes a statistical analysis package, desktop publishing software and a relational data-base package used in the analysis of qualitative data. These packages are made available to students through site licenses maintained by faculty. Further software is provided as needed and available to support innovative and flexible additions to program requirements.

Training in the use of these hardware and software configurations begins with a summer program designed to launch doctoral study for each new cohort. Comprising six students, the new cohort enrolls in a course focusing upon technology and academic writing. The existing cohort act as mentors to their neophyte colleagues as students and professors explore hardware and software capabilities within the context of problems typical of program requirements. Learning about technology in this context is ongoing and is rarely completed as new skills, and new applications, are discovered and levels of expertise increase.

Daily information technology activity for all students and professors includes the use of email, internet searching, file sharing, program organization, project management, bibliographic referencing, statistical analyses, qualitative data analyses and functional use of all required software application programs. Familiarity with printers, projectors and interactive communications hardware is also required and usually occurs, without trauma, well before the end of the two-year course of study. The level of interactivity via email, file sharing and surfing for the sake of research continues between class sessions as semester projects and planning for seminar discussions are shared. Periodically the need for applying levels of interactivity new to this doctoral program arise and provide students and professors with an opportunity to experiment with available technology and program objectives.

Experimental Applications of Technology

Apart from the normal levels of required interactivity described above, occasional opportunities for expanding the level of technology integration in this innovative program arise. In the normal course of events,

all students in this program drive to the university to attend a full day class once a week. This represents a significant commitment, as driving time can, for some, exceed nine hours: four and one half hours of driving on either side of a full day in class. These students are still required to function effectively the following day in their role as district administrators. During the last twelve months the variable of distance has provided an opportunity to experiment with interactive television in an attempt to replicate and maintain the intensity of collaborative, team-based, group interaction across significant distances.

On several occasions, arrangements were made for some students to remain in their western Kansas locations while the rest of the class met on campus at the university in south-central Kansas. Two-way interactive television links were established between both locations. The organization for the day remained as normal as possible, with the exception of a change of location to a conference room having interactive television capability. This interactive room was rearranged to replicate the physical layout described above, along with all standard technological capabilities required by the doctoral program. Planned group research and writing activities, seminar activities, and incidental personal meetings, interactions etc. continued as normal throughout the day. An evaluation of the activity was conducted. Professors, students and technical personnel were asked to complete a questionnaire on the effectiveness of the interactive activity. With the exception of some instances of sound degradation periodically throughout the day at the remote location, no other technical difficulties were experienced. Students at the remote location expressed concern that they could not go to lunch with their colleagues although they were appreciative of the reduction of driving time. All evaluations strongly supported the use of this form of interactivity as a viable program alternative and confirmed the belief that the essence of group collaboration forming the basis of this doctoral program was capable of being maintained across distance.

On another occasion prior to this interactive television activity, a discussion list designed to supplement interaction based around seminar discussions was activated with the assistance of the university's computer services division. A professor assumed the responsibility for maintaining the list. Activity continued throughout the semester and student reaction indicated that interactions provided through this medium were of value. This activity was not maintained, however. Plans for the future incorporation of discussion lists, chat facilities and web site usage into the smorgasbord of technology options forming the integrated technology infrastructure of this program are underway.

Conclusions

Banks, Stacey, and Omoregie (1997) claim that technology training for teachers and administrators is the key to successful implementation of technology in the classroom. In a research study analyzing the process of technology integration into K-12 curricula, Mahmood and Hirt (1992) conclude that a number of variables impact plans for integrating technology, but none so much as strong support from school and district administrators. In describing goals necessary for creating a technology-effective, and integrated learning environment, McPherson (1995) focuses upon the crucial role of school leaders in the process of information technology integration. She suggests the need to create dynamic leadership and organizational support, using the full range of technologies to promote school reform, meet national and state educational goals, and assure quality education for every student. These and other writers have recognized that a key barrier to the use of technology in schools is the lack of administrative support (Maurer & Davidson 1998; OTA 1988, 1989, 1995; Rodin 1997). By indicating that schools with effective technology curricula also have strong administrative leadership supporting and sustaining effective technology programs, these writers infer the need for technology-based reform in administrator preparation programs. Suggestions that administrators need to know how technology can restructure the teaching learning process and keep an active focus on the real purpose of the educational system are commonplace. Exposing administrators, who are likely to assume the responsibility of visionary leadership in schools of the future, to the positive changes brought about by technology is an uncommon practice. Modeling the technology reform process in education as a component of leader preparation programs is one way of ensuring a balance between technological ideals and practice.

Over the past seven years, and through the combined efforts of all faculty involved during that period, the leader preparation program at Wichita State University has met the calls for technological and program reform. This radically different program has managed the difficult transition from a highly traditional and predominantly decontextualized program, to an environment where situated, problem-based, and collaborative learning predominates. This answer to the calls for reform has been formulated through:

• the inclusion of required technology components in program application procedures (purchase of hardware and software as conditions of enrolment);
• the incorporation of contextualized and integrated curriculum and instruction in technology usage;
• a student cohort support system and mentoring roles required as rites of passage through the program;
• the construction of peer teams and adoption of group and individual responsibility for learning; and
• immediate and continual immersion in the use of interactive, information technologies in exploring authentic problems of professional practice.

This program has provided school leaders with the tools to think about technology in vastly different ways and the experience to do something about it.

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Graduate Technology Coursework in a Framework of Professional Leadership

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Abstract: Responding to the call for change in higher education leadership preparation programs, the Department of Human Services and Professional Leadership revised and further developed an existing model guiding the college in which the department resides. The Caring Intellectual Leader Model, is designed to focus on problem-based learning which incorporates the infusion of technology throughout all levels of knowledge acquisition and assessment: formal, descriptive, prescriptive and praxiological.

Introduction

American education has been at the forefront of public policy analysis since the early 1970's when influential groups began the clamorous call for reform. With this call came a spate of critical documents which demanded substantive change in the preparation of educators and provided data indicating that current offerings are not adequately meeting the needs of the constituents, who seek greater input into policy formation and decision making. We hear continually of the need for systemic change (Feigenbaum, 1993; Murphy, 1991; Gordon, 1992; Senge, 1994) and de-focusing on specific roles and issues. This focus on the "system" comes in the wake of unrelenting teacher and administrator condemnations following the national report, A Nation At Risk (National Commission on Excellence in Education, 1983). Indeed,

the problem is compounded by continual strident accusation, and the failure to address the root cause of school problems.

Johnson (1992) asserts that the new mission of education will require significant changes in preparation of educational leaders in order to meet the needs of the technologically driven societal and schooling domains. In support of this notion, Hallinger and Bridges (1999) state that most leadership programs focus almost exclusively on the cognitive dimension and rarely address the level of practice in a meaningful manner. In order to accomplish the task of preparing education leaders for problem-based, authentic learning, it is incumbent upon higher education and schools to shift paradigms (Wheatley,1995) and reconceptualize the future needs of schools and educators in a high technology Information Age which calls for increased empowerment of staff. Johnson contends (p. 100) that: "The need is no longer simply to induce conformity to established practice among future leaders but rather to develop a critical analytic approach to the production of new practices". Zukav (1979) depicted this need well in his classic book The Dancing, when he stated that restructuring must cause us to "slip the bonds of the known to venture far into the unexplored territory which lies beyond the barrier of the obvious" (p.82).

Changing paradigms is difficult for individuals; it is more so for institutions (Senge,1990). In general, the literature (Fullan, 1993) suggests that higher education institutions have not responded to the pressures to substantially alter their offerings or the method of instruction in educational leadership programs. Murphy (1991) conducted a study examining the effect of the reform movement on leader preparation programs and determined that only slight to moderate changes were being made in compliance with reform admonitions and recommendations. He attributed this to a lack of motivation among college preparation programs to change.

Numerous experts note the dearth of transformative preparation programs (Leithwood, 1992;Naisbitt, J., & Aburdene, P., 1986; Lampe, S. et al, 1992) and the reluctance of higher education to respond to the pressures to substantially alter their offerings or redefine appropriate pedagogy. Although the reform movement has received a great deal of attention by the popular press, it has not had as significant an effect on higher education preparation programs across the nation (McCarthy, 1988). In 1991, Joseph Murphy conducted a survey of 74 chairpersons of the University Council of Educational Administration (UCEA) and non-UCEA programs. Findings of this study indicate that the overall picture is one of slight to moderate change in response to reform initiatives, including teacher empowerment. It is very easy to discuss the empowered workplace; it is entirely another issue to deliver on this promise. One does not change long-held ideas about the organization and the power base by desire. Senge (1990) advises that substantive cognitive changes must occur before we change our behavior and beliefs. He states that "...new insights fail to get put into practice because they conflict with deeply held internal images of how the world works, images that limit us to familiar and conventional ways of thinking and acting." If leaders are to be adequately prepared for the future, higher education programs must heed the call for reform that is in accord with the needs of the times.

The single area where most higher education change efforts converge is the

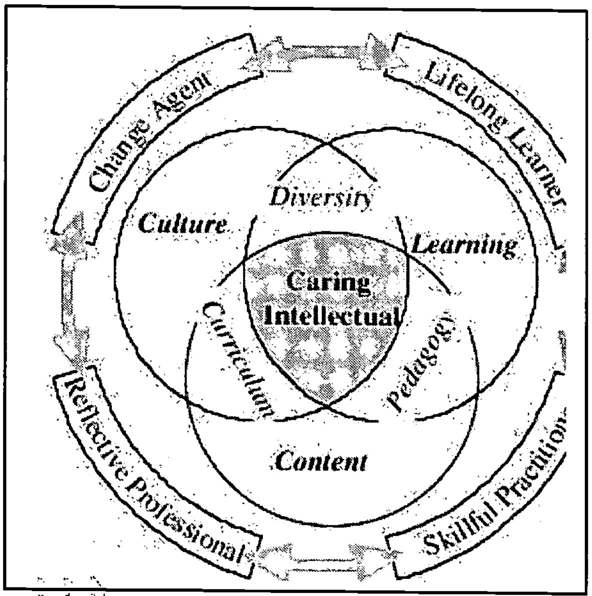
augmentation of curricular efforts to address leadership issues which are consonant with reform exhortations advocating a focus aimed at developing reflective practice (Norris & Lebsack, 1992) in a problem-based learning environment characterized by the increased focus on praxis in instruction and assessment. The literature defines four levels of knowledge which must be incorporated in both instruction and assessment: formal, descriptive, prescriptive and praxiological) Praxiology, according to Mozilla (1999) is that domain of knowledge which focuses on the practice of leadership. Mozilla has developed a computer-based model (The Complete Teacher, 1999) for teaching and assessment of each of these areas. This model will be incorporated into the Wisconsin Leadership program being discussed below.

Caring Intellectual Leadership Model

Leading educators and researchers suggest that if substantive curricular renewal and transformation in higher education is to occur, it must be at the programmatic level (Johnston, 1992). Understanding this recommendation, the educational leadership program faculty has focused on revision at this level. Norris and Lebsack (1992), in reporting findings from a three year pilot designed to examine different approaches to the preparation of school leaders, identify necessary components which include: a) programs must have personal meaning and relevancy, b) cohort and mentor experiences are important in assisting the scholars' bonding, and c) curriculum requirements and teaching must reflect the faculty's commitment to the praxis structure. The program faculty recognized that the change from traditional leadership course work and pedagogy to one characterized by problem-based learning with technology infusion is not merely curricular nor structural, but endemic in nature. The entire paradigm must be redesigned to meet the needs of the future.

In response to the literature, research and the cumulative experience of the Educational Leadership program faculty, the following model was adopted.

The Master of Science program in Educational Leadership resides within the Department of Human Services and Professional Leadership (HSPL), College of Education and Human Services at the University of Wisconsin Oshkosh,. HSPL addressed this challenge by the adoption of an empowerment model that simultaneously promotes personal and professional



growth. The heart of the model identifies the goal outcome, a Caring Intellectual, and places technology integration coursework in a unique position. Technology is the support system whereby the curriculum, personal aspects and practice all converge. Technology facilitates problem-based learning and a Constructivist approach to curriculum, which enables the Educational Leadership program to foster empowerment and a sense of self -efficacy in future leaders. The underlying philosophy guiding this model identifies the outcome component as a "Caring Intellectual" and includes the following attributes; lifelong learner, reflective practitioner, skillful professional and agent of positive change. Examination of the model includes diversity, content, culture, pedagogy, learning and curriculum.

The focal concern that was addressed by the Department of HSPL was the identification of the major issues that have the capacity to effect the terminal goal of increased student performance. Fundamental to the assessment of the Educational Leadership program was the intensive analysis of all possible elements that might contribute to this primary goal. The context is extremely enigmatic and many determinants and theories would underpin the response. Included among these might be Constructivism, the Socratic Dialogue, Case Study analysis and Problem-Based Learning. The literature and experience suggested the need for a clearly defined mission statement, program goals and assessment methods be in place for programmatic clarity and definition.

Central to the department mission and philosophy is the belief that all educators - teachers and administrators - must come to the same table to dialogue, share and envision educational reform strategies in problem situations. Toward this end, the department offers two strands or emphasis areas in technology. One is designed for teachers who envision that they will use technology as a tool within their curriculum while the other is designed for educators who wish to develop more technical expertise that could lead to certification as a district technology director. A central core of 12 hours of technology integration courses is required for both emphasis areas in an effort to insure that district administrators are sensitive to the needs of the classroom teacher and the potential of technology as a tool for curriculum delivery and assessments.

The two technology emphasis areas are detailed below. Notice that both share a common core to insure dialogue and awareness of the needs of the classroom teacher in successfully integrating curriculum and technology.

Education Leadership with emphasis in Integrating Curriculum and Technology (MS Educational Leadership, 36 credits)	**Educational Administration and District Technology Coordinator** (MS Educational Leadership, 42 credits)
Required coursework: • Leadership for Curriculum Development • Supervision of Instruction	*Required coursework:* • Leadership for Curriculum Development • Supervision of Instruction

• Org. & Admin. of Educational Systems • Multicultural Education for Leaders • Integrating Technology into Classroom • Instructional Strategies • Multimedia Design & Production I • Multimedia Design & Production II	• Org. & Admin. of Educational Systems • Multicultural Education for Leaders • Integrating Technology into Classroom • Instructional Strategies • Multimedia Design & Production I • Multimedia Design & Production II • Funding/Managing Educational Technology • Networking
Electives (select 2): • Classroom Computer Applications • Internet as an Instructional Tool • Educational Leadership • Legal Aspects in Education • Leadership for Staff Development • Funding/Managing Educational Technology • Networking	*Electives (select 2):* • Classroom Computer Applications • Internet as an Instructional Tool • Educational Leadership • Legal Aspects in Education • Leadership for Staff Development
Select one: • Seminar in Educational Leadership • Thesis	*Select one:* • Seminar in Educational Leadership • Practicum in Admin & Supervision

Conclusion

In order to provide appropriate preparation of administrators and teachers, educational leaders, the faculty in the Department of Human Services and Professional Leadership at the University of Wisconsin Oshkosh researched many models and pedagogies. The Caring Intellectual model was adopted and modified to clearly identify problem-based learning characterized by technology infusion at all levels of instruction and assessment.

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Professional Development for Systemic Change: A Strategic Approach to Scaling Educational Reform through Professional Development Programs.

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Abstract: This paper discusses our approaches, both in theory and practice, to the enactment of systemic reform as a part of the Center for Learning Technologies in Urban Schools (LeTUS). The University of Michigan and Detroit Public Schools have partnered in this Center to develop and implement a systemic educational reform program to help middle school science educators understand and enact some basic ideas and concepts of inquiry-based science focused on the use of various technologies to assist in the learning process. Presented here are the challenges of implementing a professional development program geared toward systemic reform, along with details about the enactment and scaling of this multi-faceted professional development program. The paper also suggests a variety of considerations regarding the scaling of such programs.

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Introduction

Educational reform has generally taken one of two paths in finding a way to change classroom practices, whether addressing implementation of technology use by students and teachers, or by focusing on shifts in pedagogical approaches and content knowledge. Very often, especially with respect to the infusion of technologies such as computers in classrooms, true reform has come from the grass roots; the teachers themselves. Innovative practices which involve processes of student inquiry for individualized construction of knowledge while utilizing technology were borne out of an individual teacher's ideas, and

enacted within their own classroom. They were the early "technology superstars" in the schools, making efficient and effective use of the new computer technologies to allow students to demonstrate advanced learning and thinking in a variety of ways. Occasionally, others would hear of their advancements and attempt to recreate or join their efforts. But, for the most part, these innovations were contained within a few select classrooms.

Other innovative reform efforts might take an altogether different path for their genesis. Many of the recent school and site-based reform efforts are administrative directives, the attempts of administrative leadership within the school or academic community to change educational practice by creating practices which direct individual teachers as to what to do within their classrooms to improve student learning. Sometimes, it takes the form of a new software program, a different textbook, or a set of standards and outcomes for which success (and motivation) will be determined by some form of summative assessment. While these "top-down" forms of reform efforts may have greater "volume" of impact, they too may lose effectiveness by reinterpretation by teachers, bureaucratizing of reform efforts, lack of proper support, and simple apathy of teachers who are uncomfortable with a "directive" format of change for their classrooms.

Systemic reform is a complex notion, which requires a new approach. For teachers to truly be involved in the efforts and understand both the content and pedagogy issues of the reform effort, they must be directly involved in the reform process. Yet, for the reform effort to occur throughout an entire school system, especially a large urban school system, having all teachers involved in the development of new curricula, adaptation of learning technologies, and change in approach and method of instruction would become chaotic, and would likely throw the system out of control. So, a dynamic tension is created between the two approaches. Administrative decisions must be made to properly support and motivate teachers to become involved, and teachers must take the initiative to become involved in a program encouraging their support of and enactment of innovative curricula and pedagogy, becoming collaborators in this process.

Context and Theoretical Framework

We have been working in collaboration with an urban school district to reform science education to be inquiry-oriented and make use of pervasive educational technology by creating professional development opportunities that will address the needs of a diverse population of teachers. Our experience comes from our work in the Detroit Urban Systemic Initiative, a successful reform-minded program focusing on the improvement of science education in urban middle schools. As a part of the Center for Learning Technologies in Urban Schools (LeTUS), the University of Michigan and Detroit Public Schools have partnered to develop and implement a systemic educational reform program to help middle school science educators understand and enact some basic ideas and concepts of constructivist educational practice.

There are challenges unique to urban environments, including high teacher mobility rates, spotty content-area and technology specific preparation for teachers (with many teachers teaching out of their specialization), a lack of a substantial and "teacher friendly" technology base in many schools and classrooms, and high poverty among students. These challenges (and others) must be addressed by professional development if reform efforts are to become successful for individual teachers and students, scaleable to the needs of the whole school and district, and sustainable in both individual classrooms and the system as a whole. The reform effort is systemic in nature, focusing on changing the way science is taught (and learned) throughout the entire district of 180,000 students, as well as other districts interested in the approach.

The professional development framework underlying our work is rooted in a larger theoretical frame called CERA (Marx, Blumenfeld, Krajcik & Soloway, 1997a; Marx et al., 1997b), which stands for Collaborative construction of understanding; Enactment of new practices in classrooms; Reflection on practice; and Adaptation of materials and practices. CERA provides the general backdrop for our collaboration with the school district and with teachers in all activities, including professional development.

The challenge of scalability and sustainability of a systemic reform program adds layers of complexity to the professional development program. This development effort calls for massive upscaling over a

relatively short period of time and requires constant modification of the model for implementation of professional development programs. For instance, providing individual classroom support for five teachers in two schools is relatively easy. Providing similar support for fifty teachers in twenty schools a short while later requires a massive growth in resources, if the same model is applied. This would be difficult for any such program, but, when combined with the underlying focus on individual student inquiry modeled within development efforts, the task becomes daunting; requiring constant change in the strategies and method of the development program. The infusion of computer-based technologies complicates this further, as the nature of the technology changes ever so rapidly. Thus, the development program itself has varied significantly from its inception, and will continue to do so as the scope of the program grows throughout the school system. As a result, a dynamic for sustainable growth is implemented within the development program, calling upon the knowledge and experiences of teachers involved early in the program to take on greater leadership responsibilities to encourage and promote growth as the program proceeds. In addition, the nature of the individual elements of professional development change, focusing on more global, pedagogical concerns as teachers add experiences that allow for reflective understanding of these concepts.

Elements of the Professional Development Program

Professional development for systemic educational reform (focusing on understanding and enactment of inquiry-based science curricula with embedded technology use) within a massive urban school district requires a variety of elements in order to accommodate the diverse needs of the teachers within the system. The primary element of this professional development program is the use of educative curricula, which are intended to provide opportunities for student learning through inquiry and technology use while providing teachers with activities and other constructs to enhance their understanding of content, pedagogy, and technology through active reflection. Other elements include more traditional development activities such as summer and weekend workshops (with non-traditional, model based activities during the workshops) with other, less-traditional events such as in-class support by curricular, pedagogical and technological experts; intradistrict, teacher-led, after-school study groups; and network-based resources designed to supplement activities and strategies provided through other support methods. This allows for individual teachers to center on their own goals and strategies within the classroom, while being a part of a massive development program.

As mentioned earlier, all of these activities are centered upon the use of an "educative" curriculum unit, designed to provide opportunities for enactment of the desired practices within a content-focused framework. These curriculum units provide a guided set of activities to engage students in the learning of science content focusing on a contextualized driving question. They are designed to remove the teacher from the role of "keeper and communicator of knowledge" to a facilitator of student learning through an inquiry and investigation process, which utilizes a variety of technological tools to help students understand relationships of the content concepts. They provide a number of opportunities for teachers to personally reflect upon the enactment of the curriculum, and engaging questions to help redirect the personal pedagogy of the teacher. They also provide the context for the professional development program to help teachers examine different practices and their impact on student learning.

The summer workshop functions as the kickoff activity for teachers involved in the program, in that it provides the orientation to the program and the underlying pedagogical concepts promoted by the Center. Teachers are introduced to inquiry-based, technology centered curricula by enacting their own investigation of the concepts inherent in the curricula they would be teaching in the following academic year. While participating in the inquiry projects, teachers are constantly encouraged to reflect upon their activities from a learner's perspective, and develop and share strategies for the teaching of these concepts during the school year. Teachers also participate in other work sessions, focusing on understanding the underlying content and pedagogy of the educative curricula, forming a community with other colleagues in the program, and developing a strategic plan for local enactment of the curricula.

Saturday workshops held throughout the school year provide another element of the professional development program, similar in nature to the summer workshop, but held periodically through the school

year to provide a construct for teachers to reflect on practice during the enactment of the educative curricula. These workshops group teachers and administrators working with four distinct curricula together in the mornings to discuss general concepts and strategies of constructivist pedagogy focusing on technology integration and inquiry based science. In the afternoons, teachers collect in smaller groups to discuss issues relevant to the implementation of their particular curricula, which are divided by grade level and district standards.

Another very important aspect of this program is the use of in-class support personnel who assist the teachers with the enactment of the curriculum, and encourage reflection on practice. These individuals are prepared by training and immersion in the curricula and with the technological tools. All support personnel are experienced teachers with an understanding of the underlying pedagogical concepts of the program. These individuals participate in four fundamental support activities; cognitive/pedagogical understanding support, in-class teaching assistance, technology related assistance, and logistical or documentation activities (See Table 1). Regular evaluation of support personnel takes place with teachers at the Saturday workshops, in that teachers complete feedback and evaluation forms to note needs and concerns regarding in-class support. Support members also meet regularly to share ideas and concerns brought back from their experiences in the classroom to develop strategies for working with varying teacher needs. Their feedback is crucial in the development of other professional development programs, such as the Saturday workshops, the development of the educative curricula, and development of on-line resources for teachers.

Cognitive or High Level Support	Pedagogical Support	• Reminding teachers about techniques, or prompting during enactment when needed. • Discussion of use of certain methods or past classroom events as illustrations of methods and their impact.
	Organizational Support	• Assisting in decision making regarding organization and logistics. • Helping teachers determine how to acquire materials needed. • Reviewing curriculum materials to facilitate enactment.
	Content Tutoring	• Teaching the teacher specific content (outside of class time)
	Reflection Guide	• Helping teachers to reflect about their classroom practice outside of class time (usually following an observation of the class)
	Moral Support	• Listening to other teacher issues, both project related and other.
	Classroom Management	• Assisting with classroom management, such as chaperoning a field trip or helping keep students on task during group activities.
In Classroom Teaching Related Activities	Model Teaching	• Teaching a class in the teacher's presence in order to convey a clear image of how a particular activity might be enacted.
	Collaborative Teaching	• Team teaching a class session (occasionally as a follow up to model teaching) to assist the teacher with enactment.
	Working with Students	• Asking students questions regarding the content or process. • Responding to students' questions • Supporting lab enactment or group interactions by helping keep students properly engaged in the activities of the curricula
	Point of Reference	• Being available in the classroom to add a comment or provide more explicit content information or ideas, typically to complement the teachers' own understanding of the content.
Technology Related Support Activities	Technology Set Up	• Helping make sure that computers and software are in working order and ready to be used for a particular activity.
	Technology Tutoring	• Teaching teachers how to use the technology (outside class time)
	Technology Support	• Helping out during enactment, either in a cognitive support role or troubleshooting.
Logistical or Data Collection Activities	Messenger/Materials Provider	• Conveying information or delivering materials to or from the teacher to curriculum or professional development specialists.
	Observation	• Watching and taking notes on the curriculum enactment • Noting teachers' adaptations regarding the curriculum enactment.
	Video Documentation	• Recording a particular class session for review by the teacher or curriculum/professional development specialists.

Table 1. In-Class Support Roles of Professional Development Personnel.

In creating such a program for teacher development, we have to acknowledge and utilize the experiences and strengths of the educators involved throughout the process. The efforts of working with a small group of teachers to pilot the educative curriculum and accompanying technological tools cannot simply be replicated with a large group of teachers. Rather, as the curricula was developed an evaluated and refined, other teachers were recruited to become involved in the program. Educators inducted into the process from the beginning became more familiar with the tools, the content, and the accompanying pedagogy, and moved from requiring support to providing it for others. Teacher support constructs evolve, moving from individualized in-class support to collegial sharing of concerns and ideas, all fostered by efforts to encourage individual teachers' reflection upon their practice and student learning. Web-based supplementation of support is now provided, to allow the variety of teachers involved in working with these curricula, technologies, and pedagogical issues other methods of communication, collaboration, and reflection. As the number of teachers involved in the reform effort increases, so evolve the professional development activities in order to make use of the teachers' experiences and encourage sustainability within the program.

Findings and Challenges

While findings of these curriculum units are not discussed here, informal observation reveals the impact, both positive and negative upon teacher practice. Successful enactment of the curricula allows the teachers to become familiar with the content, pedagogy, and technological tools encouraged in the program. Teachers use the materials to provide learning opportunities for students which also allow the teachers to gain experience in the enactment of an inquiry based pedagogy, and in the infusion of technological tools designed to aid in student cognition regarding the concepts and relationships of the content. The reflective questions and commentary within the written curriculum documents, when teamed with other forms of support, help the teacher understand the educational impacts of their practices on students, and focus on the changes in student learning, motivation, and content focus encouraged by the curricula.

Difficulties in the enactment come, for the most part, from challenges regarding organization, time management, and a diverse and dynamic student population. These challenges have forced some teachers to cut short elements of the curricula, as administrative and personal pressure encourages teachers to move on to more familiar practices. Such enactment seems to encourage the use of the pedagogy and technologies as interspersed "activities" and "techniques" rather than an underlying change in philosophy of teaching and learning to a more constructivist approach. Such challenges highlight the need for more comprehensive integration of all of the forms of support for teachers, as well as additional needs for addressing administrative buy-in and professional development for individuals in decision-making positions.

But, the challenges for enactment do not stop there. A number of other issues face educators in a variety of ways regarding the use of the curricula and adoption of these goals and practices. Some of the teachers struggle with content knowledge and its accompanying pedagogy. Over one third of the science teachers involved in the program have no strong science background, and so part of the professional development must address basic scientific concepts for these individuals. Many teachers who feel less proficient with the content often find themselves so tied to the activities listed in the curricula that they limit the adaptation necessary to gear the curricula to their students' specific needs and abilities. Others let their insecurities get the better of them, straying away from the design and focus of the curricula.

Perhaps the greatest barrier to enactment does not exist within the teacher, but rather within the school. Implementation of a curricula with pervasive technology use requires knowledge of and access to the technological tools utilized within the curricula. Problems with these technologies abound within the program. Some teachers have little or no access to facilities with appropriate technology within their school, either because the school as a whole is limited in these tools (though the Center made this an inherent element in the selection of schools to be involved in the program), or because these tools are used for other educational programs. The software for these curricula are specialized and require a variety of

specialized hardware and software requirements, which are often limited within some schools. And, while the software has been tested in a variety of circumstances, the tools created for this program are specialized tools for these curricula, and are continuously under development. Analysis of all of these barriers will take place in a variety of stages, including analysis of videotaped class sessions, field note forms from teachers and support personnel alike, notes from administrative meetings, and interviews and surveys of teachers and students involved in the project.

A Final Challenge: Scaling Up

As mentioned earlier, one of the critical and difficult elements of systemic educational reform is attempting such reform on such a large scale. Changing the practices of one teacher or school is challenging enough; changing an entire system, especially in a district with 180,000 students and 243 schools is an entirely different matter. One of the underlying goals of this program is to go beyond working with a small number of teachers in the implementation of these practices. In addition to all of the other challenges of working with a diverse population of teachers and the different requirements for professional development of all of these individuals, they professional development efforts must be able to scale appropriately while maintaining their relative effectiveness.

When this program began three years ago, it was piloted with one curriculum in two schools. Last year, 20 teachers in ten schools became involved in the program. This past summer, attendance at the summer workshop numbered over 45 from 18 different schools, and additional teachers have joined in the Saturday workshops ever since. This kind of growth is not only expected of such a program, but promoted. Teachers of science at the schools involved in Center activities who have not been involved in the curriculum enactment or professional development are encouraged to join the group.

TLI: Recreating University Programs to Meet School District Needs

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Abstract: This paper describes a constructivist-based initiative to recreate a university's college of education graduate programs to focus on the concept of *Teachers as Learners and Leaders*. This initiative caused the university and school district partners to examine the structure of programs for experienced teachers and their relationships to real-life needs. The Technology Leadership Institute (TLI) is one of the cohort groups collaboratively developed with school district partners to meet needs for increased expertise and leadership in teaching and learning with technology at classroom, school and district levels. Documents and products of the TLI may be accessed at http://tli.jefferson.k12.ky.us.

Introduction

The Technology Leadership Institute (TLI) is one collaboratively-implemented answer to two questions: 1) How can a large school district develop and maintain building-level and district-level support for technology adoption? 2) How can a school of education leverage its limited resources and restructure its offerings to improve experienced teacher education programs?

Like many institutions of higher learning, this university's programs and faculty enjoy a level of stability that inhibits new initiatives and change. The emergence of use of technology for instructional support and delivery has not gone unnoticed but has been slow to impact the way many professors teach their courses and the courses they teach. At the same time, the school district has implemented technology for instruction for over 15 years, in a state where technology is a priority of school reform that is accompanied by state funding. With a ratio of one computer per six students and internet connections in every classroom, the district implements a technology integration curriculum and a yearly assessment with parallel professional development opportunities. The state requires each teacher to complete a masters degree and districts provide salary incentives for post-masters work.

With 150 schools serving primary through grade 12, and a similar type of staff stability, the district's need for new and experienced teachers who can use technology is critical. The development of school-level technology leadership is essential. Collaboration between institutions around the theme of technology leadership is the challenge.

As in many change projects, personal relationships, the spark of an idea and the opportunity for some reward collided to create an opportunity. The TLI attracted a cohort of 15 teachers and librarians the first year and another 45 the second year, indicating a large unmet need. University and school district technology experts collaborated to develop the courses, house the classes, identify the instructors, manage the enrollments and evaluate the results. The TLI is still a work in progress, and the partners are endeavoring to solve problems in each institution to fine-tune instruction and products, to streamline program and course approval, to fix advising and registration problems. This paper describes the design of the TLI and the design of the School of Education's initiative which fostered the TLI and other innovative projects.

Recreating Colleges of Education Initiative

The design of the TLI is based upon a school of education model that has, so far, fostered development of six teacher cohorts whose themes include writing, social studies, and the principalship. These themes have grown from identified needs of the state and the school district and of the teachers, who collaborate with faculty in development of the programs.

The University of Louisville is one of eight southern colleges and universities chosen to participatein the BellSouth Foundation's Recreating Colleges of Teacher Education Initiative. As part of the initiative, the school of education is focusing on making the concept of *Teachers as Learners and Leaders* a pervasive theme of its graduate-level teacher education programs, a theme already embraced in its basic teacher preparation programs. Implementing the initiative is causing a major rethinking of how offerings for experienced teachers might be restructured, particularly considering the realities of emerging new knowledge, current program evaluations and the changing marketplace.

The beliefs inherent in the design of the initiative are:

1. Teachers are leaders and inventors of quality work for students.
2. Learning occurs when students construct knowledge and make meaning based on their experiences, beliefs and values.
3. Teachers must be committed to principles of equity and social justice and provide evidence of these principles in their practice.
4. The work of teachers is to ensure learning for all students by designing instruction that is engaging, of high quality, encourages students to persist, and honors diversity in learning styles.
5. Schools are places where both the students and adults are engaged in continuous learning and where they acquire the skills to become lifelong learners.
6. Technology will facilitate student and adult learning in new directions, which we have not even imagined.

Technology Leadership Institute Cohort

Purpose. The Jefferson County Public School District (JCPS) and the University of Louisville School of Education are collaborating to offer a 30 credit-hour program for Instructional Technology Leaders, based upon technology standards developed by the International Society of Technology in Education (ISTE). The purpose of this program is to increase technology expertise of educators and to foster leadership in curriculum and school change via technology.

Cohort Group. The target groups are school technology coordinators, library media specialists and classroom teachers who wish to enhance their expertise with technology, curriculum and school change. The participants work through a two year program as part of a 15 member cohort group. The primary criterion for admission to the program is applicants' showing evidence of their potential to be leaders and change agents in the school and district. Each participant must submit letters indicating agreement to support and collaborate from the principal and two other teachers in their school. Projects during the program involve the participants with others in their schools to implement technology curriculum and leadership projects.

Admission. Each participant is admitted into a School of Education teaching major at the masters or post-masters level. Each works with the cohort's advisory committee to design a Program Plan focusing on technology, curriculum and school change. The program may include a specified number of preplanned professional development activities as well as University credit courses. The Program Advisory Committee is made up of School of Education faculty, JCPS leadership personnel, and outside experts who may be from the Board of Education, the state Department of Education, a local business, or a national / international expert who may participate via distance technologies.

Rewards. Teachers accepted for the Technology Leadership Institute receive district-owned hardware and software for their use during the courses. These resources are purchased through state allocations for technology resources. The school district allows 18 hours of inservice credit for courses taken within this program. Classes are held at a location convenient to the teachers and are taught by district and university technology experts. The school of education attempts to streamline admission, registration and advising.

Program Design

The school of education's initiative guidelines call for a minimum 30 credit-hour Program of Study organized specifically for each cohort to include:

1. A core requirement of a Readings course and a Research course.
2. A Curriculum Project and a Leadership Project that reflect the beliefs above. The Curriculum project is intended to be a minimum of a year-long effort to improve teacher's design of lessons and the quality of work produced by their students, related to cohort themes. The Leadership project connects to the theme of the cohort and enhances the characteristics of leadership of teachers and their students. Presentation to an authentic audience is part of the requirement.
3. Planned Professional Development experiences can fulfill an equivalency of 1 to 12 hours and should reflect opportunities for classroom, school, or district impact. Experiences should be embedded in the job and closely related to both student and teacher needs, should link school/district consolidated plans and professional standards to the cohort theme.
4. Culminating exhibitions should grow out of the work done by the cohort. These exhibitions could include presentations to the candidate's School Council, the local Board of Education, a conference or workshop presentations to the faculty of the candidate's school, a university class, a community group or organization.
5. Each candidate must prepare a portfolio of evidence documenting cohort and individual work toward meeting professional standards. It should be a work in progress that evolves throughout the program, and will be assessed at various times dictated by the advisory committee. The portfolio should reflect on the cohort experience and the implications, which affect leadership roles and classroom practices. The program advisory committee determines the audience for the portfolio.

For the TLI cohort, standards-based credit courses, developed by the university and school district partners, are taught on a regular schedule. All courses are based upon the ISTE Basic and Advanced Standards for Instructional Technology Leaders and focus on teaching and learning with technology. Syllabi and course materials are to be posted on the server as the program develops. The program starts and ends with an assessment of expertise levels on the ISTE Standards. Each course assesses participant growth on its subset of standards and course products are posted to the project's web server where they may be viewed and used by others. The first five courses are typically taught by school district technology staff to provide depth of technology expertise and to closely align with district needs and directions.

Using Productivity Tools integrates expertise with word processing, database, spreadsheet and communication programs with the teachers' curriculum implementation concerns. Products include lesson plans that link to the district's curriculum, demonstrate applications of the tools and use the district's standard of Macintosh and ClarisWorks. The results of this course support the district's technology-integration curriculum and yearly student assessment.

Web Use and Publishing emphasizes understanding the capabilities of the web, searching for, developing and using web-based instructional resources, supported by Claris HomePage. Again, the district's academic and technology curricula and assessments are the touchstones for product development in an area that is new to most teachers. Participants begin their web-based portfolio in this course by developing an introductory page which links to a resume and products developed during the program.

Multimedia Use and Authoring takes participants into the intricacies of graphic, sound and video files in Hyperstudio program development. *Distance Teaching and Learning* introduces the concepts of distance-delivered resources and instruction, accesses the state's two-way interactive video system with its

lessons and resources, explores web-based curriculum including the state's new virtual high school, vitural library and virtual university efforts. Projects include lesson plans and products for classroom use. *Technical Support Skills* enhances abilities to work with computer hardware and software, including servers, to plan software and hardware purchases and installation, and to provide support for classroom and lab resources and teachers.

The other five courses are taught by university experts in technology, curriculum, leadership and research and are intended to broaden the participants' expertise in these areas. *Readings* course and the *Action Research Seminar* bring together participants from different cohorts to expand knowledge about their cohort's theme and to develop skills with classroom research. For the Readings course, virtual discussions are successfully supported by Tapped-In (http://www.tappedin.org). *Curriculum Seminar* and *Leadership Seminar* each extend over a school year, and involve teachers, principals and students in the participants' schools to plan, develop, implement and evaluate technology and curriculum change projects. As part of these seminars, participants are encouraged to actively participate and to present at the state technology and curriculum conference. *Capstone Seminar and Portfolio Presentation* provides a final opportunity to implement projects in the school and district, and to illustrate mastery of the standards through their electronic portfolios.

Evaluation

The school of education's initiative calls for a detailed timeline for each cohort that spells out continuous assessment benchmarks. Evidence is sought that the candidates have produced work that:

- is "real work for real purposes,"
- is based on research that is linked to the collaboratively determined needs of students, the candidates, schools, district, communities, and the University,
- demonstrates leadership at the classroom and/or school level is standards based, outcomes driven, and requires public performance and exhibitions of work,
- demonstrates expanded use of technology for curriculum design and invention of new knowledge,
- fosters new/deeper collaboration with local school district and professional development providers resulting in change in pre-service and professional candidate education.

Program standards are to be documented in the candidates portfolio, including a reflective component focused on what was learned and what should change.

The outcomes of the Technology Leadership Institute support the district's need to foster technology leadership in classrooms and schools, and are accomplished through a set of nationally accepted program standards. The products demonstrate application of technology in support of teaching and learning and are available to the public through the web-based electronic portfolios of the participants. Continuous assessments of courses, products and participants provide corrective feedback. It is clear that the most successful courses are hands-on and field-based.

The underlying construct of the university's initiative and of the Technology Leadership Institute is constructivism, as interpreted in the works of Phil Schlechty, Linda Lambert, Deborah Walker, and their colleagues. Through the TLI, we are observing a school district and a university school of education work to create change as the participants "make sense of their work and find challenging possibilities together" (Lambert et al. 1995). As the program evolves, it will become a constant source of opportunity for professional development "which includes participation in leadership processes, governance, observations and inquiry, co-planning and coaching, and new information - all of which are opportunities that involve authority, choice and responsibility" (Lightfoot 1983).

Conclusion

In the fall of 2000, the state adopted a standard for new and experienced teachers to use technology to support instruction, access data, enhance productivity, communicate and conduct research.

The expertise developed via the TLI becomes even more "real work for real purposes" as the participants are called upon to assist other teachers in meeting the new requirements. At the same time, the university is faced with the need to impact new and experienced teachers with these same skills. The collaboration embodied in the TLI provides a model and resources for meeting these need. This state-level change also points out the opportunity for the partners to design a continuum of technology experiences for new teachers, experienced teachers, and technology leaders.

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"The Usual Suspects": Explaining Success and Failure in Instructional Technology Consortia

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Abstract: This paper is a case study of the ADEPTT program, a three-university instructional technology consortium in western Pennsylvania, and the reasons for its relative success in gaining public and private grant funds and promoting the effective use of technology in teaching and learning. The paper examines the purposes and constraints of educational consortia, and in particular the limits to institutionally-mandated collaboration. The paper then examines the personal characteristics and social connections of members of the consortium as an alternative explanation for the relative success of the initiative. The conclusion is that success in a technology consortium is not simply a matter of finding "the right people" but also making sure that the group of "usual suspects" also have key connections to university leadership. The article concludes with recommendations concerning the building and maintenance of similar consortia.

"Major Strasser's been shot.....Round up the 'usual suspects.'
Claude Rains as Captain Louis Renault, Police Prefect of Casablanca, "Casablanca" 1943

How do we round up "the usual suspects"? With few exceptions, whenever a grant opportunity appears in the field of instructional technology, a group of "usual suspects" at three different universities appear, cooperate, write, apply and often are awarded grants as a consortium, a consortium that is now nearly three years old. We have all heard the hyperbole about technology enabling greater communication and cooperation, but how does this work in practice? An increasing number of both public and privately-funded instructional technology grants require or suggest consortia for funding (Dotolo and Strandness 1999). This paper will look at the institutional and social requirements for a successful consortium by examining the successful and unsuccessful experiences of a consortium of three public universities in western Pennsylvania

Successes and Failures

Advancing the Development of Educators in Pennsylvania through Technology Training (ADEPTT) is a consortium of three Pennsylvania State System of Higher Education universities, Indiana University of PA, Clarion and Edinboro, and fifty-three school districts. More than forty faculty, administrators and technology staff located as far as 150 miles apart are working effectively on the core planning team. Located in western PA (IUP), ADEPTT was created in February 1998 via a three-year grant funded by Bell Atlantic with a matching $100,000 gift of software from Microsoft Corporation. The overall goal of the consortium is to help K-16 teachers learn to use instructional technology as mind tools for deeper learning as we shift from an instructor-centered to a learning paradigm (Barr & Tagg, 1995). Hundreds of seats have been filled at fifty-five different workshops provided by the Consortium including basic software instruction, technology tools, videoconferencing, using technology to enhance teaching and learning, using the Web, and using Web course development software. Bell Atlantic also funded one instructional designer at the IUP Instructional Design Center for a year.

Based on a August 1999 proposal from the Consortium, the Microsoft Corporation donated additional software and site licenses valued at $385,000 to the Consortium to upgrade networks and laboratories and to provide pioneer pre-service teachers, cooperating teachers and university faculty with software.

The most recent success of the Consortium was the award in September 1999 of $1.7 million from the U. S. Department of Education to Prepare Tomorrow's Teachers to Use Technology in the Digital Age. This

three-year grant will assist us to infuse eleven key competencies needed to teach effectively with technology into core teacher education courses and eight subject areas such as music education, social studies education and so forth.

While the Consortium has achieved the successes summarized above, numerous challenges have been encountered as well. Several attempts to create a similar consortium occurred in the three years prior to its creation, all without success. During the creation of the consortium, a fourth state system university was included until several days before the grant proposal was due. But since we did not have "buy in" to the consortium concept from a top level administrator with signature authority for the ADEPTT grant proposal, that university has only a peripheral relationship with the consortium. In June 1998, the Consortium applied for a $7.5 million five-year Technology Innovation Challenge Grant which was not funded, and one university in the consortium had to drop its membership in the last days before the proposal was submitted. However, valuable lessons about how to apply for a major federal grant were learned. Additional challenges have included 1) learning to work collaboratively at the university level within a culture that rewards rugged individualism (competition), 2) identifying a plan for delivering instructional technology training effectively at the K-12 level where the culture is very different from the university culture, and 3) learning how to work collaboratively with the three intermediate units located within the Consortium.

Institutional Analysis: The First Cut

What is an education consortium? A brief definition indicates that it is "an agreement, combination, or group (as of companies) formed to undertake an enterprise beyond the resources of any one member." In education, one can further subdivide the types of consortia: Institutionally, we propose to examine the different types of consortia: pre-existing, created, vertical and horizontal.

Figure 1: Consortium Typology

	Horizontal	Vertical
Pre-existing	Examples: Schools in districts; universities in state-wide systems	Examples: Intermediate Units
Created	Examples: cooperative relations between private, public colleges and universities, or within systems that are not created by central institutional leadership	Examples: University initiatives with various local school districts

A pre-existing consortium is one in which an institutional framework already exists for collaboration, whereas a created consortium is one in which the members actively seek partnerships where none have previously existed. Horizontal consortia are those of roughly equal members, whereas vertical consortia in education involve different levels such as primary, secondary or post-secondary schools. The ADEPTT consortium contains elements of three out of the four of the cells of figure 1. The universities which formed the consortium all belong to the State System of Higher Education (SSHE) in Pennsylvania, a group of fourteen universities which has existed as a single system since 1983, and thus are for the purposes of examining the ADEPTT program represented a pre-existing, horizontal consortium. Several of the universities indicated interest in the grant Request for Proposals (RFP) and formed their own sub-set of universities, constituting created horizontal consortia. The ADEPTT program, having gained the initial grant, in turn brought in K-12 districts and units, turning the created horizontal consortium into a horizontal and vertical consortium. The distinctions here are not simply analytical; it is a major finding of this study that some types of consortia within the matrix are more likely to succeed than others.

Why do consortia form in higher education? The short answer is that by joining a consortium, its members gain access to resources that individually they could not afford, or gain them at much a reduced rate. Those resources may be directly financial, or information, documentation, training materials, discounted software, or bargaining leverage. Furthermore, as will be noted below, success in a consortium often breeds success, as the consortium's experience and reputation makes further grants and initiatives easier to obtain. Herein lies a problem, though: to benefit from a consortium, its members must first undertake the work and the risk of a consortium before the benefits can be derived and distributed. Thus, it is important, if not imperative, that a consortium's initial effort be successful if there is to be a second effort.

Although standard line authority would entail all initiatives from the State System office coming down through the university presidents and then down into their respective technology structures, the nature of the issues and the schedules of presidents have made a formal coordination mechanism of the Chief Information

Technology Officers (CITOs) of the system a necessity for communication and discussion. A similar coordinating mechanism exists for the Deans of the respective Colleges of Education at each of the system universities. Such meetings were very important for the establishment of personal relations between key people who were involved in the creation of the ADEPTT consortium, but they played almost no role in the creation or coordination of the consortium itself. The only other role played by the State System as a coordinating system in the creation of the consortium was the administration of a competitive system-wide Faculty Professional Development Council which gave modest grants to SSHE faculty, some of which focused on instructional technology issues.

Higher educational consortia face some substantial challenges at an institutional level: first and foremost, a consortium is by its nature largely voluntary, and thus one faces a situation in which normal line authority does not apply, or if it does apply can be largely circumvented by appeal to one's home institution. Consortia have difficulty ordering members across institutional boundaries to undertake tasks. Those tasks may be undertaken voluntarily, but the normal mechanisms of reward and punishment are diminished if not totally absent. A second major challenge of higher education consortia, particularly those in the same region, is the competitive nature of their constituent universities. By and large, the three universities involved in the ADEPTT grants compete for the same pool of students in western Pennsylvania, a point mentioned by one provost of the consortium during a meeting in a planning meeting. Thus, in the initial examination of the institutional bases of the consortium we have a paradox: three universities which might not otherwise be expected to cooperate do in fact cooperate quite closely on a number of projects.

The lack of line authority and the quasi-competitive nature of higher education consortia exacerbate the collective action problems encountered in any system that exists outside of a hierarchical governance structure. First and foremost among these are the "free rider" problem encountered with public goods: some members of the consortium do the work, some do not or do less, and yet all benefit equally. An opposite problem of "glory hogs" is also possible in which one university claims all of the credit for the consortium success, or one member completely dominates the decision making of the group because of size, contribution, or expertise. And since the interaction of the members is intermittent, the chance to build and institutionalize trust-based relations regardless of individuals does not regularly occur.

Finally, any consortium faces the "minimum winning coalition" issue: given the probability that a grant will be of finite size, the addition of more members of the consortium reduces the allocation to individual members, the total grant being divided by the number of members. The optimal number would clearly be one, yet the imperative frequently found in grant RFPs for a "consortium" eliminates that option. Furthermore, since the English language has a specific term for a consortium involving two members (i.e., "partnership"), a tendency for more than two members to be in a consortium also exists, yet every additional member reduces individual receipts. Geography is a problem as well, since travel times must be multiplied by the number of campuses for meetings and their distance. Calculating the distance between system campuses, one can see that natural associations lie in the western and eastern parts of the state.

Given these challenges, it is not surprising to find that the establishment of the ADEPTT consortium faced a number of fairly significant institutional barriers, and there were a number of earlier similar initiatives that failed. In 1996 a Pennsylvania "Link 2 Learn" grant that the State System office urged system universities to apply for contained the explicit provision that collaboration exist. Preliminary talks were held between IUP, Edinboro, and California University of Pennsylvania, but nothing came of it. One participant in those early talks described them as "premature" and indicated that for at least one of the universities the talks were strictly pro forma. A September 1998 video conference between a State System university and the members of the ADEPTT consortium was held largely because the former was required by the system office in Harrisburg to open up a dialog simply in order gain access to other grant funds, but did not participate. In short, technology consortium initiatives that have come solely from the top of the system have little record of success; cooperation cannot be mandated.

Social Characteristics

If a consortium cannot be created by administrative fiat, what then explains the relative success of the ADEPTT consortium? A number of personal characteristics of the ADEPTT team members were vital to consortium building. The members exhibited these characteristics both in the original team at the founding university and across the consortium.

Commitment and Persistence. The ADEPTT team members are distinguished by a capacity for long-term commitment. Not only the technology specialists, but also other key members of the consortium had a long-standing interest in the use of technology in education and in teaching in particular. On the IUP team, for example, Associate Provost Mark Piwinsky had been interested in computers since the late 1970's, when he wanted to help small colleges access the kind of computing power mainframe computers offered to big research universities. Future faculty member Steve Jackson began a programming course in 1983. In 1982, future dean John Butzow took his last sabbatical as a University of Maine faculty member at Digital Corporation, where he worked on a distance training program on laser discs and first used email. In 1985, the 4th grade son of faculty member Mary Ann Cessna brought his parents his lessons on computer basics.

The team members shared a common vision and goals for many years. In spite of intermittent financial resources, spotty administrative support, and many setbacks, the members of the IUP core team kept plugging away, working hard for the improvement of teaching and the use of technology in teaching. Their commitment was reinforced by friendships that predated the team, both at IUP and later in the ADEPTT universities, and new friendships grew out of the team's work. Years of collaboration and shorter-term heroic efforts on specific projects and proposals developed mutual trust and further solidified the team. Several interviewees noted the unique experience that being a member of this team has been for them.

The commitment they share clearly has outlasted any one project. In fact, this commitment now extends beyond each individual campus to the consortium as a whole. With new grants coming on line, an ongoing process of enculturation has become necessary to ensure that new members recognize the primacy of the consortium over individual grants and the potential of the consortium for further opportunities.

Diversity. But what made the team strong was not only what they had in common but also the diversity and complementary skills of the members. Their talents ranged from a flare for writing (Jackson, Piwinsky) to organizational ability (Cessna, Pickering, Piwinsky), budget (Norwood, Piwinsky), editing (Brzycki, Cessna, Piwinsky), inspiration and nurturing (Ausel, Cessna), and a critical eye that brought the team back to earth as needed (Ausel). Several interviewees noted that there were no battles among egos for control, but rather, the members were candid about their strengths and weaknesses and used this knowledge to assign appropriate tasks and roles. The members represented a variety of disciplines and colleges, including technology haves and have-nots, and they included both faculty and administrators.

The faculty-administrator mix was essential in a state system where collective bargaining agreements define what administrators and faculty can do. Professor Mary Ann Cessna commented, "Teams that include a mix of administrators, faculty and key IT staff are much stronger than faculty alone." John Butzow, Dean of the IUP College of Education, noted, "Administrators alone could not have done this.... You must hook faculty and administrators together in unusual ways. Mark Piwinsky played a key role in making this happen." In turn, Mark Piwinsky observed, "Big grants become *university* issues—you need to make institutional commitments

Communication and Generosity. Among the team members were also some truly great communicators. Dennis Ausel is in the Communications Media department at IUP. Mary Ann Cessna is tireless in her efforts to keep consortium members informed of ADEPTT developments. Steve Jackson is an experienced writer and debater. As comparative politics and international relations specialists, respectively, he and Mark Piwinsky are well versed in diplomacy and the communication skills it entails.

With these skills, IUP made it clear that it did not wish to dominate the consortium, and "Clarion and Edinboro were pleasantly surprised," according to Andy Lawlor. IUP took care to rotate meetings among the campuses, and the initial presentations were deliberately left unpolished so that the future partners could have real input and participation. In subsequent projects, IUP sometimes wrote in the other schools to keep them involved, even if it was doing most of the preparation.

Recognizing the importance of their team, the IUP future ADEPTT team accepted new members and tried to fold them into its unique culture—first from IUP and later from the other ADEPTT universities. They set out deliberately to make the new consortium members part of the team as well as participants in later grant proposals, placing great stock on meetings and retreats that were structured to nurture team spirit as well as accomplish immediate tasks. For the most part, these efforts have been successful and continue to this day. They were also supportive of new roles for current members of the team and encouraged professional growth.

Connections. The highest administrator on the team, Dr. Mark Piwinsky, then Associate Provost, not only shared the personal characteristics named above but was also positioned to have access to the IUP Provost and the IT officers at the future partner universities. He was already in regular communication with the IT officers on other administrative and academic technology issues, and at the time of the ADEPTT RFP, these connections influenced the choice of partners. Dr. Piwinsky chose to approach universities where he felt he

could trust the IT officers to work well together. Andy Lawlor observed, "It was not his idea, but Mark was the catalyst that brought the right people together." When the consortium proposal was funded, these connections constituted a second channel of communication that became critical in the pursuit of larger grants because these individuals could marshal resources that faculty and lower administrators could not.

Both Dr. Piwinsky and Dr. Cessna knew David Gray, Vice Chancellor for Information Technology in the State System of Higher Education prior to the ADEPTT RFP. After the award of the ADEPTT grant, this connection also proved vital in communication with such other SSHE officials as Vice Chancellor for Development Chuck Agnew, who was able to direct ADEPTT toward other opportunities.

At the grassroots level, faculty connections among the member universities were limited at the formation of ADEPTT. Those that did exist, however, served to reinforce and consolidate the expanding team. ADEPTT and PTTUT, a grant awarded to the ADEPTT consortium in 1999, have expanded faculty collaboration across the consortium universities.

Social Connections

Interviewees were asked to name, from their perspective, the key people involved in the formation of the ADEPTT consortium. Since some made a clear distinction between critical and important individuals, their responses were weighted with 2 points given for a critical individual and 1 point awarded for a merely important individual. This analysis confirmed that the interviewees were themselves key individuals in the creation and success of the consortium. The Associate Provost at IUP, Dr. Mark Piwinsky, was the person who received the highest score.

In addition, interviewees were asked to identify the people they knew, whether or not they named them as key people, from a list of some 30 individuals. Analysis of these data showed that there were several layers of connections among the more than 40 participants in the founding of the consortium: faculty to faculty, top administrator to top administrator (opinion makers), and manager/staff to manager/staff. At least two of the key faculty members had previous connections with their peers at the partner institutions as well as at other universities in and outside the State System of Higher Education, substantially easing the introduction and increasing the level of familiarity and trust between the key personnel. The opinion makers (top administrators such as Vice Presidents and Associate Provosts) had connections with each other as well as upward vertically (state system officials), horizontally (IT leaders at non-partner universities and some top administrators), and downward vertically (managers and faculty in their own universities). One key manager had connections of all three types.

Most faculty had chiefly faculty-faculty connections. The person with the most connections was, indeed, a key faculty member (Dr. Mary Ann Cessna). These relationships were vital in creating the consortium and promoting a sense of trust within the fledgling organization, but they were not in themselves sufficient to create the consortium. They also helped her recognize what kind of backing would be needed to make the consortium a reality, but she could not create it without such backing. Top administrators had the most connections after Dr. Cessna. To look for possible differences in these connections, we examined the number of relationships that involved opinion makers or people with line authority. Looking at connections with both potential partner universities and the State System, we determined that the chief IT officers had the most connections with people in line authority positions, with the three having virtually the same numbers of these connections.

Institutional Analysis, 2nd Cut

Returning to the question of how to build an effective consortium in technology, we are forced to recognize that although finding key personnel who combine both a high degree of technological proficiency and a large number of social connections within and across institutional boundaries, it would be impossible to form an effective consortium without the active support and participation of university administrators.

The pivotal nature of the IT officer is still more clearly revealed when we look at failures to expand the consortium beyond three universities. In one case, the dean of the college of education was supportive of the notion of a consortium proposal, but both the CITO and Provost positions became vacant during the proposal writing period, and the effort to bring in this university ground to a halt. In a second case, the connections were chiefly those of faculty to faculty, and again the effort bore no fruit.

In summary, the analysis of Who Knew Whom showed that chief information technology officers had the most connections with other people in positions of line authority and considerable connections with faculty. All three IT officers were also named as some of the people key to the formation and sustenance of the consortium. Among all the key people named, Dr. Piwinsky received the highest rating. Finally, our analysis showed that Dr. Piwinsky demonstrated all the personal qualities that made the consortium possible. Moreover, perhaps more than any other player, he is distinguished by the leadership ability to identify and bring together the right mix of people that can be trusted to perform under pressure, and by powerful gifts of communication, persuasion, and a team outlook. Dr. Piwinsky was the catalyst of the ADEPTT consortium--the kind of person in the kind of position that could have a formative influence on the its creation.

Lessons

1. For all of the hyperbole about technology, face-to-face interaction of consortium members is indispensable for building trust and cooperation. Thus, geographical proximity remains a substantial limit on the size and extent of any potential consortium. A willingness to travel to all consortium member universities in a rotation has been an important principle in maintaining a sense of shared burden.
2. Some types of consortia are more difficult to create and maintain than others. It has been the experience of the ADEPTT consortium that the elements of the horizontal-created consortium have worked very well. The vertical aspects of the consortium have been more problematic, and pre-existing consortia are usually too large to be effective. An optimal consortium size of about three or four major institutions in geographic proximity may exist.
3. Consortia cannot be created by administrative fiat; pre-existing groups of connected faculty, administrators and often staff must be found and brought into the creation of the consortium from the beginning.
4. The building of an effective university-level consortium must also have actively involved supporters at the vice-provost level, as well as deans and other administrators. These leaders are key to the success — or
5. Failed attempts at grant writing are not necessarily wasted time, and are often essential to later successes as experience and feedback are gained. However, an early success is essential for maintaining the consortium.
6. Technological aptitude is important for some key personnel in university teams but not all; some of the most important university team members in ADEPTT are not "cutting edge" in their use of technology but do recognize its importance.
7. A cadre of dedicated faculty, staff and administrators who have a clear sense of their roles in the grant writing and administration process — "the usual suspects" to whom the university leadership can turn to and rely upon — is the most important asset for building successful consortia.

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ICT Training and Implementation : Inseparable Activities

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Abstract. As a part of the Education Departments' Superhighways Initiative, senior secondary school staff in Northern Ireland participated in a multimedia CD-ROM based training programme on the use of computer based Management Information System software. An evaluation is offered of the impact on the school organisation, its management practice and patterns of staff use of ICT in management two years after the training event. Outcomes indicate that the opportunities for organisational development were not fully realised, suggesting that change strategies should involve attention to the totality of the relevant school system and should provide for professional dialogue and participation in the process.

Introduction

Developing teachers' professional knowledge and skills in the use of Information Communications Technology (ICT) is a priority objective for those involved in policy formation and implementation in the United Kingdom (DfEE, 1997; Scrimshaw, 1997; DENI, 1997). ICT based multimedia and communication systems can deliver directly into schools programmes of professional training which include video-conferenced tutorial support. But effective delivery presents complex technical, pedagogical and economic questions and often leaves unexamined the relationship between in-service training and the integration of new knowledge and skills into educational processes.

Translating learned skills into operational activities that impact on learning is a distinct stage which requires schools to develop management strategies directed towards the desired outcomes. Systematic evaluation needs to be undertaken to inform future training strategies. This paper addresses these concerns and aims to contribute to the debate by exploring the impact of ICT training on both individuals and their school organisations and identifies some of the pedagogical and environmental conditions, including internal and external support systems, necessary for successful implementation

The research and its context

The first phase of this research was part of the Education Departments' Superhighways Initiative (EDSI), launched in 1995 by the UK government to sponsor and evaluate 25 school based initiatives in the application of ICT (DfEE, 1995). A range of curriculum and organisational initiatives were supported in over 1000 schools across England, Wales, Scotland and Northern Ireland (Scrimshaw, 1997). In Northern Ireland: three selective and one non-selective schools were chosen, for their level of 'technological readiness'. In three of these, training was undertaken by the Senior Management Team (SMT); in the fourth, by the Pastoral Care Team, a total of 28 teachers (including 3 Principals and six Vice-Principals). Approximately half of the teachers considered themselves to be non-users of ICT (see North 1997). Two years later, a follow-up study examined the effects of that training experience on management practice, routine use of computer-based information systems and school-based decision-making.

Methodology

The study draws upon teachers' perceptions of the training experience as well as their understanding of the outcomes. Data was obtained from questionnaires, interviews and observations. Unstructured and semi-structured interviews were conducted with key participants. Observations of learning situations and staff planning and development meetings were recorded. Data were also collected through the self-reporting of teachers Two questionnaires were administered to provide additional data on specific individual attitudes and outcomes.

Research outcomes

Impact of Training

The pilot training project made an immediate impact both on individuals, in terms of personal and professional development, and on the school as an organisation. It successfully equipped teachers with new ICT operating skills and knowledge, and contributed towards their personal growth, conferring in particular an increased sense of professional status and an increased confidence in their use of educational technology. A contribution towards further organisational growth was made through increased engagement of teachers in school-based issues and an improved corporate understanding, expressed in the sharing of knowledge and suggested improvements based on team work. Although evidence of these positive outcomes can be found in each of the schools, they were not acquired in each to the same degree. Schools whose organisational environment promoted professional dialogue, exchange of information and also valued professional development appeared to benefit most (North, 1997).

Implementation

The implementation phase of the project began about nine months after the completion of the training programme. On completion of their training programme, teachers in three of the four project schools appeared enthusiastic at the prospect of collectively utilising their newly acquired skills and knowledge. They were also eager for upgraded equipment to arrive, making possible development of a deeper understanding of how a Management Information Data Access System (MIDAS) could be used to improve the effectiveness of their schools. During the two year implementation period there were eleven personnel changes among the 28 original participants, including retirements, new appointments and post changes. Implementation was externally supported only by the installation of the networked hardware and MIDAS software. Schools were left to decide for themselves how to locate and use their new facilities.

The Management Information system is generally perceived by schools in Northern Ireland as an adjunct to administration. Not surprisingly, therefore, most of the networked stations were actually located in the offices of Principals, Vice-Principals and school secretarial staff. Each school also located a station accessible to members of the Senior Management Team. School C, however, which focused its training on the SMT and the Pastoral Care team, purchased eight additional stations from school resources to ensure easy access for all members of the team. Each of the four pilot schools provided participants, now totaling 25, with access to a networked PC, but levels of access to the MIDAS system itself varied from school to school.

Most teachers used the MIDAS system daily (14), and a few did so weekly (3), less than once per month (2) or monthly (1), although five teachers made no use of it. In school D, the SMT teachers did not use MIDAS themselves but telephoned the school secretary to ask her to access the system for required information ("It was quicker than starting up our machine"). Locating pupils in the school was the only MIDAS function used by all four schools. (MIDAS provides a pupil record which includes a photograph, personal details and an individual timetable.) Some teachers used MIDAS for staff information (9) and examination analysis (7), and a few for discipline (3) and subject-related matters (2).

By far the greatest perceived benefit from using MIDAS was the time saved accessing required information (18). MIDAS, compared with the paper-based pupil record system, was perceived as providing information quickly and from widely distributed access points. Perceived educational benefits were most apparent to the pastoral team in school C who cited reduction of time spent locating pupils. "MIDAS reduces the time spent on administrative chores and therefore frees up time for other activities", was a typical response. Most respondents (16) said that MIDAS software had replaced a manual retrieval system (see North, 2000).

Discussion

Recent experiences of these four 'technologically ready' and well-resourced schools offer important lessons for those responsible for the development of in-service training through independent learning systems. Although each school operated in isolation from the other pilot schools, the pattern of MIDAS us was similar in each. The schools' responses, however, as evidenced by self-reporting of changed activity, suggest that to decouple training and implementation leaves organisational understanding and practice largely unaffected. In the case of the four participating schools, these deficits manifested themselves in the following ways:

Under-utilisation of software

The most striking revelation of the study is schools' under-utilisation of software capabilities. Several change-inducing ingredients, motivational, cognitive and technical, were in evidence after completion of the training programme. For example, teachers believed themselves to be competent in the required skills, were enthusiastic and motivated by the perceived potentialities of the system and were supported by adequate hardware and technical support structures. However, the MIDAS software was only used for those functions which accessed the school's existing database. Although each school understood and valued the potential of a fully functioning system, they had not invested the required human resources or made necessary organisational changes to enable the full capabilities of the system to be fully realised. To benefit fully from MIDAS, schools would need to input updated pupil data daily and convert existing paper-based recording practices to an electronic medium. Teachers themselves were also unwilling to relinquish their personal paper-based records and entrust key tasks to a system subject to the requirements of the Data Protection Act. None of the schools used the MIDAS financial analysis module. In part, this was due to an unwillingness to shift from a current EXCEL-based system (two schools) and, in all schools, to a failure to integrate analytical financial data into the SMT's routine decision-making processes.

Lack of access to hardware

In three of the four schools, the location of hardware was concentrated in the offices of the Principal and administrative staff. This localisation not only reduced accessibility for other members of SMT but also signalled the Principal and school administrative staff as the significant system users. In two of the schools where this localisation was most intensive, only the Principal and one Vice-Principal used MIDAS. The interest, enthusiasm and sense of corporate identity claimed by SMTs after completion of the training phase seemed to have disappeared.

Limited use of ICT

There appeared to have been little extension of teachers' use of ICT for teaching purposes, attributable to their training experience on MIDAS. One teacher had begun to use a CD-ROM as part of an information-gathering exercise by pupils. The belief that the training experience would motivate teachers to develop their ICT skills and incorporate ICT in their teaching was not realised. In two schools, five teachers began to use video conferencing and there was a perceptible increased use of IT for professional tasks. It is likely that these developments are no stronger or more firmly focused than would have occurred in any case, owing to the prevailing 'social climate' of greater readiness and opportunity to make use of ICT facilities.

Limited impact of further training

One of the arguments for independent multimedia training is that it offers the opportunity for teachers to re-visit the training medium to develop their skills and knowledge further and for new members of staff to acquire the necessary operating skills. However, it was found that none of the new appointments to school used the MIDAS CD-ROM to acquire the skills - in the case of school C the three newly appointed pastoral team members were trained in the traditional 'cascade' manner by being shown how to operate the system by a helpful colleague. It is interesting to note that this Just-in-Time training took, on average, only thirty minutes. This compares with an average of three hours for full training but included only the module on pupil records. Twenty of the 25 teachers had not used the MIDAS CD-ROM since the training programme: three claimed they had done so.

Limitations of the training model

The inefficiencies and ineffectiveness of implementation are also due, in part, to the limitations of the training model and in particular to its reliance upon on skills acquisition through simulation, rather than through use of a school's real data. There were instances, for example, of teachers wishing to input school data but feeling insufficiently equipped to do so. A training requirement for participants to engage with a school's own data would introduce confidence and skill-forming incentives. Surprisingly, since no teacher had used more than a small part of software, when asked to rate their level of competence on a five point scale in the use of MIDAS, fourteen teachers rated themselves as 'highly competent', five as 'adequately competent', six as 'not competent'.

Personal and Professional Benefits

There were some gains in both improved attitude to ICT and small gains in increased usage of ICT. Most teachers claimed that the MIDAS training programme increased their ICT knowledge and skills and a heightened awareness of the potential uses of IT in educational settings. Two years after the training programme, nineteen teachers were using IT in a professional capacity, compared with fourteen before training. Six remained non-users. Individually, teachers mentioned their increased willingness to promote increased understanding of IT and the improved confidence among (some) senior staff in the use of IT. Four teachers, however, could perceive no benefit. A range of uses was identified, chief of which was management and administration. However, only one additional teacher claimed to be using ICT in the classroom, although there was a significant growth in the number of applications used. Five teachers had used the video-conferencing facility since the completion of training. All reported that objectives had successfully been met, although in each case only the basic image-dialogue function was used.

Conclusion

Training and implementation should be seen as inseparable processes. Decoupling the activities that sustain them leads to ineffectiveness, inefficiency, and leaves organisational practices largely unchanged. Necessary incentives for staff to change themselves, by undertaking self-directed school development tasks through programmes of professional self-development are removed when training objectives and processes are isolated from considerations of organisational development. Skills training programmes will not by themselves bring about professional and organisational change. The limitations identified in the CLASS project strongly indicate a need to examine alternative models of the change process in relation to ICT development and implementation in schools.

The model underlying the CLASS training reflects a Research, Development and Diffusion model (R, D and D). Strong on internal coherence, as befits its empirical-rational strategic foundations (Chin & Benne, 1974), such a model highlights the rationality inherent in an objectives-driven strategy that ignores the constitutive elements and interrelationships inherent in the diffusion process. This 'weak link', at the interface between institutional culture and experience (Becher and Maclure, 1978), allows the possibilities of changing school practice to remain unexplored.

If the diffusion strategy was designed to match a more comprehensive understanding of training processes and their link with institutional practice and renewal, dissemination strategies would have to be redesigned to confront and incorporate aspects of what Havelock (1973) termed the 'social interaction' model. There, the user is a change agent and change strategy incorporates provision for normative-re-educative experiences (Chin and Benne, 1974). These principles should also formatively influence the design, development and production of Management Information software.

In the case of the CLASS project, training was designed to employ a combination of 'Pressure' (school and individual exposure to testing and possible publication) and 'Support' (provision of CD-ROM, technical expertise and a facilitative training environment). Thus linking empirical-rational and power-coercive approaches to meet training objectives. After training was completed, implementation languished, though the essential framework and nourishment of physical and technical support were fully provided. Nevertheless, staff used elements of the new ICT facilities, when they perceived an immediate individual benefit of saving time required for carrying out existing professional tasks. Readiness to adopt the new technology was prompted by perceived efficiency gains. This is very much in-line with the findings of Wild (1992) during an evaluation of a LEA initiative in the use of computer-based management information systems. The 'natural growth' that did occur showed that schools adapted the training to their needs by achieving the greatest return with the least investment of their own time.

These findings lend support to an important and already established principle (Dalin, 1978) that for effective ICT development to take place, attention must be paid to the totality of the relevant system and, in school settings, incorporate a strategy of vertical, as well as horizontal professional dialogue.

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ATTITUDES TOWARDS USING COMPUTERS IN ADMINISTRATION AMONG SCHOOL ADMINISTRATORS

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Abstract: The purpose of this experiment os to examine variables that could influnce the attitudes towards computers administrators in Malaysia. The variables investigated in this experiment were gender, age, computer skills and experience, and computer access and training. The instrument used for this experiment is the Computer Attitude Scale (CAS). The CAS is a 40-items instrument that is divided into four, 10-item sub-scales: Computer Anxiety, Computer Confidence, Computer Liking and Computer Usefulness. These four sub-scales were used to describe the four dimensions of attitudes toward computers. The findings significantly revealed that computers access and training, statistically influnced attitudes towards using computers, whereas gender, age, computer skills and experience did not. Therefore, the conclusions and recommendations based on the findings of this experiment indicated that proper training and better computer facilities should be provided by the authorities to teachers and school administrators in order to enhance the computer usage in schools and to increase the integration of information technology in education in Malaysia.

INTRODUCTION

The use of information technology (IT) in school administration is no doubt will be a plus factor for any school. According to Tofler (1991) when society have moved to IT, computer will be the tool for the societies. As for technologies, the advantage will largely depend on the usage. Correspondingly, users need to be well-verse. The government of Malaysia through the Ministry of Education (MOE) has embarked to introduce computer literacy in 60 schools throughout the country in the early 1990. This is followed by another 100 schools. Beside this, the MOE has started the Sekolah Bistari or Smart School concept. The Smart School has become one of the flagship application of the Multimedia Super Corridor (MSC) project.

Based on the Smart School Working Committee (1997), the rearrangement of school administrator to use IT will improve the administrator managing the school. The usage of computers will help the administrator manage, plan and allocates human and physical resources effectively. A lot of efforts have been done to install and provide Information Technology (IT) to each participating school. Many seminars and workshops are being conducted in discussing the usage of computers in teaching and learning, as well as in the improving the curriculum material.

Despite of the above, the usage of IT by school administrator is rarely discusses in Malaysia. We feel that in stressing of smart school teaching and learning, the aspects of school administrator usage of IT

should be emphasized. We managed to cover several studies by Chong (1995), Liong, Gan and Noran (1995) and Zainuddin (1997).

THE EXPERIMENT

Research conducted by Pelgrum and Plomp (1993) in Computers in Education Studies (COMPED) organised by The International Association for the Evaluation of Educational Achievement (IEA) among 22 countries througout the world conclude that schools that use computers in their administrative indicate an increase in the school administration.Most school administrator also have this preception and hope that by using computers in their teaching and learning will increase schools and students performance.

Pelgrum and Promp (1993) also found that training in the use of computers needs to be considered for the effectiveness of using computers in school. This finding is being supported by another research conducted by Bird (1991) in England through Computer Assisted School Administration (CASA). The findings stress that school administrators needs to be given training in using computers beside having a fully equip hardware and software. While Kristiansen (1991) view that attitudes and confidence is an important factor in determining the use of IT in education. Computer attitudes is a difficult and complex entities to measure. However there are various instruments to measure it.
Loyd & Gressard (1984a, 1984b), Loyd & loyd (1985), Koohang (1987) have found that several factors influence the attitude of user to computers such as sex, age, training, post (designation), family background, access to computer, skill and experience in using computer. Loyd & Gressard (84a, 84b) have use computer anxiety, computer confidence, computer liking and computer usefulness in their research. All these factors are relevant to the experiment that we are going to conduct. All these experiments were conducted in USA and Britain but not in Malaysia.

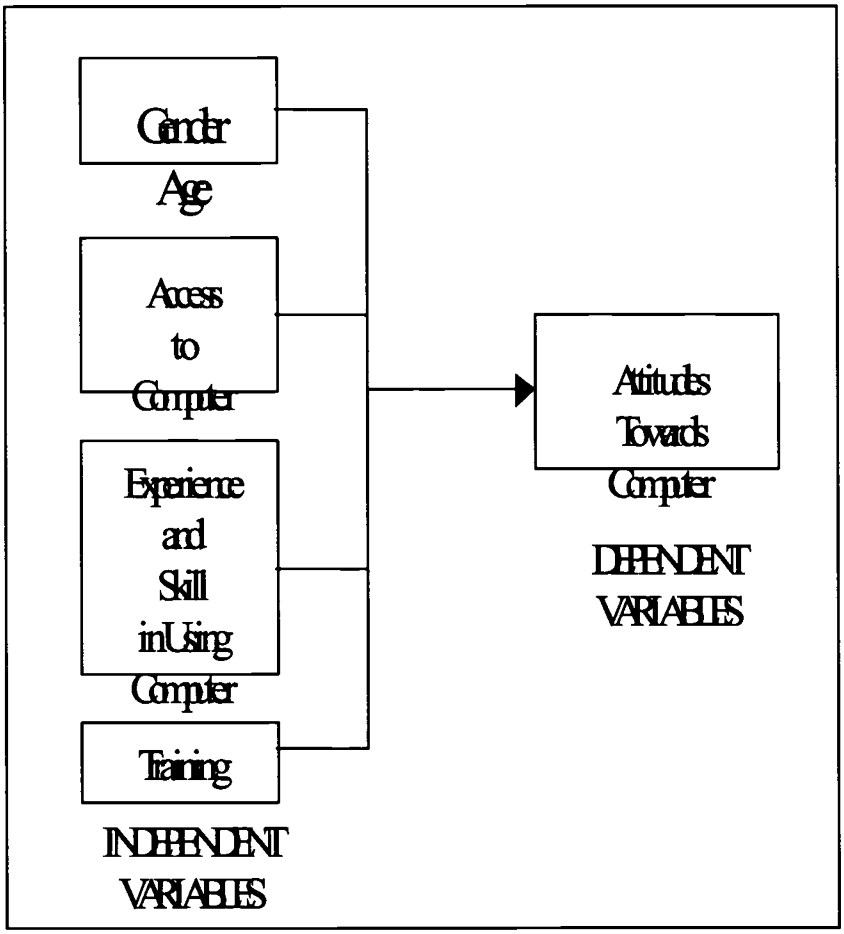

Figure 1: Conceptual Framework Model of the Experiment

Attitudes towards computer can be measured using Computer Attitude Scale (CAS) by Loyd and Loyd (1985). This view was also supported by research done by Gunter (1994) on work done by Kluever et. al (1992) and Bandalos and Benson (1990). They found out that CAS has high consistency rate of between 0.80 to 0.90. A experiment by Shaft and Sharfman (1996) found out that their instrument Attitudes Toward Computers Instruments (ATCI) and Attitudes Towards Computers (ATCS) by Reece & Gable (1982) and CAS has a high correlation which is r=0.82. This suggest that all 3 instruments can measure the same dimensions.

SCOPE LIMIT

We have limit our experiment based on the following limitations:

i) we choose our respondents at random, any conclusions and recommendations derive from this experiment should apply to the same population criteria
ii) we only experiment 4 factors that is gender, age, computer skills and experience, and computer access and training in using computer
iii) access to computer includes facilities to the computer at home or school. Whether the respondents use the computer or not is not included in this experiment
iv) Different in computer facilities at school may influence the administration in using computer for administration. This factor is not studied.
v) There are other factors that can be used to experiment computer access and training. This factors are not included in this experiment.

Our dependent variables contain 40 items with Likert scale of 4 points. These 40 items are divided into 4 sections namely computer anxiety, computer confidence, computer liking and computer usefulness. The 4 independent variables are gender, age, computer skills and experience, and computer access and training. Figure 1 depicts the conceptual framework model that we conduct our experiment.

THE METHOD

Respondents are chosen at random from the various primary (elementary) and secondary (high) schools in urban and rural areas. Stratified random sampling is been used to determine the sample size. Questionnaires are posted and collected personally on a pre-determined date. We use Lakers scale of 1 to 4 for each questions.

DATA ANALYSIS

Descriptive statistical analysis were used to describe the respondents and the population whereas inferential statistics are used to describe and explain the relationships between independent and dependent variables.

FINDINGS

We distribute 100 questionnaires to the various respondents identified and we manage to collect 81 sets, which represent 81% of the population. According to Sakaran (1992), the return of 70% of the population is justifiable to conduct a statistical analysis. Our respondents were 51.9 % male and 48.1% female. Age group are as follow: Below 30 years 25.9%, 30-40 years 50.6%, more than 40 years old 23.5%. Respondents that have computers at home are 58% compared to 42%. Respondents that use computers at school are 82.7% compared to 17.3%. Numbers of respondents having experience and expertise in using computers is for novice is 43.2 %, middle user 49.4 % and 7.4 % for expert users. This indicates that many respondents (school administrator) are average computer users. On the training side 45.7 % respondents have training and 54.3 % have no formal training. The number of training that the respondents received are as follows 54.3 % - no training, 27.2 % - 1 training, 6.2 % - 2 trainings and 12.3 % -more than 2 trainings.

In our further statistical test, we obtain a mean value of $\mu = 98.07$ for male and $\mu = 94.05$ for female. T-Test analysis is conducted which indicate the rejection at the confidence level of 95 %. This indicates

there is no significant in attitudes between male and female respondents. This is consistent with the findings of Woodrow (1990, 1991, 1994), Busch (1995), Pelgrum and Plomp (1993), Kluever et. al (1995) and Willis (1995).

A One Way ANOVA with a significance level of 95 % was conducted to compare the different mean for attitude among the respondent based on the age group. Although generally the test indicate that the mean value for the younger age group is high for all the sub-scale on computer anxiety, confidence, liking and usefulness, there is no significant difference among the age group at significance level of 95 %. This indicate there is no significant different for computer attitude among school administrator in using computer. This findings justify the findings by Woodrow (1990), Kluever et. Al (1995) and Willis (1995). The result might be due to the small age gap among the age group. Other researcher used a bigger age gap between each age groups as done by Robertson et. al (1995) .

t-Test analysis indicate that the mean value for attitudes toward computer is higher for school administrators who have access to computer (μ=99.97) compared to (μ=92.73) and significant at 95% level of significance for Confidence, Liking and Usefulness except for Anxiety sub-scale. Therefore we can conclude that there is a significant among school administrators who have access to computers compared to those who do not have access. This indicates access to computer can increase the attitudes toward computers because it can provide experience and confidence in using computers. This finding agrees with the findings done by Lioa (1993).

Mean comparison between respondents that have basic, intermediate and expert skills users indicate that intermediate skill users have the highest attitudes for computer (μ=97.7) followed by expert skill users (μ=95.5) and basic skill users (μ=94.4). Although there is significant difference in mean at sub-scale Anxiety and Confidence but a One Way ANOVA test indicate there is no significant difference at 95% significance level generally for all sub-scale. This indicates there is no significant between school administrators that have basic, intermediate and expert skills users in using computer in school administration. These findings do not agreed with that of Loyd and Gressard (1984a), Comber et. al. (1997), Chen (1986), Koohang (1987, 1989), Gardner (1993), Liao (1995) and Huang et. al. (1995). What we can conclude about these unmatched findings are that there is an obvious different between the number of respondents in computer experience where the expert skill group is 4% compared to the other groups which is more then 40%. Beside that evaluating expertise is quite subjective in this case.

Mean analysis for attitude towards computer indicate that respondents that have computer training is high (μ=99.78) compared to those who do not have computer training is (μ=93.06). This is further strengthen by t-test which indicate there is significant at 95% level of significance for all sub-scale except Anxiety. This result is also supported by test conducted based on the numbers of computer training that respondents have gone. This can be translated that there is a significant different between respondent that has computer training compared those who do not have computer training. This result agreed to the finding done by Gressard and Loyd (1985), Reed (1990), Anderson and Hornby (1996) and Kluever et al. (1995)

Person Correlation Analyst is used to compare the relationship between the above variables and there is significant relation using 95% level of confidence between sex, access to the computer, training and skill. These support the finding done by other researchers which state that computer training and access can improve the computer skills and improve the attitudes toward computer.

Linear regression analyst using multiple regression is used to see the relationships and strength between dependent and independent variables. Our findings indicate that access to computer (β=-8.06) and training (β=-6.53) is the most important factor that affects the attitudes towards computer with significance at 95% level of significance. This is followed by sex factor (β=-3.96), age (β=-3.11) and skill (β=-2.34). This finding justify the findings done by Gressard and Loyd (1985), Reed (1990), Anderson and Hornby (1996), Huang and Pardron (1995) and Kluever et al. (1995)

CONCLUSIONS

Attitudes towards computer is among the most important factor in indicating a person acceptance in using computer. Our findings have found that access to computer and computer training are the most

important factor in determining the attitudes toward computer. These are proven by the regression analysts conducted by comparing the various factors. Access to computers also indicate an obvious different in attitudes toward computer and all the attitudes sub-scale towards computer. This statement is supported because most respondent have access to computers either at home or school.. Other findings also indicate the longer a person used a computer, the more confident he has in using computer. This increased his experience and attitudes toward computer.

Another factor that we can conclude is the training factor. Respondents that have undergone training show a more positive attitude then those who do not have training. This experiment also indicates that many school administrators did not have computer training although they might have access to computers. This indirectly have an effect on their attitudes toward computers.

Finally, we recommend that school administrators should have access to computers either at home or schools. Beside that they should be given more computer training by the government.

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FACULTY DEVELOPMENT

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As new communications technologies impact higher education, faculty must be trained to determine the most appropriate tools for design, support and delivery of courses. The challenge for continuing professional development and renewal to adapt to this changing environment has becomes critical. The adaptation of existing courses to implement new technologies requires faculty to use recently acquired knowledge and new skills. The standards for teachers supporting these new skills have been developed by the professional organizations governing accreditation in each academic field.

Both the International Society for Technology in Education (ISTE) and the National Council for the Accreditation of Teacher Education (NCATE), have specified the technology skills that teachers are expected to have when they enter the teaching field. These organizational standards provide the foundation for the professional development programs designed for higher education faculty. ISTE suggests that teachers be able to meet these standards: apply tools for enhancing their own professional use and productivity, use technology in communicating, collaborating, conducting research and solving problems, promote legal and ethical use of technology, use technology to support their instruction, and plan the delivery of instructional activities that integrate technology (ISTE, 1998).

The papers included in this section address a number and variety of approaches available to meet these new standards. The papers have been grouped into five areas: 1) Models for Successful Faculty Development Training; 2) Faculty Development Best Practices 3) Teaching The Tools of Technology; 4) Research and Case Studies; and 5) Faculty Development and Preservice Education.

Papers included in the Models for Faculty Development Training group provide a variety of faculty development models. They focus on the application of existing courses to implement new technology. These models are designed to prepare faculty for the transition from the traditional classroom to the technology rich environment supported by the ISTE and NCATE standards. A critical part of training is to expose faculty to models of technology use for integration and application of today's' technology tools. Blair and Madigan present a faculty development model that not only unites technology and pedagogy, but also presumes that faculty have a vital role in defining that model. Their description of their Center for Teaching, Learning & Technology chronicles the implementation of an integrated technology-pedagogy model. Kahn and Pred present the planning process, structure and outcomes of a project to provide information about the possibilities of technology to faculty in specific disciplines within the Southeastern Pennsylvania Consortium for Higher Education, a consortium of eight small colleges in and around Philadelphia. Browne, Maeers, and Cooper explore the experience of information technology inservice workshops at the University of Regina in Canada. A technology mentorship program designed to provide staff development for the teacher education faculty of a small liberal arts college is described by Milligan and Robinson. This mentoring program included the use of ISTE standards for preservice teachers in gauging the progress of the faculty that participated in the original program Beisser provides results from a specific technology mentoring experience at Iowa State University from the perspective of both the mentor and the mentee. Terwindt presents the development and implementation of a new curriculum concept for professional education at the Amsterdam Faculty of Education that has been termed "learning through producing". McCoy examines data gathered at the University of Alaska Anchorage School of Education to determine the state of faculty technology use for teaching and learning and establishes goals for further development of technology integration.

The second section of papers represents Best Practices in Faculty Development Plans. The best practice of current instruction must be preserved and renewed. Instructional and evaluative strategies that have been successful in traditional settings need to be examined and, if necessary, altered to continue their positive effects with students participating in situations with new technologies. Barry, Walvoord, and Laughner provide a Teaching Well With Technology workshop created to provide faculty members with a systematic way of thinking about desired outcomes, use of time and space, and potential impact of technology for their classes. Topp and Mortensen share the experiences of a college of education's 10-year effort to train faculty to

use and infuse technology by means of its annual 1-3 week technology awareness and training sessions. The Distance Professional Development and Support System developed at the University of Utah Reading Center and reported on by Serdiukov, Niederhauser and Reynolds is designed to offer effective and cost-efficient teachers' professional development. Childress and Braswell address the faculty development programs at Auburn University Montgomery and Old Dominion University and the on-going evaluation of these programs. The authors also address problems perceived and overcome. Belvin and Baines report on recent research that included faculty perceptions towards technology and progress towards integration of technology into teaching. They have identified three categories of technology adoption and integration. The USE Tech Partners Program at West Chester University is geared toward full-scale integration of educational technology in teacher preparation. Newcombe and Kinslow present effective strategies, lessons learned through implementation, and future planned activities.

The third set of papers in this faculty development category center around Teaching the Tools of Technology. Teaching the tools of technology is necessary in the initial faculty development training that occurs. Training must be geared to the specific tools that support and supplement the educational mission of the faculty being trained. Maddux directs his paper to the developers of web pages to supplement traditional higher education courses and describes technical and content problems that limit the usefulness of web pages and the frustration that can occur for both students and instructors. Repman, Carlson, Downs, and Clark examine new search tools and techniques that teacher educators can use to improve the efficiency and effectiveness of their own web searching. Techniques include use of metasearch tools, improving relevance rankings with search engines, backwards searching, searching the invisible web, and use of kids' search tools. Interactive PowerPoint for teachers and students in the tool of technology presented by Cavanaugh and Cavanaugh provides specific information for the teaching of the tools of technology needed by faculty. Baty and Moir have developed a searchable on-line database of staff development material that relates to electronic teaching resources and which operates across the University network.

Section Four contains research and case studies involving faculty development and training. A study on teacher educators' reflections on using group response technology is presented by Hargrave, Foegen, and Schmidt. This study suggests that group response technology was an efficient means for all students to participate in class and for the instructor to monitor student progress during instruction. Galloway provides recent research on the teachers' use of graphics in HyperStudio screen displays. Graphic displays are analyzed and the use and application of graphic imagery is categorized into discrete levels based on their level of communication. Wideman reports on a study of the implementation of two telelearning projects based on different pedagogical models and using different delivery systems. A theoretical model of telelearning implementation is articulated and related to traditional views of program implementation. An action research methodology by Schuttloffel provides a self case study of a teacher education professor who investigates how to reconcile beliefs about classroom life with the implementation of technology. In the final analysis, the professor-researcher models to students her beliefs, hoping to shape the students' beliefs as future teachers confronted by innovative practice. Bohrn and Nulden describe a research project in progress about information technology use in education. They suggest how to initiate a discussion among educators to facilitate the start of a more substantial adoption of information technology in educational practice. Igonor and Soul report on a study concerning the use of information and communication technology conducted by South African University Academics. The impact of information and communication technology on job characteristics of teaching, research and administrative duties was investigated.

The last set of papers involves Faculty Development and Preservice Education. This dual mission of blending the training of the faculties of our Colleges of Education and the specific training programs for preservice teachers is of vital importance to all Colleges of Education throughout the higher education system. Funded through the U. S. Department of Education, Project PICT (Preservice Infusion of Computer Technology) was developed to enable preservice teachers to fully utilize modern technology for improved learning and achievement in their future classrooms. Vannatta and O'Bannon report on a model grounded in the collaboration between teacher education faculty, arts and sciences faulty, and K-6 teachers. Hoffman, Rosenzweig, Morris, and Faison discuss the Apple Summer Institute for Teacher Education attended by 42 participants who represented faulty teams from 17 universities. This panel discussion focuses on the results of this novel program in promoting institutional change within participating universities.

Swain describes the Unified Elementary ProTeach program at the University of Florida that is a new teacher education program with the potential to positively impact future teachers, public school children in the state of Florida, and the University of Florida community. Recent state legislation in Virginia requires teacher licensure programs to guarantee that graduating teachers are computer literate. In an effort to accommodate this mandate, faculty within the School of Education at Virginia Commonwealth University are analyzing the use of technology

in courses required for certification. Savitt, Hootstein, and Rezba discuss faculty development and preservice teachers as agents of change in light of these activities. Slobodina describes faculty development in technology for teachers of English for specific purposes by providing the current practices of faculty development in technology in Russia's universities and suggests ways of restructuring it to provide a high quality of university education in the new millennium.

The papers on Faculty Development describe innovative models and positive suggestions that have been designed and conducted to improve the use and integration of technology at institutions of higher education worldwide. Taken as a group, the methods and models provided will aid in the effective training of faculty and will address the critical need for continuing professional development and renewal to adapt to our changing technological environment.

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Involving Faculty in Faculty Development: A Recursive Model

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Abstract: As more and more faculty are encouraged to develop technology-based courses within their disciplines as a response to changing student populations and the resulting need for alternative sites of learning, it is vital to create a faculty development model that not ouly unites technology and pedagogy, but also presumes that faculty have a vital role in defining that model. Using our Center for Teaching, Learning & Technology as a case study, this paper chronicles our implementation of an integrated technology-pedagogy model through the creation of faculty associate positions that allow faculty using technology across the disciplines to serve as liaisons among faculty and between faculty and instructional designers. In providing an historical overview of our Center's move toward this integrated model, we profile varying levels of support, resistance, and success encountered in establishing a faculty associate program, ultimately stressing the reciprocal benefits to the university community.

Introduction

One of greatest challenges to Faculty Development Centers in post secondary education is how to incorporate technology into the practice of teaching without sacrificing either the technological or the pedagogical mission of the University. Many models within faculty development centers address this challenge by foregrounding one teaching-technology model at the expense of another. Sometimes when technology is involved in developing course materials traditional faculty development centers play a minor role if any. For example, one model may involve a faculty member "dropping off" course materials at an instructional media center to be technologically transformed for presentation purposes. This model may also presume that course materials need only be visually appealing and accessible in order to be pedagogically sound. In addition, such a model often views the use of instructional technology from a top-down perspective in that technology enhances a one-way monologue from teachers to students. A related model involves placing instructional media centers within or near faculty development centers. The initial missions of both centers presume and encourages a separation between technology and pedagogy. More recently, some faculty development centers have realized the importance of collaborations in which other experienced faculty from a variety of disciplines across campus work as consultants to instructional designers within one combined unit. Yet even within these more current models, faculty are viewed as content experts but neither technological nor pedagogical experts. Although each of the above models appear to integrate teaching and technology, there exists a continued bifurcation.

As more and more faculty are being encouraged to develop technology-based courses within their disciplines as a response to changing student populations and the resulting need for alternative sites of learning, it is vital to create a faculty development model that not only unites technology and pedagogy, but also presumes that faculty across these disciplines have a vital role in defining that model. Thus it is important to ensure complete integration of technology and pedagogy from the initial planning stage of course development through the implementation and assessment stages so that faculty have an equal and reciprocal role in the creation of technology-based learning options appropriate to their teaching styles and curricular contexts.

Indeed, any form of instructional consultation should be recursive and, as Weston and McAlpine (1999) suggest, should "integrate more disciplined-based concerns and faculty involvement" (p. 85).

Although in some cases, the possibilities and constraints of implementing any model of faculty development across campus are often budgetary, there are also those ideological constraints that maintain the separation of technology from pedagogy. From a faculty perspective, this may include the view that technology requires functional knowledge of hardware and software applications, and is therefore beyond the average faculty member's teaching responsibilities. From an administrative perspective, there are often concerns about offering incentives to faculty for appropriate uses of technology in curricular development. These concerns are particularly significant in light of traditional tenure and promotion structures that may fail to encourage and reward faculty who recognize the importance of technological teaching and learning forums (Gilbert, 1996). For technological literacy educators such as Cynthia Selfe (1998), it is simply no longer enough to ask colleagues to utilize technology and reward them for doing so: "Instead, we need to... provide them with important opportunities to participate in making hard decisions about how to pay attention to technology issues in departments, colleges, and local communities" (p. 434).

Using our Center for Teaching, Learning & Technology as a case study, we show how we have implemented an integrated technology-pedagogy model through the creation of faculty associate positions that allow faculty using technology across the disciplines to serve first as liaisons between faculty and instructional designers then as members of creative development teams. In this model, faculty associates, instructional computing designers, and other faculty development personnel, including student network specialists and multimedia designers, work as a team toward a common goal of helping faculty recognize the potential of technological teaching environments to foster active teaching and learning styles.

As this paper demonstrates, the integrated role of the faculty associate includes actively involving discipline specific faculty in planning workshops and other public forums for critical dialogue about integrating, preparing, and evaluating technology-based teaching. Faculty associates also serve as consultants to individual faculty seeking to implement technology into teaching and learning. In providing an historical overview of our Center's move toward this integrated model, we highlight the varying levels of support, resistance and success we have encountered in establishing a faculty associate program. Ultimately, in addition to the benefits for our own faculty development center, we stress the reciprocal, interdisciplinary benefits to the faculty associates, their departments and colleges, and to the larger university community.

Historical Overview

Many factors have contributed to our Center's vision regarding the successful and responsible use of integrating technology into the teaching culture at our university. It would be irresponsible for us to imply that our current vision was the vision we began with at our Center for Teaching, Learning and Technology three years ago. Although the president of our university played a pivotal role in helping to create a faculty development center that focused on all faculty development issues, including responsible use of technology for teaching, our directives were unclear. During the first year of existence, members of our advisory board (faculty, students, and administrative staff personnel) spent several months debating our vision and mission. Common questions during those early meetings were, How much technology should the Center focus on? Should the Center be involved in instructional design? How much time should the Center and its staff of two devote to technology issues? How much time should the Center and its staff devote to other more traditional faculty development issues? In response to the confusion of those early months, the director and assistant director designed a series of technology workshops and a second series of more pedagogically focused workshops. And although they tried to combine technology and teaching issues in every workshop and consultation, more often than not the two sets of issues became distinct and separate, just like the two sets of workshops.

In the second year of existence, and in answer to a technology/teaching separation model, we sought to informally benchmark (Epper, 1999) our teaching/technology faculty development profile with profiles from other universities and businesses that were successful in integrating teaching/technology models. We visited faculty development web sites worldwide, and we made visits to several campuses state wide, nationwide, and in Canada that had developed faculty development centers that integrated instructional computing design with pedagogy. Our benchmarking activity revealed that only a few faculty development centers we encountered had implemented a teaching/technology model that was fully integrated. We learned that the faculty development

programs that came closest to an integrated model that we now implement always involved cooperation between faculty associates, instructional technology experts, and faculty development centers. In response to the benchmarking activity, we began to involve more faculty in facilitating our workshops. We hired student technology experts to work with faculty on teaching/technology projects. We also investigated systems, hardware and software that would allow faculty to integrate technology into their curriculums more fluidly. Finally, we began to envision an integrated program that involves faculty associates, instructional designers, and students in a team environment. As a result of our benchmarking venture, our staff began to refine our vision and our Center's mission.

What we didn't expect in the beginning of implementing our new model is some of the resistance we encountered from a variety of areas. For example, some faculty became vocal about not wanting to use technology in their teaching. Because new instructional technologies have only recently begun to change the way we communicate, distribute resources and share ideas with students, our university did not have a system in place three years ago to support faculty teaching/technology efforts. Even two years ago, some of our faculty did not have easy access to the Internet from their offices or from their homes. Nor did faculty have access to knowledge about how technology and teaching were joint initiatives in relation to instructional design and curriculum development. Some key administrators on campus had developed a resistance of their own toward an integrated model. Primarily, they were used to faculty development centers in which technology was bifurcated from traditional faculty development issues: Curriculum design, classroom management issues, and assessment. Thus they themselves had little experience in facilitating innovative uses of technology in teaching and learning.

Although in the beginning this kind of resistance worked against the integrated faculty development model, we came to understand and learn from some of the issues related to the resistance. We learned that faculty needed better technical assistance and access in their daily teaching and research routines. We learned that they needed a secure environment in which to distribute course content and communicate with students and colleagues. We learned that they needed and wanted forums for discussing and assessing appropriate and responsible uses of technology for teaching and learning. We learned that they needed a reward structure consistent with their discipline specific guidelines for toward tenure and promotion. From what we learned, we fashioned the faculty associate program that we detail in our next section.

Implementing an Integrated Model

Fostering a reciprocal relationship between faculty and our Center staff has involved a triangulation of forums that are meant to complement one another and contribute to our theoretical goal of integrating technology and pedagogy, including theoretical seminars, individual consultation, and hands-on technological training.

Technology/Pedagogy Seminars

Once we hired our current faculty associate, the Director, a newly hired coordinator for instructional development, and the faculty associate brainstormed ways of encouraging faculty to become more actively involved in discussions relating to effective uses of technology in the classroom. In our first phase of the program, our faculty associate coordinated three special topics seminars meant to contextualize online teaching around issues of development, management, and assessment. The first session, "Integrating Technology in Teaching and Learning: Perspectives and Problems," was co-presented by the faculty associate, an English professor who utilizes web-authoring tools in electronic writing classrooms, and another faculty member in communication studies who utilizes web-based communication technologies in large lecture classes, with each demonstrating their web-based course materials and communication forums. The workshop addressed the question of when and why to use technology in teaching, as well as how to develop online pedagogies that foster alternative learning formats. To facilitate interactive discussion of these questions, breakout sessions allowed faculty to brainstorm online pedagogical possibilities appropriate to their instructional formats and disciplinary content and to share their discussion with the larger group.

A second session, "Preparing for Online Learning: Course Management Possibilities," asked participants to consider what course materials they commonly utilize in teaching and which ones would be suitable for online distribution. Similar questions addressed the advantages and disadvantages of transferring communication strategies between teachers and students as well as among students themselves from a face-to-

face setting to an online forum. In addition to a hands-on opportunity to work collaboratively with faculty from a wide range of disciplines--Geography, Family and Consumer Sciences, Art–a team of course developers shared their experiences in planning and implementing a totally online philosophy course, first as a pilot course and ultimately as a successful multi-sectioned offering in the department.

Finally, a third session, "Evaluating Student Learning Online," addressed the ways in which various technologies available to teachers, from e-mail to the World Wide Web, can be used both as tools for student assessment and as forums for student self-assessment and course evaluation. Faculty presenters included a music professor who utilized online quizzes for the assessment of basic concepts and a technical communication professor who employed electronic portfolios of student work in a course on online documentation. Despite the differences in curricula and online assessment options, both faculty stressed the preparation required in developing and monitoring online assessment strategies and helped faculty to consider the ways in which students could participate in evaluating the success of their own online learning to aid in curriculum revision and general assessment options.

Rather than foster uncritical enthusiasm for online learning forums, however, these sessions encouraged faculty to question the relative contribution of technology to both curriculum and instruction. For instance, an education professor attending the workshop was skeptical about the role of online discussion forums in fostering dialogue. While the professor could see the benefits of online groups for larger, lecture-oriented courses, he already had a smaller class of thirty students for whom creating and managing face-to-face group activities seemed sufficient. A follow-up email the next day from this professor to the faculty associate co-presenting at the seminar revealed a more reflective stance, recognizing the benefits of online discussion for a summer course in which some aspects of the curriculum could function online as well as face to face. Instead of wholeheartedly embracing this online alternative, the professor expressed concern about the perception by others in his department, as well as his own students, that he wasn't teaching because the class would not always be meeting in the traditional face-to-face environment. Currently, our Center staff has worked with the faculty member in identifying technological options to match his pedagogical goals, maintaining both a face-to-face and an email dialogue for his questions and concerns. As this example demonstrates, the successful integration of technology into the curriculum requires support of the faculty member's academic labor by students, colleagues, and departmental and college administrators whose ideological values about teaching and learning may be steeped within a traditional, teacher-centered educational paradigm.

Individual Consulting and Technological Training

Our faculty associates consult with discipline-specific faculty to establish a sense of continuity between the technology/pedagogy workshops and the actual application to classroom practice. In these consultations, the faculty associate and a Coordinator for Instructional Development, both with shared expertise in technology and pedagogy, facilitate dialogue with faculty about what teaching and learning forums they currently employ; what technological forums are available to foster equally successful student learning opportunities; what preparation is required by faculty for effective utilization of online teaching environments; and what additional training, in the form of online tutorials and hands-on workshops, will assist the faculty member in the development process.

Despite the apparent benefits of this program, Barone and Luker (1999) remind us that "Tensions on campus run high as institutions of higher education face social and economic pressure that their cultural and value systems, embedded in traditional modes of instruction, do not accommodate" (p. 68). As a result of this pressure, faculty can sometimes be caught up in the *rush to technologize*, a situation in which the *whats* and *hows* of technology are more important than the *whys*. And because, as Barone and Luker further note, "The classroom lecture and its concomitant social relationships have been dominant forms in universities for centuries" (p. 68), faculty may initially have a more transparent view of technology. From this perspective, technology is simply another medium of the traditional mode of instructional delivery. This contrasts to a view that holds technology as potentially transformative educational media, the co-production of knowledge between teachers and students. Even for those faculty who hold this latter perspective, however, it is important to remember that simply to "add technology and stir" does not ensure a recipe for transformative educational practice. Techno-pedagogues such as Donna LeCourt (1998) stress the need to challenge links between transformative pedagogy and computer-mediated instruction that presume computers to be defacto tools of educational empowerment. In response to such concerns, we encourage faculty to plan their online course components in ways that allow for participatory learning. Examples of this might be the use of online forums for group projects, or online surveys to allow students to provide midterm feedback about a course.

In these consultations we also stress that integrating technology can and should be progressive, not requiring technological mastery on the part of faculty. The belief that that faculty must be masters of technology in order to teach with technology may discourage them from developing technological learning forums in the first place, fearful of the loss of their status as *experts*. For instance, in a study comparing writing instruction in traditional vs. computer-mediated environments, Palmquist et al. (1998), noted that "One of the most common concerns teachers express is that they will not know how to help students..." as well as concerns about "losing face in front of students" (p. 9). To aid in developing more technological knowledge, each consultation addresses the necessary skills-building process for a faculty member's successful integration of technology in the classroom. Skill-building can be both self-paced, where a faculty member can work with a student technology consultant, or involve workshop-oriented activities in which faculty attend sessions that provide hands-on training. Regardless of whether training is individual or group based, the faculty associate ensures that even within these skill-based sessions, technological training and pedagogical concerns continue to be co-equal. In the case of workshops, the faculty associate secures additional faculty participants who use technology in their teaching and who are invited to demonstrate various online materials within the workshops, sharing time with the instructional development coordinator who conducts the more skills-based training within these sessions.

Conclusion

Throughout the range of theoretical seminars, individual consulting, and hands-on workshops, our integrated model presumes the role of faculty, faculty associates, and instructional/technical designers as members of a creative development team. While Moore and Kearsley (1996) suggest that faculty scheduling demands may initially make them reluctant members of the team and limit their role as designers in terms of both willingness and expertise, our experience has been that the role of faculty in this process must be that of both instructor and co-designer in order for the technology-based course development process to be effective. In addition to providing the theoretical and practical training for such teamwork to occur, we also see the importance of Moore and Kearsley's call for technical and instructional design staff, including faculty associates, to themselves become knowledgeable about the criteria for effective technology-based learning. While some of this knowledge comes from formal courses and self-instruction, it must also stem from a willingness to listen and learn from faculty, administrators, and students across the disciplines. For members of our Center's staff, this knowledge-building has a direct impact on their professional development, for just as Owen Hicks (1999) suggests, those serving as consultants often attest to the improvements in their own instruction "that occur as a result of acting as advisers to colleagues" (p. 15).

Yet in order to support the integrated model we have described throughout this paper, we depend upon continued institutional and philosophical support for our Center's technology/pedagogy initiatives. For example, our English department is supporting our current faculty associate by working jointly to consider the possible impact of the this position not only on her individual teaching and scholarship but also on larger departmental initatives, including the development of online courses as well as grant-writing projects to fund such initiatives. In addition, our philosophy department granted a course release for one faculty member and provided a graduate assistant for another faculty member to develop web courses to meet the needs of student populations both within and outside the university. At the college level, our graduate college has recognized the importance of supporting faculty associate positions from a variety of disciplines. Thus they have allocated funds for three additional faculty associates for the upcoming year. Moreover, our Center has initiated regular dialogue among Deans to discuss the value and changing reward structures for both academic units and individual faculty attempting to integrate technology into instruction. This also includes adding two associate deans to the Center's advisory board to better involve them in the existing dialogue, a process that supports and reaffirms our mission. Without continued self-assessment of the recursive benefits to the faculty associate, the faculty development center, and the university, the model remains static, rather than a dynamic response to discipline-specific goals. Finally, without these varying levels of support from those administrative units providing the funding and those faculty and departments directly benefiting from our current and future technology/pedagogy initiatives, the model cannot succeed.

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Technology Use in Higher Education: A Faculty Development Model

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Abstract: Higher education faculties have been slow to integrate technology into their college courses. In a single small college, the logistics of providing the information professors might need about technology in their subject areas are daunting. The result is that the integration of technology into college courses is a haphazard process, fueled only by the enthusiasm and commitment of individual faculty members.
This presentation will present the planning process, structure and outcomes of a project to provide information about the possibilities of technology to faculty in specific disciplines in an eight-college consortium.

The Southeastern Pennsylvania Consortium for Higher Education (SEPCHE), a consortium of eight small colleges in and around Philadelphia obtained funding from a private foundation to educate their faculties on the use of technology (web resources and software) in their college teaching. The pilot program, which took place in January of 1999, consisted of two workshops, one for education faculty and one for science faculty, held simultaneously on two of the eight college campuses. Subsequently, funding was obtained from the same foundation to do six other workshops in January of 2000, also simultaneously, on the six other campuses. These workshops addressed the following topics: Psychology and Sociology; Art; Business, Mathematics and Economics; Nursing and Allied Health Professions; Philosophy, History and Theology; and Languages and Literature. One objective of the workshops was to educate college faculty about ways to integrate technology into their courses. A second objective was to create an opportunity for faculty members from the eight separate campuses to collaborate on an academic task. The overriding objective of the workshops was to improve the quality of the college education provided on each of the eight campuses. This paper presents a model for doing such faculty development, and describes the results when this model was used.

Needs assessment survey

The first step was to survey the faculties of all eight colleges, to find out what equipment they had, what use they made of it, and how technology was used in the courses taught at each college. The survey made it clear that most faculty members knew enough about word processing and other applications to use technology to do their own work – e.g., record-keeping, syllabus creation, desktop publishing. It was also clear that the lack of equipment and infrastructure (Internet connections in offices and classrooms) was a significant factor that kept faculty from making more extensive use of technology in their teaching.

The survey showed that teachers did not use technology in their classroom teaching. It was decided to design workshops in which teachers could become acquainted with websites and software for their

disciplines. We reasoned that browsing time was needed, in an environment where technical support was readily available. We also determined that a discussion of assignments and strategies for including technology in college courses would be helpful. This would be an opportunity for faculty members from all of the eight colleges in the consortium to get to know each other and to exchange information on the ways in which they each individually included technology in their courses.

Planning the workshops

Notifying faculty

We received the grant from the Barra Foundation, designed to pay two people to plan and conduct the workshop, 25 to attend, three to present software or Internet activities, and one to evaluate the workshop. We designated two people to plan and conduct the workshop so that the workload would be shared and so that the workshop would not be jeopardized should one person be unavailable (e.g., due to sickness or family emergency) We planned the workshops for the January intercession. We chose that time because everyone would be available to attend two days of workshop sessions, and it would be possible for professors to think about the classes they were planning to teach that spring, and make slight adjustments in their assignments.

In September, a notice was sent out to all education faculty members at all eight colleges, informing them of the dates of the workshop. Notices were also sent out to department chairs. In these notices, chairs were informed that they would be asked to choose three members of their departments to attend the workshop, and also to identify possible presenters.

By October 15, signup sheets had been mailed to all education department chairs, asking for the names, addresses, phone numbers (home and work), and social security numbers of workshop participants.

Gathering materials

During the fall of 1998, the directors of the education faculty workshop began collecting handouts to be used during the workshop. We found handouts that identified websites for specific topics (children's literature, instructional planning), as well as handouts on evaluating software and websites, and on using search engines.

Selecting evaluators

An evaluation team designed a evaluative survey to be administered during and after the workshop. Both quantitative data (a Likert scale questionnaire) and qualitative data (solicited comments on the questionnaire and unsolicited comments during and after the workshop) were collected and analyzed.

Conducting the workshops

The first two workshops took place on January 6 & 7, 1999. Twenty-four professors, representing all eight colleges, took part in the education workshop. On Wednesday the workshop was structured so that each participant had his or her own computer, thereby insuring that each person learned how to access websites and so forth. Even so, considerable collaboration took place almost immediately as members of the group showed each other what they had found or helped each other deal with problems. A technical expert was available to help deal with problems. On Wednesday, at the end of the day an evaluation form was distributed, and participants were reminded to bring a syllabus from one of their courses to the workshop on Thursday.

Presenters were volunteers from among the faculty participants. One demonstrated the use of a commercial website for setting up a webpage. A pair of presenters talked about educational software, some of which was available in the lab for preview. On Thursday morning, an assistant professor illustrated the use of a website to articulate a concept addressed in her Educational Psychology class. The workshop leader described the final task, which was to create an assignment that involved the use of web technology. Each participant was encouraged to work with another professor teaching a similar course at another college. By the end of Thursday afternoon, all the workshop participants had presented to the group

assignments they had designed for use in their college courses. All of these assignments involved the exploration and examination of web resources.

Evaluating the workshops

Quantitative evaluation

Evaluations were done at the end of each day, consisting of a questionnaire that participants filled in and signed (copies of the questionaire are available upon request from jkahn@mciu.org. In addition throughout the two days, individuals commented that they valued the time to explore websites and also the time to work with each other. They mentioned the quality of the handouts, and the wealth of valuable addresses and information they had received.

Statistical analysis of questionnaire data was conducted by the project evaluator, Robert Pred. Some observations about the data are offered here. Items 1-7 remained constant on both the Wednesday and Thursday questionnaire. Scores on all items improved on Thursday, which we understand to indicate an increase in the level of comfort and sense of competence of the participants. To enhance the reliability of assessment, Items 1-7 were summed to form two scale totals, one for each workshop day. The average scale score obtained from participants on the second workshop day was higher than the average scale score for the first workshop day. This increase was shown to be statistically significant using a repeated measures methodology. A paired samples t-test showed significant improvement ($p< .01$, t paired samples test = -3.359, df= 16, 2-tailed significance = .004) in the scale scores over the period of two sessions.

Items 8-10 on Day One addressed issues of incorporation, and the content in question was various websites, which participants had explored, perhaps for the first time, that day. They responded that they would not only be comfortable using websites in their teaching but overwhelmingly indicated that they would use websites and could see value in doing so. For example, over 95% of participants indicated "Strongly agree" when responding to the opinion expressed in Question #10 (I clearly see benefits to incorporating the use of the World Wide Web in developing my courses).

Items 8-10 on Day Two addressed issues of usage, but also asked professors to assess the value of the structure of the workshop and the value of the content of the workshop for their particular teaching situations. One hundred percent of respondents agreed with the statement in Question #8 (I was introduced to websites/software that I feel can be useful in my courses). In addition, over ninety percent of respondents agreed with Question #9 (Working in groups to learn new software with professors from other institutions was valuable). To Question #10 (I was able to design some valuable activities for my course(s) using the software), ninety-five percent indicated agreement.

It was also interesting to note that, when asked in what courses faculty members would use technology, all respondents named two or more courses (they were given four blank lines), although the assignment of the workshop had been to design an activity for just one course.

Qualitative evaluation

The qualitative evaluation reflects the enthusiasm that was apparent during the course of the workshop. Participants were involved in their activities, using the information that had been supplied to pursue their own interests. They also shared what they had found with colleagues from their own campuses as well as with new acquaintances who taught similar courses on other campuses. The energy level was high, conversations were animated, and handouts were accumulated and carefully consulted. Even frustrations when websites were not immediately available did not dampen spirits.

All participants designed activities for use in their courses and presented their activities willingly for the other participants. Many participants partnered with one or more colleagues from other colleges in order to complete this assignment, working together for the first time in most cases.

There was space on the bottom of the questionnaire for "additional comments about this workshop." Thirteen of twenty-two participants used that space and the comments were entirely positive (one person

asked for a juice break). We also asked participants if they would be willing to identify themselves so that we could conduct a brief follow-up survey. All participants contributed their names and phone numbers to a database, and seventeen professors indicated willingness to take part in a follow-up survey.

Participants' written comments identified several valuable components of the sessions. Faculty members identified the time to explore the World Wide Web by themselves as being valuable. It is our assessment that this time was made more productive because they had reference materials about search engines, Web addresses, and especially the support of an instructional support person who answered technical questions.

The chair of the education department at one college wrote:

> "Please accept my commendations for a well-planned workshop! The organization of topics, as well as the delivery methodology was appropriate for the neophyte as well as the seasoned Internet traveler. The handouts were valuable and will provide a vital resource when we implement the skill that we acquired. The individual help that you gave us was very much appreciated. Once again thanks for such a valuable program."

Another identified value of the workshop was the opportunity to work with colleagues from other campuses. A good example of this is the following comment,

> "This was an outstanding two days – the opportunity to explore technology applications and to network with other education faculty."

One participant wrote specifically about the value of meeting professors from consortium colleges with whom she could share expertise. This respondent chose to identify herself (as almost all respondents did) so we know that she was one of the presenters. She had demonstrated a sophisticated use of Web resources for the rest of the group. It would have been understandable if she had complained that she had not learned anything new, but in fact, she reported that she found the experience valuable in its collaborative aspect, and suggested a follow-up session.

> "Really good to meet others teaching similar courses at other colleges. I like this kind of workshop where we had time to interact with those who teach same subjects. I wish we could have another session in a few months in which we came with something we have accomplished in our class as a result of the work we did today, and share that with 1) our subject area colleagues and 2) all of the other professionals in this workshop."

The enthusiasm with which the workshop was generally received is illustrated by the following remark:

> "The two-day professional development sessions were very beneficial to me. Very practical and very appropriate! Great job!"

There were unsolicited notes and email messages from seven participants. Each of these comments was in a personal note addressed to the workshop leader indicating that they felt so positively about the experiences offered at the workshop that they took the time and effort to provide additional feedback.

One participant wrote,

> "I want to thank you for your preparation, your enthusiasm, and the valuable learning provided. Your work was a real and professional service."

Another participant wrote:

> "The workshop was great. In addition to previewing the Early Childhood Education software, I obtained some great articles and titles of texts that I can use for these new special education courses...We all seemed to enjoy the fellowship as well."

Still another participant indicated that she would use what she had learned immediately in her courses.

> "As a result of our workshop, I am revising my own syllabi in my language arts courses to integrate more projects and assignments using website resources."

In planning for the next six workshops, we kept in mind the lessons of the first two. It did not seem to matter that participants varied widely in the level of their experience and comfort with the technology. It did not seem to matter that they came from different campuses with different levels of technology available to them. What did matter for them was that they were provided with time, resources and structures that made it possible for them to explore and use what they found to improve their teaching. They perceived that their level of knowledge and comfort regarding this technology increased substantially over the course of the workshop. They also began to understand new ways to incorporate technology into their courses. Participants suggested possible topics for follow-up workshops and indicated their willingness to attend such workshops.

This model has several features that seem to be critical. These components are 1) the subject-specific nature of the workshops; 2) the pedagogical focus; 3) the balance of structure and exploration; and 4) the opportunity to collaborate. Each of these factors had something to do with the success of the first two workshops, and each has been built into the next six workshops. Faculty again are organized into groups with those who teach the same subjects at the other colleges, and technology resources specific to those subjects are being gathered for presentation. We again suggested that faculty members each bring a syllabus and design an activity, and we provided guidelines for structuring and assessing those activities. Within the two-day workshops, we again provided opportunities for exploration of websites as well as structured presentations and tasks to be completed and described. We encouraged faculty to work together on their assignment with their counterparts from other campuses, creating an opportunity for conversation and collaboration.

By any measure of success the first two workshops qualify. Assessment data from the next six workshops will be analyzed at presented at the SITE2000 meeting in San Diego, and will be available by email from jkahn@mciu.org. We had specified four outcomes for the workshops in our original proposal, and informed participants of these outcomes in a handout that read as follows:

The purpose of these workshops is to bring our faculties together to collaborate on the creation of web pages and to review software. Faculty will identify and assess web sites and software, and consider ways to integrate technology into their various college courses. If the pilot program is successful and additional funding is obtained, workshops for six other discipline groups will be scheduled on the six other campuses for the winter of 2000.

There will be four separate outcomes of this project.

1 *The creation of working relationships among the members of our separate faculties as they discuss their syllabi and assignments.*

2 *The creation of a nucleus of computer-using educators who can return to their individual campuses and serve as resources for other faculty members.*

3 *The creation of Web pages to provide faculty members with a lasting resource of their own invention.*

4 *The enrichment and improvement of education courses by the thoughtfully designed use of technology.*

It is clear from participants' comments that the first outcome was achieved. We have described the ways in which these working relationships evolved over the two-day period. We expect to find evidence that the second outcome has been achieved when we do follow-up surveys. Certainly during the initial two workshops our participants served as resources for each other, and we expect that they will stay in touch and maintain some level of interaction as they need to. We did create an Education faculty Web page, which can be found at http://www.chc.edu/sepche.htm/. This Web page identifies sites selected by participants and organizes them by topic (reading, mathematics, special education and so forth) as the participants suggested. Finally, we are certain that faculty members from each campus will be incorporating technology into their courses in ways that help them accomplish their instructional goals.

We began this project with the expectation that professors of the SEPCHE consortium would benefit from a workshop in which they had both sufficient time to explore Web and software resources and an extended opportunity to talk to each other about the courses they teach and the resources they use. Every indicator we have shows us that we were entirely justified in this expectation.

A Faculty of Education as a Community of Learners: Growing to Meet the Demands of Instruction and Technology

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Abstract: This paper explores one Faculty of Education's experience with Information Technology inservice workshops. Expert students knew the IT content and expert faculty worked with the expert students to 'deliver' the content to the faculty and to debrief and extend the discussion to appropriate classroom learning using IT. A Community of Learners model was used, along with cooperative learning and social interaction, to develop the faculty members' understanding of IT skills and curriculum appropriate use. Recommendations for other faculties embarking on a faculty IT journey are included.

Introduction

For several years our Faculty of Education has offered short workshops introducing faculty to new software and hardware so that we can learn to use the resources and their capabilities in our research and teaching. In the last couple of years, the World Wide Web and faster processors have meant that new developments and technologies have emerged at a very fast rate, and we who are teacher educators have had to devise new ways of working together so that our program is also developing rapidly in relation to technology and its many educational possibilities. At the University of Regina, our desire to learn about and with technology was in part initiated by the context in which we work: a provincial context where Directors of Education and others have told us that schools require new teachers to be competent in the instructional uses of technology, an institutional context that changes slowly (see Maeers, Browne & Cooper, 1997) and includes students with a wide range of technological skills and abilities, and a curriculum context where resource-based learning is central. Technology is considered an important resource for teaching because of the extensive electronic on-line curriculum -- located at http://www.sasked.gov.sk.ca (see Maeers, Browne, & Cooper, 1997, 1999, and Couros, SITE 2000).

Some teacher education programs in Canada have mandatory computers in education courses and some provinces require that for teacher certification purposes all students must take a computers in education course. Other countries (for example, USA) have national and/or state teacher accreditation standards for information technology. In the province of Saskatchewan we have no external technology

accreditation or graduation requirements, and this has freed the Faculty of Education to incorporate technology in ways where we see the best fit with curriculum and instruction.

Since we are well acquainted with our provincial and institutional context, some faculty members in curriculum and instruction areas have developed a vision of the technological path to follow. For example, the authors designed an action plan to be implemented over the four-year concurrent Bachelor of Education program (see Maeers, Browne, & Cooper, 1999). Also, we have had supportive administrators who have seen the necessity of funding technology innovations. Our vision and action plans are more focused on the integration of technology into the curriculum, and on developing the pedagogy that supports appropriate use of technology as a resource for learning. We understand that our plans will continually undergo regular revision as technology and contextual changes occur.

In assessing what to do, we realised we had the vision, the action plan, the hardware and software resources, an efficient state-of-the-art Internet and multi-media computer lab, and the curriculum experts. These curriculum experts, however, constituted a mostly middle-aged faculty who would have to ascend a steep learning curve in order to pursue any technology vision. We lacked the technological skills to use the resources that we had and lacked the time to think through and work out the pedagogical application of our newly acquired skills. We knew that acquisition of skill knowledge would be a relatively attainable goal with these experienced learners, and that, given an opportunity to experiment with the technology resources, curriculum appropriate educational applications would follow.

Well aware of the need to create a safe space where faculty could learn the skills in relation to particular applications, the authors envisioned offering workshops where faculty could learn the skills and then immediately discuss how to apply them to teacher education situations. These workshops would be education-oriented rather than skill-oriented. For example, e-mail has been taught on campus, but we wanted to discuss with our colleagues the teacher education and school applications of e-mail, such as e-pals, electronic mentoring, and ask an expert.. This teacher education focus was an important part of our workshop approach.

We used a community of learners approach to implement the faculty inservice (Rogoff, 1994). This approach is founded on a leadership which listens respectfully, takes people's problems seriously, promotes roles that are asymmetrical, and provides for a variety of learning styles and needs. This approach follows a tradition of collaboration and shared responsibility that is well established in areas of our faculty.

We debated who should teach the workshops and hiring a consultant was considered. We knew that such a person could teach the skills, but were less sure about their ability to make the connection to education and apply the skills in the specialised curriculum areas. We resurfaced the idea of having expert students teach faculty (in 1995 the authors had participated in a conference called New Frontiers for Education, a conference focused on technology in the classroom, where many conference sessions included school students as presenters). We were confident that technologically-skilled students (in this case Education students) could teach us the skills, but again, we had concerns about their ability to make the connections to education. In the latter option, we could see the benefit in discussing the educational connections together, while we learned the technological skills from them. As reciprocal mentors, we would work together on making the educational connections. Using Vygotsky's notion of social interaction and learning (Krauss, 1996), and the idea that what one can learn cooperatively today (from a more experienced learner) one can do alone tomorrow, we hoped that this pairing of students and faculty would provide both groups with the knowledge and attitudes to independently learn the skills and apply them in appropriate curricular ways.

We designed 12 workshop topics and implemented six of these in group workshop situations in the computer lab. We hired six technology advanced students and each student selected two workshop topics to research, create a handbook for, and work with us to develop a plan for how they would teach their topic to faculty. Workshop topics included: advanced word processing, advanced e-mail, advanced web searches, web page development, drawing/painting programs, multi-media authoring, spreadsheets and data bases, subject-specific software, presentation software, newsletter publication, distance education, and WebCT. The workshops were quite successful in drawing people out of their offices into the computer lab, in developing skills, and in the application of these skills to curriculum areas. The reasons for the success lie in how the faculty learned from the expert students and from each other, and in how faculty members were able to apply the learning in their courses.

The development and enactment of the faculty workshops has followed a process similar to other curriculum innovation projects in our faculty. The details of this process will be divided into three sections: developing a sense of a community of learners, understanding the necessity of invisible work, and refocusing on instruction—asking how could technology be used as an effective instructional tool?

A Community of Learners.

In Barbara Rogoff's (1994) explanation of a community of learners approach she describes the workings of an Arizona school based on this philosophy. From this experience she lists and describes several criteria for a community of learners approach. The community of learners model provided us with guiding ideas and tools for analysis as we came to understand our faculty's progress in learning about and with technology. Her criteria are italicised in the following text.

Some faculty members knew what they wanted to learn and others needed assistance in devising their learning goals. We wanted the workshops to be relevant to people's work and we wanted to *foster inherent interest.* One memo said "You may not know specifically what you want to learn, but you know that you would like to feel more comfortable either using the computer for yourself or using them in your classes. Please let us know if you would like someone to consult with you as to potential areas of learning." Twelve faculty members (out of a total 45) asked for individual consultations to help them decide what they wanted to learn, about twelve other faculty members listed what they wanted. We contacted those needing consultation people and helped them select, and compiled a list of everything that everyone wanted (resulting in the above 12 workshop topics). This compiled list was once again distributed to all faculty—those who had told us what they wanted requested more than they had initially stated. This list also helped some faculty who had not previously listed a topic now list one or more workshops they would like to attend. Initially 20% of faculty responded, but as lists were distributed and announcements of the individual 2-hour workshops were posted in the mailroom, 80% of the faculty attended at least one workshop, and 20% attended 3 or more. Interest and participation in the workshops evolved such that we had to offer multiple sessions of some workshops (e.g., web page design). Most of the workshops were scheduled for Saturday mornings.

The workshops were established on an invitation-to-participate basis. This meant that participation and products would vary according to participant ability and desire. No one end product was envisioned. A person might make one card of a Hyperstudio stack or 10 cards. People understood that they could come and listen, learn, and apply what they could without being evaluated.

The student experts prepared the workshop hand-outs and presented the material clearly. The authors attended all the sessions to support learning and to facilitate the discussion of educational and curriculum application. In this leadership situation *asymmetry of roles* was evident as the two types of experts, technology and pedagogy, conversed and learned from each other.

These were productive sessions as workshop participants, who understood the tremendous gains they could make, discussed the relevance and possibilities of technology as it related to teaching and research. People supported each other's learning, talking in dyads and group discussion, *acting as facilitators for the learning of others*. Student experts saw faculty supporting each other and worked with us similarly. It was a *cooperative system* with faculty members learning skills from students, and skilled student experts learning about pedagogy with the help of faculty. There was *continuous learning for all who were and are involved* as we devised and revised ways of teaching and researching with technology.

In this way people who might have seen themselves as on the periphery could attend a session, learn what they wanted to as *legitimate peripheral participants* (Lave and Wenger, 1991) then become part of the mainstream of technology learning.

There were a few signs of *culture shock*, for example, when a person expressed discomfort when one workshop was paced too fast for her sense of success. The biggest shock was during one session where faculty needed to get a particular access password in advance in order to log on to the computer lab network. Participants were told to go to the lab before the workshop to get a password. When we arrived at the workshop only one had obtained the needed password and could sign on to the system. Others had assumed that because they could log on in their office they would be able to do likewise in the lab. Most of that session was spent obtaining passwords, learning how to sign on, and accessing the lab network. It

was a vivid learning experience for everyone, somewhat frustrating, but a realistic example of what might occur when students are in the lab for the first time.

People need time to adjust to a new milieu. In the case where the attendee felt that it was too fast, one-on-one time was scheduled with one of the student experts to review the material at a more suitable pace. In the case of the workshop that was spent assigning passwords and accessing the network, the discussion focused on coping with and working through frustration and anxiety related to technology and how teachers adjust when equipment or procedures are not as they had planned. This illustrates *the instructional focus on process rather than products* of learning.

Returning to the notion of *acting as facilitators for the learning,* the three authors have further categorized (and sometimes caricatured) our roles within the faculty group. We each teach in a curriculum area and want to integrate technology into our work and the work of our students in a seamless and appropriate way. We bring complementary strengths to the process. Vi is the knowledgeable, listening, and enthusiastic leader and planner, Nancy is the supportive administrator (without a budget), Liz is often in the role of clown, adding lightness with humour when there was tension, asking hard and sometimes embarrassing questions. Vi asks, "What is the pedagogical foundation for this? Would something else work as well or better?" Nancy keeps things moving, saying, "I know how to get this started." Liz asks "Who benefits from this? Who is excluded? Which children might be disadvantaged

In addition to Rogoff's criteria we have identified what we call a "useful confusion" which supported our building a community of learners in a faculty of education. This useful confusion tolerates and validates a variety of definitions of expertise, a willingness to organize a wide range of learning experiences, including new ones where needed, and a willingness by those with great expertise to let those with less assume leadership functions where necessary. The useful confusion enhances our ability to work together co-operatively. However, as Rogoff suggests, *cooperative learning* does not imply smooth relationships; there are sometimes frustrations and in our case anger, when student experts could not get the access to memory and machines that were needed to prepare the workshops.

Invisible Work

We also were informed by past research which describes the "invisible work" of teacher education (Kapuscinski, Cooper, Krentz, Goulet, & Browne, 1997). Invisible work is the work which must be done to maintain a teacher education program and to ensure that it continues to develop. Invisible work includes conversation, collaboration, critique, and creativity. It is work which seldom receives visible recognition and so is not rewarded within the academic reward system.. It may even bring criticism because it takes time which might be spent doing activities which are better rewarded.

In the case of this project, none of the initiators have faculty inservice or technology education as part of their job description. We teach curriculum and foundations. We volunteered to do this together when we understood the need in light of our provincial and institutional context. Organising the technology workshops, talking to faculty about attending sessions, hiring the students, planning the workshop content and schedule were all aspects of added (invisible) responsibility. Added to this was the necessity of attending the workshops to give support to learning, solving problems as they arose and facilitating the discussion on pedagogy. It was very time consuming. Many of the workshops were on Saturday mornings because of conflicting schedules Monday to Friday. For these sessions we would serve home-made muffins and coffee. We wanted to instil a sense of community in tangible as well as interpersonal ways—a community of people who gather as friends will usually serve coffee and home-made baking. Food contributed to the sociocultural comfort of the sessions. This invisible work was important to carrying out the sessions and to creating the sense of community of learners around this challenging topic.

The technology workshop also involved invisible work as the authors mediated between their vision and the realities of where individual faculty members were in terms of technology knowledge. Much of what takes place in pursuing the vision is conversation, that is voice. We participated in countless conversations planning, clarifying, re-reading, scheduling and so on. These are necessary parts

of a successful program, but they are often invisible to the dominant reward system. We continue to do them because they make us more effective.

A Focus on Instruction

How to Use Technology Effectively

We have come to understand how important it is to focus on instruction rather than on technology when doing faculty inservice. Initially, this may seem strange, it is certainly counter-intuitive. However, faculty do not want to learn technology skills for its own sake, they want to learn them to teach better, to teach student teachers to teach better, to communicate with colleagues and students, to do research more effectively, and to present projects and findings more effectively. Technology tools are highly sophisticated and what is suited to one situation may well be unsuited in another. The ongoing discussion around potential uses and what else might work better, kept the conversation changing focus between the specific skill being learned and application in various teaching and research situations. We determined that if we were going to use technology it was not because it existed, but rather because it was a superior tool to the ones we already had, or that we could see the possibility of doing something better with technology than without it.

We were also working to determine what aspects of a particular application might enable faculty members to apply and integrate technology in new ways of teaching and learning. Technology can be used in a direct teaching mode to enhance that teaching style, it can also enhance the teaching style of instructors teaching according to constructivist learning theory, and most important for our context, technology can be a catalyst in transforming an instructor's teaching style from objectivist to constructivist (see Fulton, Couros and Maeers, SITE 2000 for more information about teaching styles and technology use).

Technology Anxiety and a Variety of Teaching Approaches

The workshop organisers were not worried about the ability of the faculty to learn new technology skills. As experienced learners, faculty members are accustomed to learning. They have sophisticated strategies for learning new skills and connecting them with previous ideas and knowledge. We realized that some faculty members might be anxious about embarking on this personal technology journey because the content was outside their area of comfort. Shiela Tobias (1978) faced this same 'problem' when she worked with content area anxiety. She took experienced adult learners in one field (e.g., English) and put them into a completely novel situation (e.g., physics) and observed them exhibit the same characteristics of anxiety that physics specialists have in a new environment for them. She then worked with this anxiety and turned it into strength by using effective teaching strategies.

The authors worked with the student experts to develop a variety of approaches to the new content and ideas to be presented. A workshop would usually begin with an overview of the learning goals using presentation software. Thus, the participants saw how to use technology as a *tool* to present ideas *about* technology. The workshops included photocopied handouts with space to write personal notes. These handouts contained visual images of exactly what they would see on the computer screen. There were frequent short periods of intense hands-on activity interspersed with debriefing sessions for questions, problems, and extension ideas. Throughout the workshops it was considered essential that the participants see technology being used in effective ways in presentations and in the hands-on activities. We anticipated that this modeling of effective uses of technology would enable the participants to consider effective ways they could use technology.

Looking back, we see that the authors chose a diffuse model of knowledge production in providing this inservice. While this could have led to problems which accompany invisibility in the corporate structure, it also provided the possibility of instructional and political strength when the inservice was successful and felt comfortable to the faculty who were learning.

Recommendations

For others wanting to do faculty inservice around technology and WWW resources, we would recommend considering the following:

- Invite faculty to participate.
- Offer individual consultation with anyone unsure of what they want to know about IT.
- Circulate a questionnaire to gather data about what is wanted and needed. This also provides data which might be needed to gain funding from administrators.
- Keep the learning relaxed; recognise that each person has a unique technology learning path.
- Emphasise the focus on IT for curriculum purposes—to enhance teaching and learning with and through technology.
- Plan short workshops to teach some basic IT skills and discuss some appropriate ways to use technology.
- Provide a variety of teaching approaches in the workshops to enable faculty members to see many uses of technology. Provide opportunities for debriefing of questions and problems and also for discussion on how to use technology appropriately in the classroom.
- Ensure that everyone receives a handout summarising the content.
- Offer one-on-one assistance following the workshop.
- Hire students to teach faculty. They are an inexpensive and a creative alternative to hiring consultants. At a reasonable hourly rate, students might spend a couple of hours working with each faculty member to assist in designing a web site for a particular course or searching the web for sites suitable to particular curriculum topics.
- Muffins—treat your colleagues as you would your best friends—especially if they're coming out on a Saturday morning to learn new content.

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Faculty Development: From Computer Skills to Technology Integration

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Abstract: Faculty development serves as an important precursor to technology integration. There are several strategies that have proven successful in effecting changes in the use of technology. One strategy is mentoring or one-on-one tutoring. A technology mentorship program was designed to provide staff development for the teacher education faculty of a small liberal arts college. The program uses elementary and secondary education majors who are not specialists in educational technology to assist faculty with technology skills. The program is directed by the educational technology specialist and a regular faculty member. The model consists of four major stages: large group planning sessions, small group technical sessions, one-on-one mentoring sessions, and a final large group session for sharing projects designed and implemented. Faculty that have chosen to participate in the technology program decided on a specific technology integration project to implement in their classes this semester.

Introduction

Preparing teachers to use technology is a major area of concern for teacher education. If preservice teacher education is to make a difference in how teachers use technology then teacher educators must model effective technology use.

According to the Office of Technology Assessment (OTA) report *Teachers and Technology* (1995) too few faculty are modeling instructional methods that integrate computer technology into teacher education courses. As indicated by Ingram (1994), the missing ingredient is a college and university teacher education faculty that is sufficiently technologically literate to accomplish these goals. In a recent national survey of teacher education institutions, the best predictor of graduates' use of technology in the classroom was the actual use of technology during college training (Moursund, 1999). Although many schools reported a formal, stand-alone course in educational technology as a notable feature of their program, this design did not correlate well with technology skills and the ability to integrate technology into teaching. On the basis of these findings the report suggested that educational technology instruction should be integrated into methods courses rather than being limited to a stand-alone course.

Before faculty can model technology integration they must have the necessary technical skills. Faculty development serves as an important precursor to technology integration. There are several strategies that have proven successful in effecting changes in the use of technology. One strategy is mentoring or one-on-one tutoring. It has been used as a part of on going faculty development in both k-12 and higher educational settings.

Both Iowa State University (Thompson, Hanse, & Reinhart, 1996) and George Mason University (Sprague, Kopfman, & Dorsey, 1998) offer graduate courses in which instructional technology students mentor teacher education faculty in order to help the faculty members integrate technology into their teaching. Faculty in both programs report that the one-on-one approach was very effective in helping them increase their use of technology. Both projects began with a determination of faculty learning needs and goals, followed by one-on-one mentoring sessions with the graduate student and a faculty member. Thompson, Hansen, & Reinhart (1996) report the project forced the participants to devote time to learning technology. As a result of this required time the participating faculty members felt they made steady progress. Another strength of this project was the opportunity for the graduate students to address the specific needs of the faculty. In addition, Sprague, Kopfman & Dorsey (1998) report that participating faculty members enjoyed working one-on-one on their own computer where they felt more comfortable. The participating faculty members at George Mason University also reported that they felt they had made considerable progress in developing their technical skills.

On the basis of these models a technology mentorship program was designed to provide staff development for the teacher education faculty of a small liberal arts college (Milligan & Robinson, 1998). Unlike the Iowa State and George Mason University mentoring programs, this program used elementary and secondary education majors who were not specialists in educational technology. The program was directed by the educational technology specialist and a regular faculty member. Key elements of the technology mentorship program included one-on-one relationships between faculty and staff, the training of student mentors in mentoring techniques, communication with the program director in the form of meetings and e-mail journals, and a formal commitment for both faculty and students.

Model Description

The ISTE standards for preservice teachers were used to gauge the progress of faculty that participated in the original program. These standards include goals in three major areas: basic knowledge of computer operations and concepts, personal and professional use of technology, and integration of technology in instruction. During the first two years of the technology mentorship program the faculty developed skills in the first two areas of these goals. At the present time the technology mentorship program has been revised to focus on the third major area of the ISTE goals: integration of technology into instruction.

The new model consists of four major stages: large group planning sessions, small group technical sessions, one-on-one mentoring sessions, and a final large group session for sharing projects designed and implemented.

The key elements of the new mentorship program are similar to the previous model. As before, the one-on-one mentoring relationship is the primary feature of the model. In addition there are formal commitments for both faculty and students. Faculty commitments include time spent with mentors as well as time spent working on skills and projects between sessions, sharing their projects with other faculty, and participating in an evaluative interview at the end of the semester. For the students the formal commitment is in the form of a one-hour course. Course requirements include planning and implementing large and small group sessions. This will be part of the 35 hours of participation required. Other hours will be spent preparing for, and meeting in, one-on-one sessions with the faculty, developing their own technology skills, and attending mentor meetings throughout the semester. Mentors will provide updates between meetings through e-mail journals Description of the four stages of the model follows.

Large Group Planning Sessions

There were three large group planning sessions. The program directors led the first session with an overview of the way technology has been used in instruction in the past, and a description of the new technology mentorship model. Emphasis was placed on the relationship between pedagogical beliefs and practices, and technology. The following ideas were presented for faculty consideration. Teaching with technology means we must think about both pedagogy and technical skills. Historically, technology has been used as a way to deliver instruction, as an aid to teaching, to enhance what the teacher is doing already. However, we propose another way to use technology, as it is used everyday in society, as a tool. We can use technology as a tool to challenge our beliefs about teaching and learning. Do we deliver information to students or help our students construct knowledge? Do we tell students what to do or do we facilitate their own ways of working and learning? It is time to make a decision about the way in which you will use technology in your teaching: to enhance what you already do, or to challenge you to do something different? As you focus on your pedagogical beliefs and goals you will develop the technical skills to support them.

The student mentors were the leaders of the second session because the primary purpose of that session was to inform the faculty of the abilities of their students. The mentors presented their own projects from the educational technology class that all education majors are required to take and from other educational technology courses and experiences. One technology mentor shared her web-based instruction on file management that she had created as a technology mentor during a previous semester. Others presented activities and lessons using spreadsheets, databases, HyperStudio, and PowerPoint. They also shared the departmental web page and the syllabus from the educational technology class, focusing on Internet sites for professional resources and organizations.

The final session focused on what other programs and institutions are doing to integrate technology into teaching. In addition to the review of the literature discussed earlier in this article, the project directors shared specific ideas from a variety of educational disciplines, including student assignments as well as faculty presentations. After this session, faculty were asked to consider a single course in which they wanted to

integrate technology. Planning sheets were provided to assist them in deciding what integration projects might be possible for them. The planning document included questions regarding the course in which they would use technology, ideas for use in instruction, ideas for use in student assignments, the software or technology they might use, and any additional needs they would have to implement their project. Faculty that chose to participate in the technology program decided on a specific technology integration project to undertake this semester.

Small Group Sessions

On the basis of the planning documents that were turned in by the faculty, three small groups were formed. The mentors led sessions for each small group. One mentor developed a session on using Netscape Composer, one mentor led two sessions on Internet searching skills, and another mentor worked with the faculty who wanted to learn PowerPoint.

Mentoring

Following the small group sessions, the mentors began working individually with faculty on their projects. Three faculty have chosen to develop web pages and put course syllabi and other teaching materials online. Three other faculty members have chosen to work with PowerPoint and develop electronic presentations for their courses. One faculty member has decided to learn about moderating listservs and will set up a listserv for a regional professional organization.

Project Sharing

We are currently planning the process by which faculty members will share their project with the department. This may be in a large group session or via special web pages. Evaluation of the program will be conducted using student journals, program director journals, and faculty and student interviews.

Conclusions

As you will see in the words of the students, they have started the program with enthusiasm. "We have some great opportunities in front of us. I am very excited about this." They are already experiencing the benefits of sharing knowledge and learning about teaching. "I was extremely nervous about this presentation. I couldn't sleep the night before. It was the most nervous, I have ever been, but then it was the least. It's hard to explain – I think the fact that because I'm so comfortable with using technology helped me get through this presentation. I realized that I was there to provide information of which the faculty didn't have knowledge. That gave me a confidence I don't think I've ever experienced before." Most importantly students and faculty are building

relationships from which they all will grow. "The part most beneficial to me is the relationships that are forming. In that area I am very pleased and learning a great deal. I knew that I was gong to enjoy doing this, but it has gone beyond my expectations. That is very good." Professional development is ongoing, and it is going on here with this mentorship program to integrate technology into instruction.

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TECHNOLOGY MENTORSHIPS IN HIGHER EDUCATION: AN OPTIMAL MATCH FOR EXPANDING EDUCATIONAL COMPUTING SKILLS

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Abstract: Mentoring relationships to invite higher education faculty to learn educational computing skills on a one-to-one basis are an "optimal match". An optimal match involves a carefully constructed personal learning experience accommodating the inevitable differences in learning. An appropriate match builds connection with the circumstances that learners encounter and the schemata that they assimilate into their professional repertoire. Faculty technology mentorships build trust between participating individuals in order to implement new skills in non-threatening, meaningful ways to build personal knowledge and skills, to integrate new learning in a professional context, and to reflect on the learning process. Results from a specific technology mentoring experience are described in this paper including the perspective of both the mentor and the mentee.

Lack of University Education Faculty Leadership in Technology

An inadequate number of teacher education programs have faculty who are modeling instructional methods that integrate computer technology (Handler & Marshall, 1992; Office of Technology Assessment, 1995). Teacher training programs must recognize the need for training in technology, taught either in a specific class or across the curriculum. While scholars have advocated integrating technology in both methods and foundation courses (Berger & Carlson, 1988; Billings & Moursund, 1988; Bitter & Yohe, 1989) coursework needs to be redesigned to integrate technology in in relevant contexts. Computer technology should facilitate content learning from carefully designed course goals and objectives which, then, can be developed using appropriate technology-based activities and practices (Todd, 1993).

New teachers learn to teach the curriculum using the technology they have already learned or have seen modeled in their college classrooms. Without faculty role models to observe in methods courses, preservice teachers are deprived of opportunities to witness models for teaching with computers (Bruder, 1989; Fulton, 1989, Beisser, et. al., 1997). According to Wetzel (1993), most college professors simply do not use it, in spite of adopted competencies that education majors should learn how to use computer productivity tools for effective instruction, and how to demonstrate those abilities.

The International Society for Technology in Education (ISTE) and the National Council for Accreditation for Teachers (NCATE) have established Foundation Standards requiring competencies to use and to evaluate computers and related technologies. Learners must operate software, multimedia and hypermedia, and telecommunications to support instruction. They must demonstrate skills in productivity tools for personal and professional use, understand equity, ethical, legal, and human issues related to technology; and stay current in educational applications of computers and related technologies. Despite ISTE/NCATE Standards first initiated in 1991, many universities have not adhered to these guidelines nor have they taken leadership role in this movement (Wilson, 1995).

This poor response to technology may be influenced by the fact that many college of education faculty, themselves, lack requisite skills or experience to model teaching techniques using computers in their areas of expertise. Therefore, it is necessary for them to receive personal assistance in learning how to use computers, as well as implementation of computer technology in their respective courses. Using graduate students to mentor college of education faculty has been shown to be an effective technique for integrating technology into the course work of preservice teachers (Brewer, 1995; DeWert & Cory, 1996; Thompson, Hanson, & Reinhart, 1996; Thompson & Schmidt, 1994; Zachariades, Jensen, & Thompson, 1995; Zachariades & Roberts, 1995, Beisser, Kurth, & Reinhart, 1997).

Background

A technology mentorship program developed at Iowa State University involves a one-to-one experience inviting faculty members to work with graduate student mentors as part of a long term department effort to improve faculty competencies and confidence (Thompson & Schmidt, 1994). Although mentorships last one semester, educators need much more time to fully implement goals and objectives using technology in the instructional process. Experienced computer-using teachers require five to six years to develop a framework for effective use of technology in teaching (Sheingold & Hadley, 1990). The paired mentoring experiences helps university faculty to learn and reinforce skills. University faculty members who volunteer for this semester-long experience are encouraged to introduce technology into their respective courses in a meaningful context.

A mentorship match begins with pairs of students and faculty assigned to work together. The mentorship involves weekly meetings and an established agenda. Crucial to the task, is the successful pairing of individuals willing interact regularly in order to develop technology skills and experiences in teacher education. Pairing should be an "optimal match" (Hunt, 1961), whereby both mentor and mentee are willing to engage in carefully constructed personal learning experiences reflecting the inevitable substantial differences in rates of learning. The appropriate technology-driven circumstances encountered by the mentee and mentor should match the schemata of the faculty member. The experiences assimilated into their professional repertoire must build trust between the two individuals in order to implement new technology skills in a non-threatening, meaningful way. The goal of the mentorship is to provide personal knowledge and skills, to integrate new learning in a professional context, and to reflect on the learning process.

Key Factors in an Developing an Optimal Match

Learning is a sequential, developmental process. The development of skills, understanding in domains of knowledge, and strategies for solving problems are acquired gradually in sequences that are more or less predictable (Hilgard & Bower, 1974). Effective teaching involves a sensitive assessment of the individual's status in the learning process, as well as a presentation of problems that slightly exceed the level already mastered. Tasks must be neither too-easy nor too-difficult to understand. Hunt (1961) describes this as the "problem of the match" which is based on the principle that learning occurs only when there is "an appropriate match between the circumstances that the learner encounters and the schemata already assimilated into his repertoire." In other words, "teaching must start where the learner is (Hunt, 1961, p. 268)." The pace of educational programs must be adapted to the capacities and knowledge of individuals (Robinson, 1983). Mentorships provide an opportunity for starting with the learner's experience and for progressing to exceedingly higher levels of complexity.

Elements of "joy" must be a part of an optimal learning match. Engaging, collaborative, complex, intellectually invigorating learning situations reflect elements of joy in order to sustain efforts (Csikszentmihalyi, 1990). Mentorships allow learners to confront tasks they need and want to complete together. A successful mentor pair must concentrate on mutually-determined regularly scheduled activities. The pair may establish clear goals for the tasks before and during each mentorship session or may freely explore ideas that emerge into an agenda. The intimacy of a private mentor learning experience allows immediate feedback through internalized criteria, trial and error, or explicit responses. They act with a deep yet effortless involvement, removing awareness of other worries and frustrations of everyday life. Both members exercise a sense of control over their actions. The concern for the self disappears, yet paradoxically, each member experiences a stronger emerging sense of self after the experience is over. For example, a scheduled hour of time seems to pass by in minutes (Csikszentmihalyi, 1990).

Mentorships, as an optimal match, account for the needs of the learner. Such a mentoring pairing program may facilitate the development of basic technological competencies, implementation of technology in college course goals and objectives, and reflection of the mentoring process. However, the success of any mentoring relationship is dependent upon several key factors. A successful mentor relationship is dependent upon a developmental, multidimensional relationship (Clemson, 1987). "Spontaneity and personal fit" invites mutual choice for mentor pairs to work together (Clemson, 1987, p. 86). Both participants in a mentoring program should have the freedom to choose one another. Both the mentor and protégé should benefit from the relationship (Clemson, 1985). Mutual respect and trust (MacArthur, et. al., 1995; Clemson, 1987) and mutual participation (Kay, 1990) are key factors. Open dialogue between mentor and protégé allow each participant to express their feelings, talents, knowledge and expectations (Gehrke, 1988). The more success factors present in a mentoring relationship, the more beneficial the relationship will be to each of the participants.

The Mentorship Experience

Carol M., an Iowa State University reading language arts instructor, volunteered for the semester mentoring experience. Her background included no formal training in technology, little experience using computers in personal or professional work, therefore utilizing the computer primarily as a word-processing tool. Her college teaching experiences included work in a small private college without much technical support or encouragement for using technology in teacher education. At a Midwestern public university she now has exposure to skilled faculty peers and eagerly sought a mentorship experience during her first semester. The following excerpts were from reflective journals maintained throughout the semester.

The Mentee's Perspective: Building Personal Knowledge and Skills

"On the first day, we made sure my e mail was operating and set up my e mail address book. I made a file folder called 'Sally' for communication with my mentor. We labeled [Eudora Pro 3.1.1®] icons and changed them to labeled words. We switched them from the horizontal to vertical and reduced the size to be more accessible and practical. I also learned what they meant. Some I had known before this, but not all. I wanted all of my college classes to be on e-mail. I didn't know how to do that. I was thrilled today when I was able to send all my class an e mail without highlighting each name separately. Sally had left a great message that enabled me to highlight by holding down the shift key. Hurrah!

We started Power Point®. My assignment for next time was to do several slides that I could actually use in class. Sally said she would show me how to "take them on the road" electronically. I am excited about this new aspect of computer technology application!

I felt very good as yesterday I accessed Power Point and started a presentation. I used the automatic method but still have a number of questions such as: How do I get to see what I've done? How do I change backgrounds? I am anxious meet with Sally today! I was very excited today when I was able to figure out how to add slides, pictures and text to those slides in Power Point®. I changed my printer port to a new printer, conveniently located in our office, and it worked! Sally left great instructions on how to do that. She also left me a message on how to access my class list and send a group e mail.

So funny! Today I couldn't even remember what the shift key was called! The brain functions differently under pressure, especially when you feel inadequate about the content area - it doesn't work even with things that you know! When I struggled for the word, Sally whispered the word "shift key" to me. This was real HELP!

I am now up and running with e mail to my classes. I have sent several whole class messages and a number of students are corresponding urgent needs via e mail that could not have been taken care of otherwise. (This is using the media as it is intended - I love it! Real individualized attention too).

Next I learned about borders and shading, finding files, labeling disks, justification, alignment, and page preview. We started on templates, but will finish next time. Between now and then I will make sure I have the format just right for what I want made into a template. I usually hand out a paper to be filled in and handed back. Using a template will save paper and time. I will ask that the students access it and return the completed assignment through e mail. No paper should be used . I will tinker with what I learned today.

My computer monitor quit today. After I had tried to re-start it, I asked my office mate for help. She couldn't diagnose the problem, so we called Lance, the technical specialist. Meantime she taught me the "paper clip trick," a "trick of the trade" to get my disk out of the computer. She bent a paper clip and inserted the straight end into the small hole just beneath the disk hole. The disk jumped right out! Hurrah! Lance responded within 15 minutes to my phone message. He determined that my monitor had died. He said not to worry as it was an old one and it happens. He went right down and got me another one and it was up and running immediately. What service! I was so relieved that I had not 'killed it.' Such thoughts promote computer phobia!"

Integrating new learning in a professional context

"Today was 'D' day because I decided to use Power Point in class. It was my first time using it to produce and present a lesson. In a relatively "safe" environment, I was able to think on my feet, process the steps to hook up the technology, and take it down while I was lecturing and interacting with my students. It went very well and I was amazed that I actually could do all of that at the same time.

I checked out the LCD panel, took the laptop, and went out into the real world ALONE! I went to my empty classroom before class and carefully set up everything by myself. I let the class know that this felt similar to their reading/language arts practicum. I, too, had butterflies and fear that things might not work. They asked me to

go back to one of the slides and I never had done that before, so I just pushed the back arrow and it worked! Yes! Problem solving is always a big deal when under pressure. I honestly felt that I could have used regular overheads with the same effect without all the hassle of toting heavy, very expensive equipment in a room so dark.

Fun time with Sally! I was able to make my Power Point scroll or change slides using various styles and rates. It was so simple and I think it really improves the presentation by making it a bit unpredictable (nobody goes to sleep). I will enjoy trying it in my class. I was reminded how to get rid of files, folders etc.

I also learned about a program called 'Inspiration®'. I am so excited about it as it goes right along with webbing and mapping that I am doing in my classes. It is a real graphic organizer that will certainly help us with our work. Once I am familiar with it and feel "safe" I will reserve a computer lab to show my students. I accessed theme units through the Internet search engine Alta Vista. I printed several pages and made overheads of them so that I could show my two classes what was already done on themes. For beginners it would help to have such an organizer. Some students already were very literate about this [Alta Vista], but most were not and were encouraged and thought it helpful.

What a riot! Neither Sally or I could find how to shut off my computer. Even after we called the computer guru's office they only could say, pull the plug! I had to get on my stomach on the floor to get at the plug. I like Sally's ability to say 'I don't know' and then seek to find a way or ask someone."

Reflecting on the learning process

"I decided today that there wasn't as much carry-over into the real world of useable technology as I'd hoped. I was beginning to feel frustrated again. I am going to keep a little notebook next to me when Sally is teaching me, so that I can write down exactly what steps were taken to produce the needed effect/product/site, date them and then try the steps when Sally isn't there.

I have concentrated on the goal of learning IN MY WAY. I learn best visually, then write ideas down and try it from my notes. Under pressure I really "down-shift." It takes me MUCH longer to learn (if I really ever do!). Most of the time I just muddle my way through it and then finally somehow get an end result, but have no idea how to replicate it. I am always just glad to be done and not to have looked like an absolute fool."

Reflections of the computer technology mentorship

"I am not intimidated by the computer any more. I no longer feel I might ruin the computer, nor am I afraid I will break something. I was worried I would display my ignorance to humanity. I felt the consequences of not knowing were great...especially in the eyes of others--I felt I was losing information in the fast-growing educational technology field at an alarming rate. The mentorship provided instruction and interpretation in a meaningful way. This mentorship helped to bridge the gap. The mentorship was a match for my learning style. I was able to take risks and pursue new ideas. This is very important. Sally was able to adapt to my learning style and make technology important to me. In the absence of threat, I was able to reduce to a low level of stress and engage in new learning that was of benefit to my teaching immediately!

The purpose of a mentorship is to scaffold-to build meaningful experience (Vygotsky, 1933). I liked Sally's role as mentor. She operated under, ' I'll be there for you...Your level of progress is your own. Your rate of learning is OK...I have no expectations for you!'

I needed new skills in small increments. I needed time to process those skills. I needed hands-on experiences. I don't do well with "tell me." I'll lose it otherwise. The regularly scheduled weekly hour was perfect. I knew this was my time to ask questions, to bring my concerns to Sally. It didn't encroach on faculty time. We agreed on "our time" together. There was a starting and ending time. This was a safe environment.

In summary, I've learned that just a little information to open up a vista of opportunities. There was so much I didn't know. It has been a great rapport builder with my students! They have thanked me for the personal attention I have learned the power of Power Point®. I imagined uses and can now explore new uses for meaningful, interactive presentations in class. It added 'class' to my presentations. It has given me vocabulary and new language. Knowledge is power! You hear so many computer terms thrown around...file, folder, attachments, disk, server, upload, download, etc. I can not only name but now use technology terms. I learned in privacy, not in a class or a workshop. We had a chance to talk and to relate this to my personal and professional needs."

The Mentor's Perspective: Building Personal Knowledge and Skills

"Our mentorship began by establishing 'spontaneity and personal fit.' This was a mutual choice for us to work together as mentor pairs (Clemson, 1987). I provided Carol with the freedom to ask any question, figure things out on her own, and establish new skills with technology in her teaching and communication.

Indeed, she has learned new skills in technology. In summary, she has learned specific functions of e mail, word processing programs, files and folders, and management of information on disks and the hard drive. She learned about Power Point® software within the context of presenting content, not as a substitute for overhead transparencies. She practiced using a laptop and LCD panel to present her program to various audiences.

Using Inspiration 4.0® software for brainstorming, she increased the skillfulness of her students using graphic organizers. She searched the Internet for information, bookmarked valuable websites, ordered books from http://www. amazon.com, and learned about technical terms. She was introduced to Hyperstudio® as an authoring tool and has not only begun to experiment with it, but has a useful purpose to create a stack of book sharing slides from each of her students. Last but not least, she learned how to turn off her computer by crawling under her desk.

Clearly, her reflective journaling describes not just what she learned, but the ways in which she learned. I see that she is figuring out solutions to problems on her own."

Integrating new learning in a professional context

"In the process of learning new skills, Carol acknowledged that autonomy and self-reliance were powerful learning tools. Her journaling gradually progressed from episodes of needing help, asking for assistance, and calling the department experts to making attempts to solve problems herself. She began using more specific technology vocabulary and credited herself with learning and using skills.

An "optimal match" is based on the principle that learning occurs when there is an appropriate match between the circumstances that the learner encounters and the schemata already assimilated into his repertoire (Hunt, 1961). Beginning with conversations about her experiences and needs in using computer technology in teaching and learning, we began with her level of interest and progressed gradually to exceedingly higher levels of complexity. The pace of Carol's technology mentorship was adapted to her capacity and knowledge. (Robinson, 1983).

Carol did not learn skills in isolation. To learn Power Point®, she compared Vygotsky and Piaget to illustrate methods of teaching reading. To learn Internet search skills, she found thematic units and ordered literature online. To communicate with her students, she used e mail, word processing, and various software programs."

Reflecting on the learning process

"Hawkridge (1983) summarizes that schools primarily adopt technology for *social* and *vocational* purposes to be sure learners are aware and unafraid of using technology. They know students should understand computers and their role in society. They want students to implement technical skills for employment in the twenty-first century. While Carol began the mentorship semester with social and vocational goals in order to overcome a perceived lack of skills, she finished the semester, using technology skills as teaching tools to influence the quality of learning in her classroom.

Hawkridge (1983) states that few schools implement technology with a *pedagogical rationale* in an effort to understand that there are known advantages to using computers in learning as compared to traditional methods. Fewer still use technology with *catalytic rationale* hoping to reform teaching practices or to make desired changes in student learning.

Carol's final product, a Technology How-To Notebook, archived her new technology skills and interesting ideas from our mentor experience. She has entered process steps in order to help her remember what she has accomplished. Next, she noted an application of each new skill to her Reading/Language Arts teaching and learning. Entries are dated in the order that she learned them during our mentoring sessions. They are for her, 'real life' experiences that fit her schemata of learning in an optimal learning match."

Conclusions

In reality many teacher preparation programs do not have sufficient faculty support in order to use technology in teacher education preparation. Encouraging teacher education faculty to use technology in teaching and learning is possible using effective mentoring as an optimal match to increase technological competencies. One-to one mentorships can provide cost-effective, personally-rewarding experiences for faculty with motivation and freedom

to progress at their own pace. A mentorship team can explore and investigate responses to individual technological needs, address challenges of complex and open-ended problems, and rely on inquiry and invention.

As Harrington (1991) suggests, there is a difference between preparing teachers to use technology and using technology to prepare teachers. If we only prepare teachers to use technology, we limit the conception of the role of technology in education. University-level education faculty must be empowered to take more responsibility for both acquiring technological competencies in order to improve the capabilities of their preservice students.

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Constructivistic Learning: Also for Faculty!

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Abstract: The Amsterdam Faculty of Education is developing and implementing a new curriculum concept for professional education, for which it attained the status of "the experimental teacher education in the Netherlands" in 1997. This concept, fitting in the constructivistic learning paradigm, is nicknamed 'learning through producing'. The concept does not only yield a vision on learning processes, but also an implementation strategy. By basing the professional development of the Faculty of the Institution on the same constructivistic principles one induces a transformation of both the curriculum and the organization. The result of this transformation should prepare both students and Faculty for the information age. ICT plays a role as catalyst in this complex transformation.

Introduction

This short paper will focus on the implementation strategy towards Faculty members and the Institution. The professional development on these levels uses the mirror principle of congruence: use the same concept of learning and education as the one you use for students.

Quality care in an institution is dependent on the way one succeeds in arranging learning processes for Faculty and Organization. Lifelong Learning is not only the future of a student, also the Institution must show the skill to keep developing itself using learning goals en learning action plans. At EFA we use the metaphor of "The Expedition" for this way of life in the Institution.

The mirror effect of congruence concerns the following central elements of the educational concept:

- constructivism (learning through producing; authentic learning tasks, resources of knowledge and skills)
- learning cycles: orientation, planning, execution and evaluation
- responsibility for one's own learning processes (integrative assessment, digital portfolio system)

The effect is also connected to some corollary elements:

- the teacher as coach
- collaborative learning
- information and communication technology

An extensive presentation of these basic ideas can be read in the SITE 2000 paper "Proving Competence: Integrative Assessment and Web-based Portfolio System in a Dynamic Curriculum", by Douwe Wielenga. We will not repeat that information here, but for the figure on the next page.

The mirror

We see the improvements in the quality of the programs' components as a learning process of the Amsterdam Faculty of Education itself, both on the level of the teacher educators and on the level of the institution. This makes it possible to mirror the model, concepts and facilities we use to facilitate the learning processes of the students on the learning processes of teacher educators and the institution!

We see the professional development of teacher educators as a continuous learning process, which follows the same phases as the learning cycle of the students. See figure 1 on the next page.

We are in the process of collaboratively describing the professional competencies that teacher educators need in the new concept of curriculum, we are using the same portfolio system for teacher educators that our students use, and we are thinking about possibilities to organize integrative moments of assessment where teacher edu-

cators have to show to their peers their growth on the desired competencies. In the last two years the development of new learning practices is already organized in a way that is *both* a process of development of new learning environments and learning materials *and* a learning process of the teacher educators that carry out this development. In this learning process experts are coaching Faculty on new learning technologies and peers are assisting them in formulating learning goals connected to their innovative productive work and connected to the desired competencies.

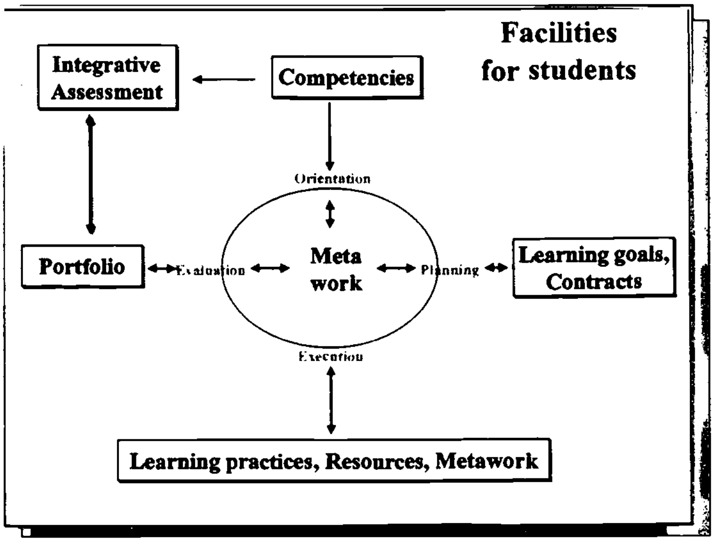

Figure 1: program facilities in a dynamic curriculum

The same model can be used on the level of the institution. The expedition towards a more dynamic curriculum must be seen as a learning process. We have defined our learning goals as the main aims of the project. We use a portfolio to keep record of the development within the Faculty, of the results and experiences, and to prove our growth to the outside world. This portfolio registers products, reflections, and comments from people outside EFA. These reflections are often based on action research by Faculty and by academic research that is carried out by independent research institutions, commissioned by EFA.
The management of EFA is coached by a group of experts on education and ICT, and we plan to organize external audits, which will act as integrative moments of assessment.
In this way both the institution as a whole and the teacher educators individually will have to act as role models for the students.

Examples

During the SITE 2000 session the congruence on learning concepts will be shown using two examples of constructivistic learning by Faculty:

1.

The first example concerns an expertise center for curriculum development, where Faculty, relieved of their teaching duties, work on a specific curriculum development project and, at the same time, through this work acquire new knowledge and skills. As part of their development assignment Faculty heighten their expertise on subjects like the design of digital learning environments, self directed education, or collaborative learning. In this process another person is coaching them. This approach must result in a significant reduction of resistance to change. In the presentation we will show the details of this learning process and the dilemma's that we encounter.

2.

A second example is about the professional development of those members of Faculty who are responsible for the implementation of a brand new system of integrative competence assessment of students at the Amsterdam Faculty of Education. These persons develop their knowledge and skills in this area by producing innovative materials for assessment. Following questions that arise hereby they start research, consult experts or take part in demand driven training sessions that they think they need for their development work.

Information in the English language on the expedition of the Amsterdam Faculty of Education can be seen at the Publications part of the home site of EFA: http://www.efa.nl

Building a Vision for Technology Integration

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Abstract: Students have few opportunities to observe faculty using technology in courses and more rarely use a wide range of technologies in the classroom. This report examined data gathered to determine the state of faculty technology use for teaching and learning. Expectations of faculty for students to use technology, barriers and possible solutions to achieving technology integration in teaching and learning were examined. Three goals for further development of technology integration were established. 1) Preservice teacher education courses will be redesigned to reflect best practice and include the infusion of appropriate technology throughout. 2) Faculty will have the training they need to successfully integrate technology into their courses. 3) Students will have experiences that enable them to demonstrate effective and appropriate use of technology based on ISTE/NCATE standards. A plan was developed to build a vision for technology integration. Strategies for faculty development and program development were identified and implemented.

Introduction

The State of Alaska has been improving education through its Quality School Initiative. As part of this initiative, teacher education standards were developed and adopted as regulation (AK DOE, 1997). In September 1998, the State Board of Education adopted the National Council for Accreditation of Teacher Education (NCATE) standards and entered into a state partnership with NCATE. UAA is participating in the transition plan leading to required NCATE accreditation for approval of all Alaska teacher preparation programs by 2002. The University of Alaska Anchorage School of Education is reviewing and revising its teacher education program to meet these standards.

The University of Alaska Anchorage (UAA) is one of three state universities in Alaska. The University of Alaska system is aware of the importance of technology support for education. UAA implemented a system wide technology initiative and invested resources into developing an infrastructure of modern information technology that includes hardware, software, and training. The School of Education (SOE) continually upgrades its technology. All faculty offices and all computers in the SOE computer lab are networked into the campus backbone. All permanent faculty and staff members have multimedia-capable computer stations in their offices with 17" monitors and Ethernet connections. Grants have provided SOE faculty with professional development opportunities and support materials. School of Education has shared full time technician support (Macintosh and PC) with other departments within the College of Health, Education, and Social Welfare. To support the use of technology in the academic programs within the SOE, a student technology fee is assessed on any student taking any SOE course on the UAA campus. The implementation of this fee has resulted in the availability of modern technology resources and support for students. Students have access to multimedia computers, color scanners, color printers and other equipment in the SOE computer lab. A lab technician is always available while the lab is open to assist students. As part of a continuing effort to improve the integration of educational technology in teacher education, a needs assessment was conducted in the School of Education to determine the state of faculty technology use for teaching and learning.

The Study

Sixteen permanent SOE faculty members were interviewed in April 1999 to determine areas of strength and areas of need. Faculty were asked how they integrated technology in their teaching and their expectations for student use of technology in their classes. The *Teacher Educator Integration of Technology Skills, Concepts, and Standards into K-12 Teacher Education Programs* instrument (McCoy, 1998) was used to gather quantitative data. The questions were based on the ISTE/NCATE Foundation Standards (Thomas et al., 1997) and the types of integration as identified by *Teachers and Technology Making the Connection* (OTA, 1995) as supportive of technology integration. Quantitative data were analyzed with the Wilcoxon Matched-Pairs Signed-Ranks Test using SPSS. Areas of strength and areas of need were identified. Qualitative data were gathered as faculty defined the barriers and identified needs to be able to integrate technology in their teaching and learning. Data analysis was inductive. The results were presented to the administration in a SOE Education Technology Use Report.

Findings

All faculty members interviewed have used computers for a long period of time. Previous studies have shown that length of use does not necessarily lead to greater integration of technology in teaching. Other factors, including computers with Internet access, on-site technology support, time needed to use computers, training, access to adequate hardware and software, and opportunities for faculty to see multimedia computers used effectively to support teaching and learning are needed for that to occur (OTA, 1995).

The survey found that faculty expect students to use word processing and telecommunications. Most do not expect students to be able to operate multimedia computers or to use technology in learner centered classrooms. Only a few faculty use local, state, and national technology standards in their teaching.

Students have few opportunities to observe faculty using technology in courses. They rarely have the opportunity to use a wide range of technologies in the classroom. Lack of facilities, a smart classroom or laptop computers with a projector; limit the methods of technology use available to faculty.

All faculty members mentioned lack of time as a major barrier. On-site technology support, time needed to use computers, training, access to adequate hardware and software, and opportunities for faculty to see multimedia computers used effectively to support teaching and learning were all found to be significant areas of need. Most faculty stated that professional development opportunities have not been available at a time and in a manner that is appropriate for their learning. Many lack knowledge of how to use available hardware and software.

Expectations for Students to Use Technology

The needs assessment found faculty expectations for student use of word processing, communication and on-line resources, and computer-based technologies (including telecommunications) to access information (27% of survey items) to be areas of strength. Seven out of eight remaining items (64% of items), generally those skills needed to operate a multimedia computer, to use technology as a tool in a learner centered classrooms and those technologies which support different learning styles and needs were found to be significant areas of need. Faculty expectations for student use of technology do not prepare students to meet *ISTE/NCATE Foundations in Technology for all Teachers* nor the *Alaska Teacher Standards*. Faculty are not providing models of appropriate technology integration for their students.

Support for Use of Technology

School of Education faculty described the support they receive from the university. One item (17%), a computer with Internet access available at work, was found to be an area of strength. The other five items (83%): on-site technology support, time needed to use computers, training, access to adequate hardware and software and opportunities for faculty to see multimedia computers used effectively to support teaching and learning were all found to be significant areas of need. When universities provide these support items, faculty are more likely to integrate technology into their teaching (OTA, 1995).

Barriers to Integration of Technology into Teaching and Learning

Several themes emerged as faculty identified the barriers that kept them from integrating technology in their teaching and learning. They cited lack of time, lack of facilities, lack of technical support, and equipment issues as major reasons they do not use more technology in the classroom. Curriculum issues, as well as, administrative issues, training, and budget comprise other barriers. They also often found it difficult to coordinate work with other departments on campus.

Training needs are not currently being met for a variety of reasons. Faculty development classes are scheduled at an inconvenient time, are not on topics of interest to them, or are in formats they are uncomfortable with. Providing professional development in a variety of ways would serve them better. Many would like to learn "as needed" while others would like help with specific subjects. They asked for a faculty workroom where they could learn informally from each other, prepare materials, and learn in small groups. They would like to learn to use the software that is available to students in the computer lab. They would like to know more about how to incorporate technology into the K-12 classroom and into their teaching.

Faculty Needs for Incorporation of Technology into Teaching and Learning

When asked what they needed to be able to use technology for teaching and learning about half of the faculty identified laptop (both Mac and PC) computers. Other items requested were high-end computers, color printers, access to digital equipment and the same software that students have. They would like readily available technical support for both hardware and software, for distance course development, and for development of web pages.

UAA SOE faculty report they have not seen technology being adequately and appropriately used in the K-12 schools that they visit. The status of technology in the Anchorage School District impacts this proposal because the UAA SOE places students in local schools for practicum and student teaching experiences. To meet NCATE standards preservice teachers need to use technology throughout their teaching experiences.

Hardware and Software

Faculty members developed individual lists of hardware, software or other support needed to facilitate incorporation technology into their teaching and learning. About half of the faculty identified laptop computers (combination of both Mac and PC), with mobile projection units to use in smart classrooms, as equipment they need to incorporate technology in their teaching. Some would like equipment for students to check out to use in the field. E-mates (no longer made) or something comparable that is practically indestructible.

Faculty asked for a variety of software applications. In addition, they felt is was important to have the same software that their students have. They would like to be able to read any documents they receive. They would also like to have technology support for whichever platform they choose. They would also like to be able to access their work computer at home.

Faculty Development

Training needs are not currently being met. There are a variety of ways to provide professional development. Many would like to learn "as needed" while others would like specific subjects. Some would like coaches to work with them. They would like low key demonstrations of capabilities of things we have available in the SOE. They would like training to use digital equipment. They would like training to learn to use a variety of different software applications.

They would like a faculty workroom where they could learn informally from each other. They would like the opportunity to meet with others in their field at regional and national meetings. They would like to know more about how computers and technology are being used in the K-12 classrooms as well as how to use elementary software and have time to practice.

Technical Support

Technical support is very important. They would like readily available support for both hardware and software that is accessible when needed. Faculty would like more ready access to technical person for help with

software problems on an as needed basis. They would like support for distance course development and for development of web pages. They need technician who comes in to office in a timely manner, to troubleshoot and stay until problem is fixed, and a choice of what is updated. They would like to define what they need and have technical services provide it.

Facilities

Many faculty are not aware of what is available to students in the SOE Computer Lab. They would like a tour of the lab and the opportunity to learn to use the hardware and software students have access to.

The School of Education will be remodeled in the summer of 2000. The faculty are interested in developing classrooms that will promote the integration of technology in teaching and learning. When the new classroom is designed, faculty would like PowerPoint capable hardware in every classroom, video capability, a smart room with anything that is appropriate for the subject matter being taught, and videoconferencing capabilities.

Other Support

Everyone needed time for learning, for course development, and for technology related activities. There is also a need for a technician to assist with online course development, course revisions, and web page development. They would like help getting courses online and a secure spot (server with course management software) to house them. They would also like the technology funds to be allocated to the SOE to the same extent they have been allocated to other departments. The greatest need seemed to be TIME and assistance as needed.

Conclusions

The Office of Technology Assessment of the U.S. Congress published a report in 1995 called, *Teachers & Technology: Making the Connection*, which found: "To use new technologies well, teachers need more than just access to these resources, they also need opportunities to discover what the technologies can do, to learn how to operate them, and to experiment with ways to best apply them in their classrooms." The report recommends avoiding the common approach of "short-term, one-shot training to familiarize teachers with a specific application or encourage general computer literacy" in favor of more long-term training that centers on the relationship between technology and the teacher's role. "Helping teachers effectively incorporate technology into the teaching and learning process may not only help students become competent technology users, but may also help them become more accomplished learners overall, with skills necessary for the *Technology and the New Professional Teacher: Preparing for the 21st Century Classroom* (1997) that highlights the impact of technology on society and the importance of redesigning teacher education programs to prepare teachers for the new demands of the classroom.

Recommendations from the UAA SOE Faculty Technology Use Report included the need to provide adequate technical support; to involve faculty in technology planning and design issues; to provide a variety of training opportunities in several formats; to upgrade hardware and software, to provide equipment for classroom use of technology and to provide time and administrative support for the integration of technology into teaching and learning.

A plan was developed to help faculty build a vision for technology integration into teacher education. Strategies for faculty development and program development were identified and implemented. Three goals for further development of technology integration were established. They include: 1) Preservice teacher education courses will be redesigned to reflect best practice and include the infusion of appropriate technology throughout. 2) Faculty will have the training they need to successfully integrate technology into their courses. 3) Students will have experiences that enable them to demonstrate effective and appropriate use of technology based on ISTE/NCATE standards.

Models for faculty, and program development were designed. The models did not focus on the isolated acquisition of technology skills, but concentrated on the rationale and strategies for integrating technology across the curriculum. They were designed to provided faculty an opportunity to experience collaborative,

problem based learning. The models were incorporated into a successful Preparing Tomorrow's Teachers to Use Technology Capacity Building Grant. They also support technology integration in a successful Alaska Partnership for Teacher Enhancement Grant.

Faculty Development Model

Faculty will have the training they need to successfully integrate technology into their courses. A community of learners (COL) will be created to help all members of faculty realize the need to take responsibility for integration of technology and to help them acquire the skills and attitudes needed to infuse technology into the curriculum. The faculty will be invited to join the community of learners, as they are introduced to a new "work room" and provided information about faculty development opportunities. Faculty will become comfortable working in both an on site and an online collaborative environment. To meet the diverse development needs of the faculty, several types of learning opportunities will be developed, including online and CD ROM materials developed by our partners, as well as, one-on-one sessions provided by the ACT 3 methods faculty member. Apple Computer will provide online professional development opportunities that will allow the faculty to complete courses in applications and integration of technology on their own time schedule. Multimedia in the Classroom and Internet in the Classroom will give them specific examples of appropriate uses of technology in teaching and learning.

As the faculty become comfortable with applications the focus will move beyond basic technology skills to learning to use applications, such as the use of data bases and spreadsheets, to promote problem solving, higher order thinking skills, and effective communication in targeted student standards. Faculty will investigate strategies and techniques for the development of technology-integrated units that engage students in these processes and produce higher achievement, especially in under-achieving schools. They will have the opportunity to participate in ASD technology development activities. The "work" room will serve as a place for faculty to share learning, collaborate on joint projects, and to develop the community of learners. It can be used in conjunction with the ACT 3 methods classroom activities. Further opportunities for collaboration and professional development will be available through supporting attendance at national technology conferences.

Program Development Model

The Alaska Partnership for Teacher Enhancement Grant (APTE) is a five-year grant to redesign the teacher education program. Program Development Design Teams, composed of members of the SOE and CAS faculty, teachers, parents, and business partners, meet online and face to face, to restructure the School of Education and redesign courses. Activities will be provided to guide them as they develop and pilot methods for learning about best practice and integrating technology into the curriculum. They will develop a vision for teaching and learning which includes the use of technology and develop a model for redesign of preservice teacher education courses. The work groups will investigate larger technology issues that relate to parents and community as well as education. They will also have access to training in the Faculty Development sessions.

To help them develop the vision needed as they experiment with using technology in their current courses and model use of technology in the field, faculty members participating in this project will receive laptop computers with software comparable to what the students have in the SOE lab. A small projector and "smart cart" with student laptops will be available for check out. Apple Computer will conduct a workshop on mobile computing that is based on their work with other schools.

By the end of the 1999-2000 school year, members of both teams will have participated in three on site meetings and online collaboration. They will have developed the vision and skills needed to integrate technology into their teaching. Our goal is that by the end of the spring semester, UAA faculty will use the laptop computers and the "smart cart" in the classroom weekly.

Evaluation of the project is ongoing. More faculty members were interviewed this fall. Their current syllabi were assessed for current technology integration strategies. Records are being kept for each activity and assessments and evaluations help guide the projects. At the end of the school year, activities will be evaluated for their effectiveness.

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Teaching Well With Technology: An Educator's Guide to Wise and Time-Efficient Use of Instructioinal Technology

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Abstract. The Teaching Well With Technology workshop was created in an effort to provide faculty members with a systematic way of thinking about desired outcomes, use of time and space, and potential impact of technology for their classes. For the purpose of the workshop and our consultations with instructors, Educational Technology is defined as any human-made tool used to enhance the learning process. This session provides the rational for and an overview of "Teaching Well With Technology: An Educator's Guide to Wise and Time-Efficient Use of Instructioinal Technology" workshop. It is a full day workshop that resulted from a collaboration between the John A. Kaneb Center for Teaching and Learning and Educational Technology Services at the University of Notre Dame with support from AT&T.

Introduction

The Teaching Well With Technology workshop was created in an effort to provide faculty members with a systematic way of thinking about desired outcomes, use of time and space, and potential impact of technology for one of their classes. For the purpose of the workshop and our consultations with instructors, Educational Technology is defined as any human-made tool used to enhance the learning process.

The workshop is structured to provide the participants with an opportunity to select tools and strategies based on clearly identified learning goals that they define for one of their courses. Technology is demonstrated and discussed but there is no hands-on use of technology during the workshop. This format helps to avoid the tendency to find a problem to fit a "cool" technology solution. It also reduces the amount of time instructors spend learning technologies that are not viable solutions for their classes by helping them eliminate tools and strategies that are not likely to succeed before spending the time to learn how to use them.

The workshop is a result of collaboration between the John A. Kaneb Center for Teaching and Learning and Educational Technology Services (ETS) at the University of Notre Dame and has been underwritten by a grant from AT&T. The collaborative relationship between the Kaneb Center and ETS began when the center opened and has lead to the merging of some of the functions of the two groups and the appointment of two educational technology specialists as assistant directors of the Kaneb Center effective July 1, 2000. In addition to the workshop we consult with faculty and teaching assistants to assist them in the selection and implementation of technology tools that will help meet identified learning goals. A typical consultation with an instructor begins with the development of a mutual understanding of the goals for a course. When the goals have been clearly identified, tools or methods that may assist in achieving them are considered. These tools or methods may or may not be based on computer technology. The tools and methods identified are then evaluated to determine whether they fit with the instructor's style and to determine if they fit within time pressures and other external constraints (infrastructure, support, etc.).

The Workshop

The workshop consists of the following Seven Steps:

1. What Do I Want My Students to Learn
2. Identify the Best Teaching Approaches
3. Plan Major Assignments and Exams that Will Teach and Test the Learning that You Want
4. Plan Times and Spaces for Learning
5. What Technology Tools Can & Cannot Do
6. Choose the Technology
7. Implementation, Evaluation, Think Creatively

Step 1: What do I want My Students to Learn?

This first step of the workshop is used to focus the participants on the learning goals for a specific course that they teach. It is very important to take this step so that the decisions made later can always be tied back to the goals for the course. Basic instruction is given on the importance of defining clear measurable goals that will be useful for informing the choices made throughout the remainder of the day. The participants are encouraged to use specific terms such as describe, analyze, argue, solve, create and compare and avoid vague terms such as know, understand and be exposed to while listing their goals. At the end of this step, each participant has a list of goals that they will use to inform their choices throughout the remainder of the workshop.

Step 2: Identify the Best Teaching Approaches

In this portion of the workshop the best teaching strategies for undergraduate education are outlined and discussed. The focus of this section is the importance of increasing student involvement as a method to enhance the learning process, followed by the discussion of ten teaching strategies that may be used to attain the desired increase in student involvement.

Student Involvement is the Key to Learning

> "The theory... Students learn by becoming involved... seems to explain most of the empirical knowledge gained over the years about environmental influences on student development... What I mean by involvement is neither mysterious nor esoteric. Quite simply, student involvement refers to the amount of physical and psychological energy that the student devotes to the academic experience." (Astin, 1985, pp. 133-51)

> "Analysis of the research literature... suggests that students must do more than just listen: They must read, write, discuss, or be engaged in solving problems." (Bonwell & Eison, Executive Summary, n.p.)

> "The body of research on the impacts of the college academic experience is extensive...The strongest general conclusion [is that] the greater the student's involvement or engagement in academic work or in the academic experience of college, the greater his or her level of knowledge acquisition and general cognitive development." (Pasquerilla & Terenzini, 1991, p. 616)

Ten Teaching Strategies Suggested by Research

1. Have students write about and discuss what they are learning.

> "Learning is not a spectator sport. Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves." (Chickering and Gamson, 1987, p. 3)

2. Encourage faculty-student contact, in and out of class.

"Frequent interaction with faculty members is more strongly related to satisfaction with college than any other type of involvement, or, indeed, any other student or institutional characteristic." (Astin, 1985, pp. 133-151)

3. Get students working with one another on substantive tasks, in and out of class.

"Students' academic performance and satisfaction at college are tied closely to involvement with faculty and other students around substantive work." (Light, 1992, p. 18)

4. Give prompt and frequent feedback to students about their progress.
5. Communicate high expectations.
6. Make standards and grading criteria explicit.
7. Help students to achieve those expectations and criteria.
8. Respect diverse talents and ways of learning.
9. Use problems, questions, or issues, not merely content coverage, as points of entry into the subject and as sources of motivation for sustained inquiry.

" Students learn what they care about and remember what they understand." (Erickson 1984, p. 51, cited Bonwell & Eison, Executive summary, n.p.)

10. Make courses assignment-centered rather than merely text- and lecture-centered. Then focus on helping students successfully complete the assignments. (Astin, 1985: Bonwell and Eison, 1991; Chickering and Gamson, 1987; Erickson, 1984; Frost, 1991; Kurfiss, 1987; Light, 1992: Pascarella and Terenzini, 1991; Penrose, 1992.)

Step 3: Plan Major Assignments and Exams that Will Teach and Test the Learning that You Want

In this section of the workshop, we review the learning goals that the faculty members have identified and point out the frequent mismatch between these goals and the traditional coverage centered model of course planning. We do this by creating a course skeleton that shows using the coverage centered model and then creating a new skeleton using an assignment centered approach, identifying the major assignments and exams then inserting them in the week in which they are due. We then ask participants to ask these questions. Are the assignments likely to elicit the kind of learning you want? Consider what the assignment is called, will an assignment called a "Term Paper" get the same response as one called an "Argumentative Essay"? Consider the context in which students produce work (time frame, level of memorization required, and accessibility of help and likely work strategies). Are the assignments and exams manageable in terms of number, type, length, and spacing across the semester?

During this section we suggest to participants that it is better to concentrate on a few, well-chosen assignments and exams rather than to proliferate ill-conceived ones. Sometimes, "Less is more". We also discuss the importance of content. The assignment-centered approach does not excuse the students from learning the content but focuses the learning of content as needed for the completion of assignments.

Step 4: Plan Times and Spaces for Learning

In order to discuss times and spaces we first define three aspects of the learning process. These are **first exposure**, during which the student first hears/sees new information, concepts, procedures, etc. **Process**, during which the student applies, critiques, contrasts, synthesizes, argues, analyzes, etc. Process usually results in a product such as a test, exam, assignment, lab or clinic, performance, etc. The third aspect is **response**, during which the teacher, assistant, or peer responds to the product of student work.

The next step in the discussion of times and spaces is to look at how times and spaces are used to accommodate the three aspects of learning we have defined. To do this we compare the use of times and spaces in a traditional lecture vs. an interactive model for a class.

	Students with Teacher (Class)	Student(s) "Study" Time	Teacher Alone
Traditional Lecture Method	first exposure	process	response
Interactive Method	process, response	first exposure	

Table 1: Aspects of Learning for Instructional Method vs. Times & Spaces

Notice that in the interactive method the teacher alone time is no longer spent responding to student work. This is positive in that the time can be used for other tasks and that response is moved to a time when it is much more likely to be effective for the students. Also, notice that by moving the first exposure to the student study time the more difficult task of process can be handled while the instructor is available to help with it. At this point in the workshop we discuss several cases of instructors that we have worked with and how they changed their courses to take advantage of these alternate ways of using time and space. To illustrate our point the Teacher alone time is left empty for the interactive method in this table. In the workshop we discuss the possibility that there will still be some amount of response to student work that happens in teacher alone time. At this time we also discuss alternate times and spaces such as lab, clinic, or recitation which may be used for first exposure, process, or response and office hours.

Basic Principles for Using Times and Spaces

1. Increase student time on task.
2. Involvement is the key to student learning.
3. Invest teacher time in the most difficult aspects of learning and/or aspects of technology that TA's or students cannot do alone.
4. Use peers or TA's appropriately; train and guide them for their tasks.
5. Make students responsible for first exposure in their own time or with TA's and peers.
6. Use technology to create, expand and enhance times/spaces and to accomplish all of the above.

Times and Spaces Created/Enhanced by New Technologies:

New technologies mean that the class, lab, clinic and recitation may be face-to-face or distributed and synchronous or asynchronous. Web pages, interactive software and multimedia are now available to students in their alone time and students' time with peers outside class, the instructor and TA's may be face-to-face or distributed and synchronous or asynchronous. Individual technologies that facilitate these changes are discussed in the next step of the workshop.

Step 5: What Technology Tools Can & Cannot Do

This section of the workshop is spent discussing various types of computer based technology tools and presenting cases that illustrate how they have been used successfully. In our cases we explicitly identify how the use of the technology ties in to the ten strategies suggested by the research and alters the potential uses of times and spaces. We do this by talking about a variety of categories of tools and providing examples of them to go along with the cases concerning their use. The tools that we cover are:

1) Collaborative Writing Tools: Tools in this category allow multiple authors and reviewers to interact with a document. The authors or reviewers are associated with the comments and or edits that they perform. This type of tool can be used by groups of students (or colleagues) to collaborate on a document. They also provide an excellent method to grade student work in a paperless environment. Examples of this type of tool include the reviewing features of Microsoft Word and Sixth Floor Media's CommonSpace.
2) Presentation Software: Facilitates the display of text, graphics, sound, video and other media and provides a relatively simple environment for the creation of presentations using these types of media. Also allows

for easy update and customization of presentations and for presentations to be made available for use outside of class. Microsoft PowerPoint is an example of this type of tool.

3) E-mail: Usually considered a one to one communication tool (may be one to many using aliases or nicknames). It is asynchronous (does not require the presence of both parties at the same time) and facilitates professor/student and student/student interaction. May reduce stress for those who don't feel comfortable with verbal interaction.
4) Listserv/Bulletin Board
   a) Listserv List: This tool provides asynchronous group communication using e-mail. List subscribers are able to exchange e-mail with all other subscribers by sending mail to a single common address. Listserv facilitates professor/student and student/student interaction and may reduce stress for those who don't feel comfortable with verbal interaction. Examples include Listserv and Listproc lists.
   b) Bulletin Board: This type of tool provides asynchronous group communication requiring login to Bulletin Board System (often web based). Facilitates professor/student and student/student interaction and may reduce stress for those who don't feel comfortable with verbal interaction. Bulletin boards allow creation of a forum for each topic to be discussed and display messages organized by topic. Both of these features are advantages in online discussion of course topics. Examples include WebCT"s and Blackboard's bulletin board systems.
5) Chat/Conferencing: These tools are designed to facilitate synchronous (all parties present at the same time) electronic discussions. They facilitate professor/student and student/student interaction and may reduce stress for those who don't feel comfortable with verbal interaction. Text based systems do require keyboarding skills for full participation. Participants use chat software or other conferencing software to connect to a common server that allows them to interact as a group. The keyboard is the input device in simple forms with more complex forms including white board, audio, video and application sharing. Examples include IRQ, WebCT, Blackboard and AOL Instant Messenger (text based and white board) and NetMeeting and CUSeeMe (video conferencing with text chat and whiteboard available).
6) Web Pages: Simple web pages facilitate display of and interaction with information that may be presented as text, graphics, sound, video and animation. They also allow linking of course materials to a larger body of information and can be used to "publish" student work. Simple web pages can be used to move first exposure outside of the class time. If students are the creators then they can also facilitate the increased involvement that leads to improved learning.
7) Integrated Course Delivery Systems: Products available allow the development of a one-stop location that provides the functionality of E-mail, Listserv and Chat along with presentation of information. These tools facilitate the creation of complex, interactive sites that may include on-line self-evaluation or testing, drill and practice, etc. Examples include WebCT and Blackboard CourseInfo.
8) Interactive Course Software: Applications that provide instruction and responses that may include multimedia elements. They could be web based (using one of the products above) or stand-alone applications and may be custom designed or commercial products. Examples include ADAM (anatomy and physiology), Progetto Italica (ND Italian language learning software).
9) Simulation: A presentation that attempts to model a real-world or theoretical process or event. Simulations may be used to show a simplified view of a real world event to facilitate understanding. They are most effective when they require student involvement/interaction. Examples include PCMolecule (Molecular Modeling), Orbital Motion simulation (http://www.nd.edu/~edtech/orbital).

Step 6: Choose the Technology

In step six we look at our sample course outline with major assignments and necessary steps mapped to the semester. Then considering the goals for that course we select technology tools that would help to achieve those goals and map them in the appropriate locations. Once they are mapped, we ask the following questions. Does it lead to learning/teaching improvements? Does it enhance community? Does the strategy fit with philosophies, priorities, and styles of teaching? Is it Feasible? Is the strategy consonant with time pressures and other constraints? The tools that pass these questions are then evaluated and one or more are selected for implementation in the course. Participants then go through the same process with their own courses.

Step 7: Implementation, Evaluation, Think Creatively

In step seven we discuss the methods to improve the likelihood and awareness of success. We suggest implementing in small steps when possible. Trying to use the new tool to do something you're already doing and to do something you've never done or to do something in a radically new way. We also discuss the importance of evaluation, even if informal. Finally, we talk about using this time of change as an opportunity to rethink in major ways by asking questions such as: What is teaching? What is my role as a teacher? What is learning? How do my students learn? What is "class"? How can I use times and spaces more effectively? What is the optimal relationship between students and teacher and students and students? And how can my time, TA and peer assistant time, and student time best be used?

Conclusion

This workshop works well because the focus is on teaching and learning. Technology tools are treated like other tools and methods and only selected when they will help meet learning goals and fit within the instructors style and other constraints.

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Ten Years of Technology Training for Faculty

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Abstract: Assuring that education faculty members use educational technology effectively in their classes requires that they know and use technology themselves. This paper shares the experiences of a college of education's 10 year effort to train faculty to use and infuse technology. The college has held an annual 1-3 week technology awareness and training session for the past 10 years, along with several other efforts to help prepare professors, instructors, and staff. Keys to success are included in this paper, as well as an effort to look at the future possibilities and challenges for education faculty development.

Introduction: The Challenge of Helping University Faculty Become Equipped to Prepare Preservice and Inservice Teachers to Use Technology

Preparing teachers to use educational technology in classrooms is an important and exciting challenge for the educational community, especially teacher preparation institutions. Teacher education is often criticized for the inadequate preparation of education majors concerning the use of educational technology in the teaching/ learning process. In a 1995 study, Colon, Willis, Willis, and Austin (1995) reported that on a nation-wide survey, over one-half of the teachers who graduated within the last two years believed they were not well prepared to use educational technology in instruction. In a more recent study, first year teachers indicated that their preparation to teach with educational technology lagged behind their preparation for other instructional strategies (Strudler, McKinney, Jones, & Quinn 1999).

In addressing the issue of educational technology infusion in teacher education programs, several national and international organizations, such as the Society for Information Technology and Teacher Education (SITE), the International Society for Technology in Education (ISTE), and the National Council for Accreditation of Teacher Education (NCATE), have focused attention to the problem by holding conferences, publishing journals, and writing standards. In addition, many states, including Nebraska, have developed minimum technology compentencies for educators. Changes in the amount of technology preparation in teacher education are a substantial challenge, but these changes are important to the future of education and its institutions. One of the most important factors in improving technology preparation of students is the increased use of technology by faculty, especially in the classroom setting (Persichitte 1998; Kent & McNergney 1999).

The faculty of the College of Education at the University of Nebraska at Omaha has developed a model for the integration of education technology into teacher preparation programs. This model was designed to adapt teaching methodology and curriculum in response to ever changing educational technology innovations. The need for infusion of education technology into the teaching/learning process was identified as a major goal by the college ten years ago. The goal was divided into teaching with educational technology, teaching about educational technology, integrating educational technology into the design and delivery of curriculum, and engaging in research regarding the use and impact of educational technology in the teaching/learning process.

The college established an Educational Technology Task Force, comprised of faculty, administrators, and support staff from all departments. This group was instrumental in providing operational direction to the educational technology vision of the college. This task force worked in concert with information provided by a similar group of educational technology personnel representing the Metropolitan Omaha Educational Consortium (MOEC) comprised of seven local school districts. Input from the two task forces provided input which resulted in:

- a formal College of Education mission statement for educational technology
- goals and objectives for the college in the area of educational technology
- educational technology competencies expected of all preservice and inservice teachers
- a coordinated plan for the purchase of all educational technology hardware and software for the college
- suggested research studies and topics reflecting the type and amount of educational technology utilized by the faculty of the college
- a formal advisory group to the dean of the college for feedback and future directions related to educational technology integration

Three Components for Increasing Faculty Use of Technology

Three general components were paramount for the increased faculty use of educational technology in the College of Education at the University of Nebraska at Omaha: 1) access to equipment, both in offices and classrooms, 2) expectation from the institution that effective educational technology be used, and 3) training and assistance to use technology, both personally and professionally.

Component 1: Access to Equipment, Both in Offices and Classrooms

During the past ten years, a concentrated effort has been underway within the College of Education to provide the technology necessary to prepare preservice and inservice teachers. Computers for offices and classrooms have been a priority. To equip faculty with current and appropriate desktop computers, two general guidelines were established, giving direction and rationale for these computers purchases. First, faculty members were allowed to choose either a PC (Windows) or a Macintosh for their office desktop computer. Second, high-end users would receive newer models, while trickling down their older computers to lower-end users. These guidelines provided general direction as the college moved ahead in giving basic microcomputer technology to each faculty and staff member in the college.

Early in the technology planning process, the college installed Ethernet connections in all faculty offices, instructional areas, computer laboratories, research laboratories, and support staff offices. The college local area network (LAN) is connected to the campus network, as well as the Internet. The room connections and the building wiring have been recently modernized to category 5 wiring and fiber optic space cabling. The file server for the college has been updated several times and is currently a Dell 300 MHz Dual Processor running Novell 4.11. The college will connect to Internet II soon.

Technology in classrooms and laboratories is important if faculty members are expected to infuse technology into their teaching/learning. The University of Nebraska at Omaha College of Education has developed, expanded, and updated this technology several times. Currently, several high-tech classrooms are available. These rooms have a computer, VCR, cassette deck, an audio board, an ELMO station, as well as a high quality ceiling-mounted projector. Several mobile carts, containing a computer, VCR, and projector are available for checkout to use in classrooms. A 30 station Mac lab, a 24 station Windows lab, and a 10 station Mac/Windows resource center are used for teaching, and other specialized research laboratories are also available to faculty and students.

Component 2: Expectation from the Institution that Effective Educational Technology Be Used

Many faculty are capable of believing that if educational technology is important enough for them to integrate it into their own classes, then technology is important enough to be an expectation for the institutional curriculum. In essence, it should be expected that all faculty will integrate technology into the

appropriate courses and situations. It is especially necessary for faculty to understand that they are not only supported in personal or office use, but also encouraged to use and model educational technology related teaching techniques. This support should be included in the merit, promotion, and tenure process.

Component 3: Training and Assistance in the Use of Technology, Both Personally and Professionally

The training and development efforts for the faculty of the college were designed around three levels: awareness, experience, and integration. On the awareness level, faculty members were provided with several opportunities merely to overview the vast uses of educational technology in the classroom. These sessions focused on getting faculty excited about, and aware of, the potential of educational technology use in the teaching/learning process. Also, it further provided faculty with a basic knowledge of several software programs. For the experience level, faculty members were given opportunities to experience some of the technology uses in a supportive and comfortable 'hands-on' environment, where knowledgeable individuals were available for assistance. For the integration level, the faculty participated in learning opportunities which focused on sharing how certain technologies might be used in instruction. This phase also permitted faculty to share with each other some of their integration projects and plans. Each of these training activities addressed improving instruction, expanding research, and increasing scholarship using the resources available through educational technology. This college-wide training of faculty and staff at each level has been addressed in various ways: summer intercession training, brown bag presentations, coaching/assistance teams, and the technology in education advancement model.

Summer Intercession Training

During the summer intercession the faculty had the opportunity to engage in hands-on training sessions in technology. These training sessions have typically been one to three weeks long. Initially, faculty was instructed in the basic use of a networked microcomputer laboratory along with its software. During the sessions, each faculty member developed projects that utilized educational technology relevant to their respective areas of expertise. From this beginning, the intercession summer training sessions became more individualized, focusing upon the specific needs and interests of participating faculty. More than twenty of the faculty per year has participated during the ten years this program has been in operation. In addition, the training format has been altered to provide large group instruction as well as one-on-one instruction and technical assistance.

The overall training during these intersession activities was designed to meet the needs of faculty members at their own level of expertise. The expertise of participating faculty ranged from those with very little knowledge of technology and no experience with its use in teaching, to those with some knowledge of technology who do not currently incorporate it into their teaching, to those currently using technology to some degree in their classroom instruction. All sessions encouraged faculty members to address their own specific needs and interests and to help be a resource to each other following the session. The following are examples of topics that have been addressed over the past ten years:

- productivity tools for curriculum integration (e.g. email, web browsers, ClarisWorks, MS Office, Hyperstudio, Persuasion, video editing, Harvard Graphics, and Micrograde)
- resource applications (e.g. instructional aspects of the Internet in support of the teaching/learning process, and authoring Internet-based materials using HTML, HomePage and Blackboard);
- experiential applications of integrated hardware and software resources available in high tech classrooms, mobile multimedia carts, and computer labs;
- integration of computer managed educational technology and media in the classroom; and
- restructuring teaching and learning applications using educational technology in a high-tech environment.

Brown Bag Presentations

In addition to the intersession training, the college also provided training throughout the academic year in a series of "brown bag" lunch hour presentations. The college's Educational Technology Coordinator and several technology using faculty members offered the presentations. These presentations primarily

focused upon the use and integration of software programs resident on the college's file server, which is connected to every faculty member's office and all instructional classrooms in the buildings used by the College of Education, via a local area network (LAN). Topics for these workshops included a variety of software applications such as MS Works, ClarisWorks, Paradox for Windows, SPSS, e-mail, and Netscape, as well as other high interest topics such as the use of multimedia and the Internet. These content-specific sessions, usually one-hour in duration, were followed by coaching and encouragement from the instructors, as faculty and staff members implemented their newly learned skills.

Coaching/Assistance Teams

After several years of training, technology integration was on the increase, but still, several faculty members struggled with the issue. To address this concern, a coaching/assistance program was piloted in two teacher education methods courses: elementary language arts and elementary science. A team of five educators was assembled for each of the two content areas. Each team consisted of the subject-specific professor (the course instructor), an area K-12 teacher, a Teacher Education Department graduate assistant, an educational media professor, and an educational technology professor. Early in the semester, each team met weekly to discuss ways that educational technology could be infused into the methods courses. After these discussions, the methods professor chose appropriate strategies, and the team assisted with the implementation of those strategies. Software was reviewed, activities designed, and equipment reserved or acquired by the team. During class periods when technology was used, team members assisted the professor in any way needed, and in some cases, members of the team actually instructed the class. All the educators in this program were positive about the program. The educational technology integration increased greatly, not only in these two undergraduate methods courses, but also in all levels of the program and support team. Participants indicated that they had learned a great deal about technology, including various teaching techniques, curricular concepts, and collaboration approaches.

The Technology in Education Advancement Model (TEAM)

Project TEAM-Internet (Technology in Education Advancement Model), was an innovative Internet based inservice model, supported by the Helena Foundation. Project TEAM-Internet was directed by the University of Nebraska at Omaha together with the Metropolitan Omaha Education Consortium (MOEC). This most recent project was the third of a series of Project TEAM grants addressing educational technology.

The general goals of the project included building a community of learners/educators who were interested, involved and trained in the use of the Internet in classrooms, as well as development of cutting edge models of Internet use in the teaching/learning process. The project sought to enhance the use of the Internet by involving 25 educators (both K-12 teachers and College of Education professors) in a comprehensive and extensive one-year Internet training program. The project participants met over a 12-month period, with sessions being held on two Monday evenings and one Saturday morning each month. Sessions included training on specific topics related to Internet use and resources and were conducted by both participants and outside experts.

One of the requirements of Project TEAM-Internet was the development of an Internet based educational project by each participant. Because the educators worked with kindergartners to graduate students, the projects were varied in topic and complexity. Each participating educator presented her/his project in a large showcase at the end of the year, with area teachers, administrators, and professors invited to attend the presentation.

The participating institutions agreed that it is indeed more effective to approach technology inservice through a collaborative environment, where resources and expertise are shared. One of the most impressive aspects of this collaborative approach has been the emergence of a committed and energetic network of individuals who are continuing to share their expertise beyond the initial two projects. This network of knowledgeable individuals is now a substantial resource to all initial partners in the project. Many of the individual integration products developed by the project participants are truly remarkable, and several local districts adopted individual participant projects as part of their overall school or district curriculum.

The program labored to prepare the participating educators to assume a true leadership role in the effective integration of the Internet into education. The project attempted to take a very practical and

comprehensive approach to inservice training, by involving participants in extended and well planned instruction that was carefully focused on classroom impact. Perhaps what was most encouraging in the project, however, was the change in the individual participants themselves. At the conclusion of the project, most, if not all, of the participants were equipped with the technical skills, as well as the general enthusiasm, to help others use the Internet confidently and effectively in the classroom. It appears that collaboration is indeed a possible key to helping educators keep current with Internet related technology. In essence, we are adding additional evidence to support the old adage that sometimes all it takes for success is a little help from a friend, or in this case a *TEAM* of friends.

The Future

Predicting what the future holds for educational technology is extremely difficult. The commonplace of today was, in many instances, unheard of just a short time ago. The integration of educational technology into the design and delivery of instruction is definitely on a fast track. Faculty members are continually finding innovative ways to use technology in educational settings. Software and hardware manufacturers are moving ahead with new products that faculty will integrate into their teaching repertoire. Educators will see a tremendous increase in the development of teaching/learning models, which link technology developments with teacher preparation curriculum designed to better meet the learning styles of all students.

Although the future is uncertain as far as developments in software and hardware, there are some constants that are known. K-12 students have become visual learners, hence, preservice and inservice teacher preparation programs have adapted curriculum to effectively meet this learning style. The availability of computers, connectivity to the Internet, and on-going developments in educational technology will continue to strongly influence future teaching/learning environments. In addition, technological developments in the use of worldwide connectivity, broad band availability for distance education, lower costs for computers and related equipment, Internet II, software packages, and the adaptation of technology advancements from the area of information science and technology will fuel the use of educational technology in teacher preparation programs. Technological developments from the Jet Propulsion Laboratory and NASA are but two examples of scientific developments being adapted into teacher preparation programs. It is safe to say that the surface has just been scratched in the use of educational technology compared to where it will be in the next five to ten years and into the future.

College of education faculty will need to be on the cutting edge of educational technology, researching ways to better use current educational technology as well as how to infuse new developments into their curriculum. This small group of faculty will be a significant influence on colleagues, which will ultimately result in continued adoption of new instructional models.

Perhaps one of the greatest constants for the future is what has been learned in the past. There will be a need for new equipment, both software and hardware; training for faculty to assist in the integration of educational technology into the design and delivery of curriculum; and the continued expectation that faculty will indeed model the effective use of educational technology in teacher preparation programs. These three elements will be in constant flux. However, faculty in teacher preparation programs must continue to move forward in developing the very best teachers who can integrate educational technology into the design and delivery of instruction to all children.

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Teachers' Distance Professional Development and Support Model

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Abstract: An efficient professional development program for teachers should be open, friendly, well-organized, capable of modifying, and self-contained. To satisfy these requirements, it must be built as a distance information and learning environment that offers access to various types of educational resources, to instructor-mediated independent and group training, communication and collaboration among all the participants in the program, and methodological support.

Introduction

Professional development (PD) programs for schoolteachers are of crucial importance as the quality of education depends heavily on teachers' expertise. Although teachers have completed preservice teacher training programs, the nature of schooling changes through ongoing instructional reform efforts. Thus, teachers need to be continuously engaged in PD to keep up with advances in the field, update their competence in the subject area and pedagogy, and improve the efficiency of their teaching and quality of students' learning. Developing and maintaining a PD program is a complex undertaking for it embraces a wide spectrum of pedagogical, psychological, and content area aspects of teachers' professional competence. It demands extensive time and funding commitments from the government, school and the teachers themselves. So, we, as teacher educators, must help teachers become life-long learners by developing efficient models for teachers' PD.

Professional Development

PD is a planned, continuous, life-long process of dynamic personal development in a certain area or several related areas, a "constant process of reinvigoration and growth" (4, 22). It is, certainly, teacher's own responsibility, yet, as his or her performance is evaluated by the outcome in the classroom, PD becomes a condition and an integral part of the teacher's career. However, we cannot expect all teachers to volunteer for PD, or know exactly what they need and how to do it. So, we have to develop a permanently accessible (just-in-time) system that, together with rich resources that any teacher is free to use via a menu of options, offers some kind of organized training and management. We need to establish a "dynamic process which will be self-sustaining for a significant amount of time" (4, 26) with a structure, training facilities, efficient collaborative activities, counseling and consulting, and communication between teachers involved in the same program, and with the instructors and experts in subject matter and methodology of teaching.

Technology for Professional Development System

Such a system should include up-to-date and effective PD and training programs, all the necessary learning materials and an easy access to qualified methodological help in addressing everyday classroom

issues. These problems are particularly acute for teachers in rural schools. An efficient system of continuous professional development and support that would assist them in all aspects of their pedagogical activities can be built on a multimodal approach developed in our TSAT Model (Training based on Systemic Application of Educational Technology) [5, 310-319]. The technological basis for this kind of PD involving both group and individual work, independent or instructor-managed, is computer-based telecommunications via the Internet: e-mail, listservs, bulletin boards, chat rooms and videoconferencing. These tools allow multiple representation of information, communication and collaboration with other people, and are regarded not as merely delivery tools but as "mediators of learning interactions in educational settings" (1, 240). This distance learning approach to PD has such advantages as mass accessibility, economic benefits, convenience, flexibility and immediate feedback.

System Structure

A Distance Professional Development and Support (DPDS) System developed on our approach consists of 3 modules: training, communication and information [6].

The training module includes on-line courses, computer courses, telecourses, automated tests, workshops and teleconferences. These courses can be either planned credited courses or non-credit courses for general learning. *The communication module* allows participants of the PD program to interact with the instructors of the course. It also serves the function of providing access to peers, experts, teachers engaged in the same PD program and colleagues outside the program and is a tool for cooperative and collaborative activities in the group. *The information module* provides current information on the developments in the field, access to distributed educational resources like on-line libraries, university databases, educator web-pages, to various materials for self-study and teaching collected in the DPDS bank, etc. This module can also be localized to tie in with a particular training module or course. It may include an automated methodological expert subsystem for continuous online teachers' support. There is overlap and intermingling of the modules' functions to a certain degree, but each serves a unique role.

To be efficient, this DPDS system should satisfy a number of requirements, among them openness, friendliness, flexibility, and capability for modification and improvement. The system must also be self-contained.

Training Module

The training module is a central component of the DPDS. It includes 5 important elements that are presented in the Integrated Model of Professional Development (IMPD):

Teacher

Web-based course

CMC/Videoconferencing | **Independent study** | **Support** | **Live sessions**

A key unit in the system is the Web-based course. It provides structure for the course, learning materials, assignments, quizzes, readings, and calendar. Communication in the web-based course is supported by two groups of technologies: Computer-Mediated-Communication (CMC) including email, chat, and discussion groups, and videoconferencing (CU-SeeMe and whiteboard). Independent study is based on both the materials offered through the Web-based course and on the more traditional materials like books, audio and videotapes, floppy and laser discs. The Support unit is a multifaceted subsystem that provides resources including an automated expert system, a bank of teaching and learning materials, tests and quizzes for self-evaluation, and reference materials (online and print-based).

It is clear that this model makes complex use of a variety of educational technologies. Among other technologies used in the DPDS system, "computer- and video-mediated conferencing are tools especially suited for continuing social arrangements that enable the joint construction of knowledge. Discourse created by these tools provides and opportunity for prospective teachers to relate everyday classroom teaching experiences to theoretical knowledge acquired in university courses, and, conversely, to use theoretical knowledge to make sense out of everyday classroom events" (1, 238).

Model of Training

Application of this approach can be seen in this model of a complete training session designed for one lesson of a PD course:

Steps	Independent Activities	Small Group Activities (without instructor)	Whole Group Activities (instructor-mediated)
1	Course outline study	-	Video lecture
2	1. Independent learning 2. Project design	Group collaborative work (classroom video assessment)	Workshop (video conference)
3	1. Independent learning 2. Lesson preparation	Teaching practice in the classroom (videotaped)	Analysis, discussion and evaluation by the group (video conference)
4	1. Project development 2. Self-evaluation	Peer consultations and chat	1. Project presentation 2. Assessment 3. Lesson summary

This model was developed from a number of experiences, in particular from our TSAT Model [5] and a corporate training scenario [2]. The 4-step lesson session that can take from 4 to 12 study days includes the types of activities necessary to provide efficient PD, starting with the new topic and material introduction (Step 1), offering various types of learning activities, both individual and group, that also includes a training classroom video assessment and every trainee's lesson analysis and evaluation (Steps 2 and 3), and ending with the project development, presentation and assessment (Step 4). It combines individual, small group and whole group collaborative work that may be either independent or instructor-mediated, and three kinds of assessment: self-evaluation with the help of automated tests, group evaluation and final overall instructor assessment. All the activities are supported through technology. Various types of feedback (general, selected group, individual) are possible depending on the students' needs.

It is worth noting that one of the main components of this model is practical lesson development and implementation by each teacher who is involved in a PD course. "Teachers develop as teachers through the process of teaching" (4, 24), or in the 'on-the-job' activities. Experience and PD come through research and practical performance in the real classroom (lesson preparation, implementation and self-evaluation) and training outside this classroom (lesson analysis, discussion and assessment by the peers and

instructors), besides regular learning. So, practice teaching or micro-teaching and team-teaching with observation or videotaping of each class given by one of the teachers with subsequent group analysis and discussion is an essential part of this model.

Communication and Information Modules

Two other modules support the main training module. The communication module allows communication and collaborative activities among the teacher who is in a PD program, and three categories of communicative partners: other teachers, instructor and experts:

Teacher

Teachers	**Instructor**	**Experts**

The information module provides access to several learning resources – system bank, distributed resources, educational web publications, and automated expert subsystem:

Teacher

DPDS Bank	**Distributed Resources**	**Educational Web-pages**	**Automated Expert Subsystem**

Face-to-face training

In addition to distance learning activities, live sessions are, in our view, a necessary part of PD and should be maintained wherever possible. Though they are not cost effective, they promote live, face-to-face interaction between the teachers participating in the PD course and their instructors thus allowing to preserve personal, human touch that is essential for educating people. Such a communication, undoubtedly, remains vital to education even in computer-based learning environments. To combine a distance, technology-based and traditional, live training, a "sandwich" approach to distance teacher training that involves periods of study alternating between on- and off-campus work can be very effective [3]. The main principle of the sandwich program is that it allows students to participate in face-to-face sessions periodically throughout the program. For example, students might begin the program with an intensive two-week summer session, then complete distant courses while working at their home schools, then return for another face-to-face session at the end of the program. Thus, they can continue both their careers and PD courses by alternating periods of intensive, group, instructor-supported study at the central location with periods of distance learning organized and mediated by a PD center while maintaining their regular teaching job.

Conclusion:

This DPDS model is actually teachers' informational and learning, social and technological environment that offers all the materials, tools, guidance and help needed to support their successful professional activity in the class throughout their careers. The strength of the model lies in the fact that the teachers' individual learning and PD is embedded in various social processes organized and supported via a system of educational technologies.

The DPDS system based on this model is designed to offer effective and cost-efficient teachers' PD. It can be expanded by adding intensive instructor-managed training sessions that help to preserve an optimal ratio between technology-based and live teaching/learning experiences. Students then engage in collaborative and individual work through both technology-mediated and face-to-face communication.

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Teaching the Teachers:
Faculty Development Institutes at Two Universities

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Abstract: Many universities recognize the need for additional training in the proper uses of technology for their faculty. Schools have invested in the infrastructure and hardware, yet find that many of their faculty need time, guidance and instruction on how to best use technology in their courses. Faculty members are being asked to teach distance learning courses, using either the Internet, videoconferencing facilities or both. As we are well aware, teaching a university course via the Internet or videoconferencing is not the same as standing in front of a group of twenty students. Many faculty need assistance and information on the best practices which can be incorporated into their teaching of these types of classes. Many faculty are including resources found on the Internet in their courses or are developing web sites for the Internet which are then used in their courses. Faculty requests ranging from developing PowerPoint presentations to learning how to program in Java are becoming commonplace. Yet where does the faculty member go who wishes to utilize these new technologies, but who does not have the training needed to incorporate them into their courses? Some universities are offering faculty development institutes on-campus which address these issues.

Introduction

As our university campuses become more technology-intensive and our courses use more technology-based sources of information, we are finding that many faculty require and request training in using various technologies. Many universities are addressing these needs through combinations of workshops, training sessions and one-on-one mentoring. These 'faculty development institutes' provide much needed skills which the faculty member can then take back into the classroom in order to provide additional resources for their students. Universities take varying approaches to these institutes, ranging from on-going workshops, work sessions which cover several weeks, to intensive one day programs which cover very specific needs of the faculty member. This article will discuss the programs at two universities, and the on-going evaluation of these programs.

The Faculty Development Institute at Auburn University Montgomery

Planning for the Faculty Development Institute at Auburn University Montgomery began Winter Quarter 1999, with the actual Institute conducted during Summer Quarter 1999. Several faculty members and the director of the Technology Center at Auburn University Montgomery began research into similar programs at other universities (primarily Florida State University and Virginia Tech) and quickly began planning to offer technology training at AUM. A committee was formed, consisting of faculty who were presently using technology in their classes and others who had expressed an interest in using technology to enhance their teaching. This committee dealt with two major tasks: defining how the institute would be conducted (the how, when, and what) and determining who would be the initial participants. The vice-chancellor at the university had provided funds for the Faculty Development Institute and participants were offered release time for one quarter for participating in the ten week institute. A call for proposals was delivered and the committee met to evaluate the requests and choose the participants. The range of the initial proposals was varied; some as little as a paragraph stating what the participant wished to learn, others, very detailed, covering how the participants would use the information learned in the institute in their classes. We learned from this that our call for proposals for the upcoming institutes would have to be very clear in detailing exactly the type of information we needed to better evaluate the proposals. As part of the initial proposal, faculty members were asked to rank their level of computer skills in several areas, ranging from software use to web page design. This information allowed the planning committee to determine which technology-based skills would best fit the selected participants. Skills requested by the program participants ranged from basic PowerPoint use, creating web pages to use as a supplement in the classroom, to creating web-based courses for use as a distance-learning class.

As a result of the proposal evaluation, twenty faculty members were selected to participate in the initial Faculty Development Institute. Ability levels, as noted by the participants themselves, ranged from very basic ("I only use my computer to do word processing and check e-mail", to advanced ("I am presently teaching classes in JavaScript."). It was decided to run the institute in two tracks: one for the more basic skills (PowerPoint, creating a web page) and one advanced (JavaScript, developing streaming video for use on web sites). The classes were combined when topics such as copyright issues and paradigms used for evaluating Internet-based classes were discussed. It was decided, during the planning stages of the institute, to use WebCT as the basis for creating web-based Internet classes as well as web pages for use in other classes. Students were initially introduced to creating pages using HTML and then were provided instruction in WebCT. Classes were held once each week for two hours. This schedule was decided upon due to the rapid nature in which the institute was being developed and offered (basically developed over a five month period, and our teaching loads are set months ahead of time). We found this schedule provided time for the participants to cover the various tools that are available through WebCT. The original idea was to introduce the concepts during the class and allow the participants to work and practice using the concepts during the next week. This was a very good idea in theory that was much harder to put into practice. Future institutes will allow for more in-class time that will allow the participants to develop and refine their work in a more instructor-accessible setting. Future institutes will meet during a regular class periods so that

the participants will have adequate time to develop the skills needed to become more independent.

The Faculty Development Institute at Old Dominion University

The process of planning the faculty technology workshops began by outlining competencies in eight areas. The "blueprint" for technological literacy for faculty members was developed by the college of education instructional technology committee. The committee is comprised of members from each of the college departments.

1. Instructional personnel shall be able to demonstrate effective use of a computer system and utilize software.

2. Instructional personnel shall be able to apply knowledge of terms associated with educational computing and technology.

3. Instructional personnel shall be able to apply productivity tools for professional use.

4. Instructional personnel shall be able to use electronic technologies to access and exchange information.

5. Instructional personnel shall be able to identify, locate, evaluate, and use appropriate instructional hardware and software to support Virginia's Standards of Learning and other instructional objectives.

6. Instructional personnel shall be able to use educational technologies for data collection, information management, problem solving, decision making, communications, and presentations within the curriculum.

7. Instructional personnel shall be able to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational settings.

8. Instructional personnel shall demonstrate knowledge of ethical and legal issues relating to the use of technology.

Following the adoption of competencies by the committee, enablers were created for each of the competencies. Topics for the faculty technology workshops were selected to support the competencies and enablers.

Classes Offered at the Faculty Development Institute at Old Dominion University

A smaller committee of four instructional technology faculty developed the topics for the faculty technology workshops. Workshops were held in the college of education computer labs every other Thursday from 12:30 to 1:25, which is the university-wide "activity time." Planning for the fall workshops was completed and advertised early in the summer to avoid conflicts with departmental meetings. Topics for the workshops included:

1. Using file servers and file maintenance

2. Using Lotus Email

3. Finding information with search engines

4. Creating a web site with Lotus Notes

5. A constructivist view of online interactions

6. Using scanners, digital cameras, and importing images into documents

7. PowerPoint and basic screen design principals

8. Using the Banner student information system

Based upon the topics, technology proficient faculty members were asked to conduct each of the workshops. Special care was taken to select faculty from each of the college's departments, not relying totally upon the instructional technology faculty. Workshop presenters were then asked to create a "fun" and "exciting" title for their workshop, such as: Clean up your mess! Using your server space for organizing, sharing and safekeeping your files. The title of each of the workshops, description, prerequisites, and what to bring were published in a six-page brochure and distributed to each of the faculty. Workshop presenters' e-mail addresses were included for workshop registration.

At the beginning-of-the-year meeting for the college of education, each of the workshop presenters gave a five-minute presentation highlighting his/her upcoming session. These light-hearted, yet technology and information-rich presentations created a high level of interest in the faculty, resulting in over-capacity attendance. During the workshop, attendees were presented with meaningful and relevant tasks which could be directly applied to their everyday duties.

Classes Offered at the FDI at Auburn University Montgomery

As noted, the classes that were offered at Auburn University Montgomery were based largely upon the perceived needs of the participants based upon the proposals submitted. The institute was held each Friday during Summer Quarter 1999. Classes were offered in PowerPoint, Basic HTML, WebCT (the majority of the institute was devoted to WebCT), copyright issues, using the distance learning classroom (two-way interactive audio/video), technology resources available on campus, educational issues related to the use of technology in the classroom, and, at the advanced level, JavaScript, developing streaming video content for web pages and mastering CD-ROMs. At the conclusion of the institute, a university-wide open session was held in which the participants could showcase the work they had accomplished during the summer. This mode of presentation allowed time for the participants to demonstrate what they had learned during the institute and provided additional advertisement for future institutes.

Problems Perceived and Overcome

At Auburn University Montgomery, during the initial planning stages, several faculty members commented that they had never, in the entire history of the university, seen the administration back so completely and so quickly the concept of the Faculty Development Institute. The initial funding, which included equipment to be used as servers, software licenses (primarily for both WebCT and Real Video), as well as monies to provide for the faculty release time, was quickly approved. Several committee members were allowed to visit and observe how other universities conducted similar faculty development programs. The quick turnaround time available from the initial call for proposals to the notification of the participants was a slight problem, which resulted, as noted above, a wide variety of the types of proposals submitted. The call for proposals for the Spring and Summer Quarter Faculty Development Institutes addressed that issue and provided a stronger guideline for prospective participants to follow and resulted in both a higher level of proposal and a much more consistent style of proposals from which to select the faculty participants. The reason all faculty who apply are not selected is primarily due to the funding needed for faculty release time. If funding is increased in the future, more faculty can be served. A primary problem that arose is one of equity of equipment across the campus. There were faculty who were using computers so old that they could not adequately access the Internet. We felt that we needed to show these faculty what they could do with adequate technology and attack the problem of finding this adequate technology at the same time. Fortunately, when the administration saw the level of enthusiasm and dedication from the participants of the institute, monies were found which allowed newer computers to be purchased for many of the faculty.

At Old Dominion University, although the workshops were endorsed by the dean of the college and were scheduled during the activity time well in advance, some meetings were scheduled which conflicted with workshop times. Interestingly, most of the conflicting meetings were scheduled by senior faculty members who had little or no interest in the technology workshops. In the future, ways must be found to ensure that such conflicts will not arise. The 55-minute time slot for the workshops was also problematic. Such a short time period was inadequate for most of the workshop topics. In the future, longer sessions will most likely be added, in addition to the 55-minute sessions.

The Evangelist and the Conscientious Objector - Lessons Learned from Faculty Development

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Abstract: This paper is a report of recent research that included such areas as faculty perceptions towards technology and progress towards integration of technology into teaching. Encouraging faculty participation and ownership of technology integration had both rewards and revelations. Three categories of technology adoption and integration were identified. It was found that encouraging faculty to implement technology in their teaching by providing equipment, training, and release time proved more beneficial than costly

Introduction

In fall of 1997, our college won a grant from a telecommunications and technology company that paid for some new desktop computers, software, projection machines, and most significantly, laptop computers for all faculty in the School of Education and Human Sciences. A crucial component of the grant was that faculty would integrate technology into their instruction in the classroom.

Design of Professional Development

Professional development opportunities were made available for all faculty members. The types of activities offered ranged from seminars to release time. Charter School faculty members have shown great resolve and initiative through their attendance at college-wide and school-wide seminars in technology that are offered by the Office of Academic Computing, Charter School, and Memorial Library. Charter School faculty are actively involved in researching the effects of technologically enhanced environments in the schools. Recent research has included such areas as faculty perceptions towards technology and the effects of multimedia technologies on the quality of classroom instruction. Several faculty were given release time to create technologically enriched environments for their classes.

Pitfalls and Epiphanies of Program Design

Encouraging faculty participation and ownership of technology integration had both rewards and revelations. The initial factor of access was addressed with assigning faculty members a notebook computer for their personal use. Notebook computer funding was grant based and therefore a one-time source of funds. The pitfall found here was related to funds to repair and replace equipment as well as provide notebook computers for new faculty positions. The rapid advances in technology itself also created a situation of functional obsolescence in the computers with no path (or funds) for upgrades. At the time of the initial purchase of notebook computers, the campus network infrastructure was rather fragile and would not easily support added devices nor allow any form of dialup access. This resulted in an appliance that faculty could not use for communication or research and therefore resulted in the notebook becoming a slideshow device. Network interfaces were eventually provided on a check-out basis for the notebook computers thus allowing email, network, and internet access.

Training opportunities were provided in operating system basics as well as application software basics. The initial training sessions were an addition to the existing teaching load and offered in lab environments. A technologist was also hired to work directly with faculty to learn and implement the new technology. In a campus-wide survey on technology, several faculty noted the additional time required to become adequately acquainted with the new toys, yet in every case, the faculty member noted that the time, effort, and "disequillibrium of learning a new way of thinking about learning" (as one professor put it), was worth the accrued benefits.

Following the initial training opportunities several faculty were given a reduction in teaching load to research and implement technology in their teaching. The research was guided by the question, "How does technology affect your area of expertise?" The participating faculty were asked to document their findings, integrate innovative technological applications in their courses, utilize technology in communications with students, and require students to use technological tools in fulfilling course requirements. Although reports from faculty varied widely, most agreed that the opportunity to focus upon technology for an entire semester gave them a chance to lay a foundation for future expansion of technologically-enriched teaching. On the negative side, faculty complaints centered upon equipment and specific software packages.

From an administrative viewpoint, encouraging faculty to implement technology in their teaching by providing a modicum of equipment, training, and release time proved both beneficial and costly. A grant was used to fund the initial technology and professional development. What occurred after the grant was a well justified demand for additional technology from the faculty. The notebook computer opened the classroom for technology integration and created a need for projection devices and network drops in all classrooms. Even though such expenditures were not initially anticipated, the momentum of the faculty made locating new funds absolutely essential. Although mining for dollars to fund projects is a tricky enterprise at best, the enthusiasm of faculty made the task tolerable.

Developments in Technology Uses

The faculty at the Charter School have enhanced many of their courses through technology so that prospective teachers systematically experience the power of digital and other technologies. A major focus of the ways that technology are integrated throughout the curriculum is to ensure that prospective teachers see these technologies being modeled by professors in the teacher education program. A second focus is to familiarize students with these technologies so that they are comfortable in using them in their own teaching. As evidenced by the high demand for projection devices in the building were education faculty teach, use of technology is a matter-of-course. In their assignments, faculty expect students to move beyond the "technology as toy" phase and become innovative producers and users of technology beyond the rudiments of course assignments. The faculty realize that students cannot create an effective cutting-edge lesson without first "seeing how it will fly" in a real classroom. Thus, through their progressively more intense field experiences, students learn to use what they have created in the computer lab in a classroom setting. In this manner, students move from learning about technologies to enhancing instruction through different kinds of technologies.

Categories of Technology Adoption

The levels of technology adoption and integration by the faculty can best be classified into three groups: Evangelist, Balanced, and Conscientious Objector. The evangelist group includes professors that have moved from little or no technology usage to full adoption, including many who insist on implementing some form of technological infusion in each class meeting. The following response in a recent survey of the faculty typifies this mode:

"I think students expect us to use technology as the main mode of instruction now. When we first were all using it, I think they were frustrated with us 'learning' on them! Now I feel funny if I don't use some form of technology in a class. The students appear to appreciate the note pages I hand out, so we can focus on the verbal information and interaction without having to worry about writing down every word. I'd like to infuse more technology with different types of software and applications that are used in the field."

Other "evangelists" have moved their course information to the web, taken technology leadership roles in national organizations, acted as technology consultants for international publications, and begun to share what they have discovered with other faculty. Some "evangelists" continue to seek new and innovative ways of utilizing technology by experimenting with technology as a matter of course in their teaching. For example, one professor who only two years ago pronounced himself a "neo-Luddite" has recently started an online magazine in his field and routinely requires students to read and report on breaking news via his personal message board.

The "balanced" group consists of professors who are comfortable with communicating with students and colleagues using email, searching various on-line databases for research, using some type of presentation software in their lectures, and feel that technology has helped improve their instruction. A survey response from this group stated that "even though the infusion of technology in upper-level classes required a great deal of time and energy, the benefits to the students outweighed the inconvenience."

The "conscientious objector" group was a small percentage of the faculty and could best be described as those that tried to incorporate technology and were not delighted with the time required to learn the new skills nor the results of their technological endeavors. Typical survey responses from this group were related to problems encountered with the equipment, how technology "distracted students," the lack of extended time for one-on-one training, and complaints related to technology services at the college. While the "conscientious objector" might rarely use technology, they did not actively attempt to dissuade other faculty from using technology. Like Bartleby the Scrivener, in regard to becoming technology users, they simply "preferred not to."

Implications for Faculty Development

To reach both the conscientious objector and the evangelist, a program of faculty development must be adaptable and appealing to a diverse group of professionals. Group instruction classes are the usual means for teaching new skills. This method may work well with the "balanced" group but is too limiting for the "evangelists" and too intimating for the "conscientious objectors". A move to individualized instruction is currently under study. This method will utilize both web resources as well as CD-based media. Such individualization would combine access to the college's central help desk with limited one-on-one personalized help from the school's instructional technology staff.

Infusion of technology into teaching requires a different kind of commitment. Because no one-size-fits-all technique exists to enable a faculty a member to comfortably plug technology into teaching, individual faculty must be allowed to research and observe exemplary teachers. While such programs can be found on campus, sometimes faculty are most comfortable leaving town for a few days to watch the different ways that faculty at other institutions employ technology in their teaching.

Perhaps the greatest epiphany of our three years of research is learning the importance of offering useful, welcoming, non-coercive faculty development. A serious commitment to ongoing faculty development is at least as critical to the integration of technology into instruction as providing the machines and the software.

PUZZLED BY TECHNOLOGY PROFESSIONAL DEVELOPMENT? WHICH PIECES FIT IN HIGHER EDUCATION?

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Abstract: The USE Tech Partners Program at West Chester University is geared toward full-scale integration of educational technology in teacher preparation. This program, funded by the U.S. Department of Education's "Preparing Tomorrow's Teachers To Use Technology" grant aims to promote effective technology use in a University–K-12 school partnership. The presentation highlights strategies that have been effective, lessons learned through implementation, and next steps in the project.

Introduction

An important goal for teacher preparation institutions in the first years of the 21st Century is to graduate teachers who can meet national standards of technology integration. To achieve this objective, colleges and universities must insure that their own teachers (i.e. professors) can model the kind of technology integration they want their students to replicate in K-12 classrooms. For many teacher preparation schools, finding feasible ways to help faculty become role models will be a challege: professional development resources are limited, faculty technology skills are just beginning to develop, technology integration at the university level is an unfamiliar concept, and personal incentives are uncertain.

However, driven by the realization that school districts will most quickly hire those candidates who are technology proficient and that the responsibility to educate students for a technological world cannot be ignored, higher education will find ways of addressing these professional development needs. Yet exactly how teacher preparation institutions can best provide the kind of professional development needed by faculty remains a puzzle. The USE Tech project is seeking to identify the pieces of that puzzle during its capacity building year.

Project Background

Undergraduate teacher education has been a primary mission of West Chester University (WCU) from its beginning in 1871. WCU now ranks as the third largest university in southeastern Pennsylvania and teacher education remains the most popular major for both undergraduate and graduate students. Over 600 teachers each year are graduated from WCU teacher-education programs. There are approximately 100 fulltime and adjunct faculty members within the School of Education. Additional faculty from the College of Arts and Sciences (CAS), School of Health Administration and School of Music also help prepare teachers.

At the beginning of the project, only a few teacher education professors were integrating technology into their courses on a regular basis. WCU received a grant from the *Preparing Tomorrow's Teachers to Use Technology* program funded by the U.S. Department of Education. One of the major goals of the project funded by that grant, the Use Tech Partnership Program, is the modeling of technology integration by WCU faculty in both methods and content area courses. To achieve this objective 16 faculty have been awarded released time during Spring semester 2000. These faculty members, with technology skills ranging from novice to advanced, have written proposals describing their plans for technology integration. These plans range from basic ideas such as putting lectures on PowerPoint or using e-mail with their classes to complex schemes for capturing instructional video that will be made into CD-ROMs.

Professional Development Activities

West Chester University is addressing the professional development challenges presented by the needs of those faculty participating in the Use Tech project as well as other faculty who prepare teachers in several ways: by establishing a faculty technology center in the School of Education, as well as by providing skill training, assistance in integrating technology into specific courses, and supportive services.

Faculty Technology Center

Prior to the grant request for proposals, the WCU School of Education had established a Faculty Technology Center (FTC). The FTC loans equipment, provides a technology service, and conducts technology training. Knowledgeable staff from the FTC will assist professors in integrating technology in the specific courses they teach. Although there are other supportive technology services available from the university, the School of Education believes technology support available within their building and oriented toward the specific needs of an education faculty are integral to greater and timely technology integration in teacher preparation courses. The FTC maintains a room in which to conduct training and perform administrative functions.

Technology Skill Development

As part of the grant project, we plan ongoing professional development activities to prepare faculty to model technology integration in their own teaching. This will include both activities that develop technology skills and the ability to integrate technology into existing courses. Workshops and training sessions will be provided on the selection and use of software, the use of peripherals, the use of technology as a tool that focuses on extending thinking and learning skills in students, and the use of Internet resources. Additionally, faculty will explore the use of two-way video to increase connections to the K-12 community and to allow more opportunities for preservice teachers to practice teaching in an on-line environment.

Faculty will identify technology skill areas in which they need further development and training will be provided. Our initial plan is to feature the use of "just-in-time" support to address the immediate technology skill training needs of WCU faculty. Training activities will be ongoing throughout the project -- either one-on-one or in small groups.

Mentoring

Professional development research shows that peer coaching provides additional avenues for teachers to share expertise, perspectives and strategies with each other. Cohen, Talbert & McGlaughlin (1993) point out that "understanding how teachers respond to an ever-changing situation with knowledge that is contextual, interactive, and speculative." For this reason, we believe that faculty development programs should be structured around peer-coaching or mentoring in which the relationship between learner and coach is grounded in actual classroom practice. Learning new practices (such as technology integration), often involves changing old habits that have made teaching comfortable and predictable. A "buddy system" pairing a more experienced technology user with a novice will be established and should be especially helpful in the integration of technology in WCU classrooms.

Integration Strategies
In addition to on-going professional development offered through the FTC, a Technology Integration Institute is planned for the semester break between the Fall (1999) and the Spring (2000) semesters (January10-14, 2000). During this time faculty members will be given time, training, and support in a "How to Infuse Your Course with Technology" workshop. Professors will be asked to attend the conference with their course materials in hand and will be given technical assistance to take the necessary steps forward in becoming technology-integration models for our preservice teachers. Project staff, WCU faculty, and consultants from other universities will lead the institute. Planned events for this workshop include clarification of goals, development of standards by which faculty will measure their technology integration activities and improvements, and workshops on web page basics, creating an online course, and K-12 technology integration.

The 16 participating faculty with released time during Spring semester 2000 will develop and test integration strategies in one or more of their courses. As a result of their activities, the project will detail a set of promising strategies and activities for technology integration in the WCU School of Education and College of Arts and Sciences. We expect the faculty to describe how they use e-mail, the Internet and web-based learning applications, content specific software, and common software productivity tools such as word-processing, spreadsheets, databases, presentation software, and video-conferencing to enhance the learning of preservice teachers. Faculty will explain what strategies best support learning with technology in their courses. By the end of the year, we will have a model of ongoing professional development for technology integration.

Visits to K-12 Classrooms
In order to become role models of technology integration for the teachers they prepare; university faculty must be knowledgeable regarding the use of technology in K-12 schools. After identifying master teachers who are able to serve as exemplary models for technology integration in K-12 schools, faculty will visit their classrooms either in person or via two-way video.

Communication of Successful Activities

A project web page will communicate project activities including preservice teacher technology competencies and strategies and activities for integrating technology into the teacher preparation program. This source of on-going development and communication will become important to the continued success of WCU technology integration as more of our work becomes web-enabled or web based for distance education purposes. By the end of the year, this project web site will post the work of this initiative to the participants or others interested in teacher preparation throughout the world. As a result of this activity, we expect to learn from colleagues who have common interests. Perhaps, through collaboration with others, we will identify enough of the pieces of the higher education professional development puzzle to realize our goal of enabling faculty to become technology-proficient role models.

Lessons Learned about Professional Development

The evaluation for this project will be a formative one. The purpose of the evaluation is to provide information that can help identify any problems and improve project design and management during our capacity building year. With such information in hand, we can adjust project plans for the implementation phase. Since we will focus during our capacity building year mainly on training faculty and developing integration strategies, the evaluation will focus on this emphasis. Key to the formative process will be a systematic effort to document and learn from the ongoing project activities to better understand faculty needs and identify the strategies, which meet them.

While the project is still in its initial stages we are beginning to receive feedback from working with the participants.

- Faculty members have different parts of a shared vision for technology integration and need time to share these ideas with one another. Hearing the same story from the same person in the same way can inspire not all.
- Released time from a course for the specific purpose of improving technology skills and integration of technology into their courses is a good incentive for faculty. Faculty appreciate the time allocated for their own development.

- Faculty can become more interested in technology use when they see their own students modeling technology use in the course they teach. Making technology accessible to students for the purpose of class presentations enables their professors to see how technology might be used.
- Easy access to technology when and where it is needed is very important for higher education faculty. Requirements for advanced planning, complicated sign out systems or movement of equipment from floor to floor creates barrier to use.

Next Steps for the USE Tech Partners Program

We are still in the in the early stages of our project and much remains to be done. During Spring semester, 16 faculty members with reduced course loads will have the time to integrate technology into their courses. The project will support efforts at continuous improvement as they use ISTE/NCATE standards as a guide for their technology integration. Future plans include a scaled-up effort with additional faulty becoming involved and additional activities with K-12 schools that will include both preservice and inservice teachers.

Aids and Cautions for Developers of Web Pages to Supplement Courses in Higher Education

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Abstract: This paper presents a number of problems commonly found in web pages intended to supplement traditional courses in higher education. These technical and content problems limit the usefulness of such pages, and frustrate both students and instructors. The solutions to these problems are simple and can be implemented by any instructor. Some require an elementary knowledge of hypertext markup language (HTML), while others require only an awareness of how common pitfalls can be avoided.

Introduction

The World Wide Web has become ubiquitous in nearly every walk of modern life. An index of the unprecedented growth in size and popularity of the web is the fact that there were fewer than 50 web pages in existence when President Clinton took office. Today, of course, there are literally hundreds of millions of pages, and an early study of popular use patterns revealed that in the first three months of 1995, Internet users spent more time surfing the web than the total combined playback time of all rented videos in the United States and Canada (Masotto 1995)!

Not surprisingly, the web is transformingdiverse elements of our culture, including education. One of the earliest educational movements to be affected was distance education. Only a few years ago, distance education around the world was centered on audio signals, closed circuit television, and videotape. Today, colleges and universities around the world are offering web-based undergraduate and graduate degrees of all types and descriptions. In the future, as web-based, multimedia technologies evolve and improve, distance education will continue to expand its involvement with the web.

Perhaps in the future, there will be web style and design standards that are well-thought-out and widely-accepted. However, no such standards exist today. Consequently, the quality of web pages varies greatly, and the state of the art in education related web pages could justifiably be termed chaotic.. This is true for pages of all types, including (or especially) those associated with higher education courses.

There are two general types of web pages associated with higher education. The first type is more highly developed than the second type, and consists of those pages that are part of higher education courses that are delivered to students completely electronically. These pages are, in general, of higher quality than those associated with the second type, which are those intended to be supplementary to traditional courses.

The reason that many pages for use in totally distance-delivered courses are superior to those that are supplementary to traditional classes, is that many institutions employ both technical and pedagogical experts to help develop such pages. Although such experts do not

always produce excellent pages, either technical or pedagogical, they do often avoid some of the more obvious problems that novice developers frequently make. Individual professors, on the other hand, frequently do not have either the time or the expertise needed to produce even minimally competent pages, and their institutions often provide little if any technical support to help them do so. Consequently, many supplementary web pages are of such poor quality that they are of little use to students, and some are so crudely done that they represent student liabilities rather than assets.

The purpose of the present paper is to present a variety of aids and cautions for developers of web pages that are intended to be supplementary to traditional courses.

Some Common Web Problems and Some Easy Solutions

The widespread availability of HTML editors and translators, together with the lack of institutional support to help instructors develop supplementary pages has resulted in many pages that have been designed and developed without even cursory expertise in HTML (hypertext markup language). Consequently, there are serious technical problems with many web pages.

Many pages lack TITLE tags (a descriptive title located between <TITLE> and </TITLE> in the code for the page). This omission results in popular search engines and directories listing these pages as "UNTITLED" or with titles that are incorrect or misleading.

Other pages lack META tags (tags containing a brief narrative description and list of keywords for use by search engines and directories). This may cause search engines and directories to list such pages in the wrong categories, or to provide descriptions that are not accurate.

Much of the growth and popularity of the web is probably due to the ability of modern browsers to display graphics. However, many pages do not make judicious use of graphics. Developers should remember that many students are equipped with slow, obsolete modems, and even up-to-date, fast modems will be slowed unacceptably by the overuse of graphics. However, good HTML and a little common sense in the choice of graphics can overcome the problem of pages that load too slowly due to graphics problems.

Developers should keep in mind that once an an image has been loaded into a user's browser, it can be used again on that page without reloading time. Therefore, horizontal divider bars and other incidental graphics should be reused whenever possible.

Developers should also take care to include the pixel height and width of all graphics in the image source tag for the page (An example using a graphics file named "bar.gif" might be <IMG SRC="bar.gif" HEIGHT=10 WIDTH=200>). Defining the height and width in this manner will allow each graphic to display as it is loaded, thus providing something for users to see immediately. A lack of height and width specifications will cause the browser to display a blank page until all graphics are loaded.

Then too, the HTML code should make use of the ALT attribute to specify a text description of each graphic for display in case the user views the page with a browser that is not capable of displaying graphics, or in case the user has turned off the browser's graphics display capability in order to speed loading. (The example above might be <IMG SRC="bar.gif" HEIGHT=10 WIDTH=200 ALT="Blue dividing line">

Large images can take several minutes to load, especially by outdated modems. Therefore, large images should always be preceded by small, "thumbnail" images that will

load quickly because of their small size. Then, users who wish to view the large image can click on the thumbnail, and other users are spared the necessity to wait for these images to load. Developers should display the size of the full image below the thumbnail link, so that potential viewers can decide for themselves whether or not the full image is worth the wait.

Web pages should never make use of graphics that must be loaded from another site. Instead, all graphics should be copied and stored in the same place as the files that make use of them. Loading graphics from a different site slows loading unacceptably. Then too, the owner of the site from which the graphic must be downloaded will not appreciate a "hit" on that site every time anyone on the web views any page containing the image. Many graphics sites on the web have been removed or a password system instituted because repeated hits caused by this practice have brought the server down or slowed it unacceptably. (Of course, before copying and displaying any image, developers should make sure that the image is in the public domain, or that the owner has given permission for its use.)

"Imagemaps" (special areas of a graphic that function as links) should be used sparingly, and there should always be alternative, text-based links available. Developers should keep in mind that many students are not highly skilled web users, and some may not realize that areas of graphics can be made to function as links.

Developers should avoid the use of "frames" (an HTML strategy for dividing the browser window into separate displays or windows.) Frames present a number of user problems that can be highly frustrating to students who are web novices. Such students often do not understand that bookmarking a page located in a frame merely stores the frame definition page, rather than the page to which they wish to return. Thus, they may find themselves searching repeatedly for pages they erroneously believe they have already bookmarked. Then too, incompetent HTML frames code can cause any page viewed subsequent to viewing a frames page to appear in a frame within a frame. Novice users are often frustrated by this problem. (Developers should consider the use of HTML tables rather than frames for most uses that require distinct areas featuring separate displays.) If frames are used, the HTML should be written to provide a link to the same material in nonframes format.

Every page should contain a link to the e-mail address of the person or persons to whom problems and suggestions should be reported. Such links should display the full e-mail address, in case users do not have browsers that are properly configured to automatically open blank e-mail messages when such links are chosen. Such users can then copy the e-mail address for use later when they have opened their chosen e-mail application. (An example of code to display a link to the author's e-mail is: <"mailto:maddux@unr.edu">maddux@unr.edu</A>.)

Every page should contain a link at the bottom that will return the user to the top of that page, and to the site "home page." (The home page is the first page that the developer wishes users to view.) A link to the top of the current page saves the user from the necessity to scroll to the top of the page. A link to the home page is necessary to avoid another surprisingly common and frustrating problem - the problem of failing to fully and properly identify pages. It is essential that developers take care to identify institutional and departmental sponsorship of pages. Such identification of sponsorship should be complete and should not involve abbreviations or acronyms of any kind. However, an almost unbelievable number of higher education (and other) web pages contain no identification whatsoever! This often happens because the developer of a given page erroneously assumes

that the page will be found only by those who follow a link found on one of the developer's other pages. However, most pages are not found by "surfing." Instead, most are found by users who type a search string into one of the many popular web search engines or directories. (Search engines are large, automated databases that attempt to include all pages on the web, while directories are smaller databases that include only those pages that have been viewed and categorized by human workers.) Consequently, all pages should be self-contained with respect to identification of institutional and departmental sponsorship. The full names of all institutions and departments should be spelled out at the top of the page, and complete addresses provided. More and more institutions have developed style manuals for use on all official pages, and developers should check to see if such a manual is available. In the absence of an institutional requirement, developers should also include a "footer" at the bottom of every page. This footer should contain an identifier, a link to the institution's home page, a statement as to when the page was last revised, the full URL of the page, and a link to the e-mail of the developer of the page.

Many course pages do not contain a link back to the home page (the "home page" is the first page of a series of pages at a web site). Pages with no link back to the home page are web "dead ends." Viewers of such pages are often unable to locate the home page for the site, particularly if the site does not contain proper identifiers. Again, this problem may be due to web page developers incorrectly assuming that all users will arrive at each of their pages by choosing links located on one of their other pages. Such users who have chosen a link on the site home page can return to that page by clicking on the "back" button of their web browser. However, users who found the page through use of a search engine or directory, and who wish to view the site home page, will be able to do so only if the developer has placed a link to the home page on every one of the site pages.

Many supplementary course pages contain lists of links to other sites that deal with course content. Such links can be extremely helpful to students who wish to view more complex information on a topic, or who need a different approach to the same material. However, many course pages contain links that are no longer active and that produce error messages when they are chosen. This can be highly frustrating to students and may cause many of them to ignore all links provided by their instructor. All links should be checked frequently - probably at least weekly to make sure that they are still functional. "Dead links" should be removed or brought up to date.

Every page at a site should begin with a short statement of the purpose of that page. This will assist the developer in keeping the proper focus as the page is developed. Then too, it will assist students who are looking for the page on the site that contains specific information.

Pages should not be too lengthy. At most, there should be two to three screens of information. If more lengthy information needs to be included, it should be broken into smaller "chunks" and placed on one or more linked pages.

The content of supplementary web pages is also of obvious importance. A recent informal survey of several hundred students in the author's department revealed that students most want lecture notes to be available on the web. Such notes need to appear soon after each lecture, ideally within 24 hours. Students also want full syllabi including grading policies and criteria, a course calendar, and the ability to download all handouts given during class.

Many course pages show inadequate attention to the mechanics of writing. Spelling, punctuation, and grammar should be meticulously checked for accuracy. There is no excuse for educational pages that provide poor models of such mechanics.

Developers should also take care to view their pages in more than one browser. At a minimum, Netscape and Internet Explorer should be used to preview pages. Every browser is slightly different in the way it displays certain elements of HTML. Therefore, developers need to ensure that the page is acceptable when viewed with these two browsers.

Conclusions

Web pages that are supplementary to traditional courses can be highly beneficial to both students and instructors. However, the web is full of pages with serious problems that limit their usefulness. Many of these problems are easy to rectify. This paper has provided a discussion of some of these common problems together with some suggested solutions. For a complete discussion of these and other recommendations, readers are referred to Maddux and Johnson (1997).

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Power Web Searching Techniques for Teacher Educators

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Abstract: Examination of new search tools and techniques that teacher educators can use to improve the efficiency and effectiveness of their own web searching. Techniques to be presented include use of metasearch tools, improving relevance rankings with search engines, backwards searching, searching the invisible web, and use of kids' search tools.

Introduction

Showing students great curriculum-related web resources is a popular activity in many teacher education courses at both the graduate and undergraduate level. Not only does this allow faculty to model the integration of technology into the curriculum, it also gets students excited about the new kinds of resources available. But is it enough? As E.M. Forster said, "Spoon feeding in the long run teaches us nothing but the shape of the spoon." Knowing how to search for web-based information is the critical skill. Unfortunately, searching for web-based information can be a frustrating and time-consuming experience. This paper identifies new search tools and techniques that can be demonstrated to students to improve the efficiency and effectiveness of their searches. Five specific techniques will be highlighted: using metasearch tools to improve the comprehensiveness of web searches, improving search relevance with search engines, backward searching, searching the "invisible web", and using kids' search tools to identify developmentally appropriate resources.

Comprehensive searching with metasearch tools

A recent article in *Nature* (July 8, 1999) by Steve Lawrence and C. Lee Giles received wide attention in the press. Lawrence and Giles examined the World Wide Web in February 1999 and found that publicly indexed web pages had increased to 800 million (up from an estimated 320 million in December 1997). Their article analyzed how well eleven search engines/directories performed in accessing the information contained in those 800 million pages. Lawrence and Giles estimated that the combined coverage of the 11 tools was only 42% of the total web and that the overlap among the search engines was surprisingly low. This research implies that using multiple search engines is a necessity today. Metasearch tools allow us to do just that -- quickly and effectively. Metasearch tools that will be demonstrated include ProFusion (http://www.profusion.com), Metacrawler (http://www.metacrawler.com) and SavvySearch (http://www.savvysearch.com).

Improving search relevance with search engines

Most of us probably have a favorite search tool, such as Yahoo!, Infoseek, or Excite, and there is certainly something to be said for developing a high degree of familiarity with the search features of a single search engine or directory. However, in the rapidly changing world of the web, it is important to be aware of new search tools and the features that they use to try to improve the relevance of results. New search algorithms are developed regularly, usually in conjunction with a new search service.

Google (http://www.google.com) is one of the most exciting search tools available today. Google's search algorithm is based on an approach called PageRank. The FAQ states that, "PageRank capitalizes on the uniquely democratic characteristic of the web by using its vast link structure as an organizational tool. In essence, Google interprets a link from page A to page B as a vote, by page A, for page B. Google assesses a page's importance by the votes it receives. But Google looks at more than sheer volume of votes, or links; it also analyzes the page that casts the vote. Votes cast by pages that are themselves "important" weigh more heavily and help to make other pages "important" (available online at http://www.google.com/why_use.html). Google allows users to capitalize on this by choosing an "I'm feeling lucky" button. When this button is chosen the user is directly linked to the page Google identifies as the most relevant. A search limited to United States government sites is also available through Google.

While Surf Fast (http://www.surffast.com) isn't based on a new searching algorithm, it does provide "one stop shopping" for web searchers. This well organized page provides keyword searching for all of the major search engines, plus quick access to major news organizations and other useful web resources such as Mapquest and Travelocity. Surf Fast can help students understand how important it is to match the

kind of information needed to the search tool. Making this match is crucial in improving search relevance. Search Engine Guide (http://www.searchengineguide.com/) offers similar access to thousands of specialized search engines.

Backward searching

Chris Sherman suggests the term "backward searching" for the technique of using the "link" operator to identify pages linked to the URL that you have entered (http://websearch.about.com/library/weekly/aa082499.htm). The basic idea is that people only add links to sites that they consider highly relevant, although searchers still need to determine whether or not popularity actually equals quality. Backward searching is done using a link operator. Queries are usually structured like this: +link:URL. To assess quality, look over the list of "linking" URLs. Are all of the links from individual pages or are the links from well respected sites like Kathy Schrock's Guide for Educators (http://school.discovery.com/schrockguide/index.html) or the Librarian's Index to the Internet (http://sunsite.berkeley.edu/InternetIndex/)? If you find a promising page and you follow these "backward" links, you get a sense of whether others find the page so useful that they link to it. Backward searching is just one of the many power search tools educators can utilize once they become aware of the advanced search features included in different search engines. Unfortunately it can be a challenge to locate information about using advanced search features. At Infoseek you have to choose advanced search then choose help before you come to this information (http://infoseek.go.com/find?pg=advanced_www.html&ud9=advanced_www).

Searching the "invisible web"

Many resources that are very useful and relevant to teacher education cannot be retrieved using standard web search tools. ERIC, online library catalogs, and archival resources, are examples of resources that are simply not retrieved by the spiders and bots used to build search engine databases. If you have ever spent hours fruitlessly searching for information you're sure is accessible electronically, the information is probably "hidden" on the invisible web. And if students tell you that they couldn't find *even one article* on a common educational topic, they have probably been doing a web search, not searching in a specialized database. Students often do not understand the difference between information on web pages and information found in databases and indexes. Identifying places to search for these "invisible" resources is one step toward developing this understanding.

Direct Search (http://gwis2.circ.gwu.edu/~gprice/direct.htm) is a comprehensive index maintained by Gary Price at George Washington University. Direct Search provides links to a variety of education

specific resources, plus general interest resources including Your Nation (which uses data from the CIA World Fact Book to create customized, comparative statistical profiles for different countries), Termium Plus (billed as the definitive French-English dictionary), and the Writer's Guidelines Database. Lycos provides access to over 300 searchable education databases at http://dir.lycos.com/Reference/Searchable_Databases/Education/. Infomine (http://infomine.ucr.edu/) permits multiple database searching, which is a significant time saver, and it also has two long lists of instructional resource databases (for K-12 and for higher education).

Using kids' search tools

Another common task for teachers and teacher educators is to locate developmentally appropriate resources on curriculum-related topics. One strategy is to design a Boolean query such as "lesson plans AND nutrition AND third grade" and then to try the search with a general search engine. It may be far more efficient to search using kids' search tools. These search tools are directories of resources that have been carefully reviewed and evaluated for accuracy and age-appropriateness. Three examples will be demonstrated: ALFY (http://www.alfy.com), a totally icon-driven search tool designed for pre-readers, Searchopolis (http://www.searchopolis.com), an excellent search tool for elementary and middle grades students, and the Britannica Internet Guide (http://www.britannica.com), which is very useful for high school students. These well organized sites almost always identify relevant sites on the topics commonly taught in K-12 schools. As an added benefit, when students become comfortable with these specialized search tools they will be more inclined to let their own students begin to search the web.

Web searching is a complex activity that requires a considerable amount of knowledge and critical thinking. Learning about new search tools and search strategies that allow teachers to focus on the task and not the tool are important skills.

Interactive PowerPoint for Teachers and Students

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Abstract: PowerPoint has become more than a linear presentation tool. The later versions of PowerPoint support branching navigation, custom buttons and menus. These features make a powerful and flexible product for creating custom lessons. In addition, a PowerPoint show can include Web links, and a variety of files created in other programs. PowerPoint has also streamlined the process of designing for the Web. When using presentation software in the classroom it can be applied for education in three general formats: Teacher to Audience; Teacher to Individual; Student to Audience, depending on the structure of the presentation. Additional two types of interactivity that can be included in any PowerPoint presentation are navigation and feedback. When creating PowerPoint presentation, design considerations should be followed concerning number of items/points, font size, and color applications. Additional the use of multimedia (such as sound, images, and video) is an excellent way to enhance a presentation.

The Presentation

PowerPoint has become much more than a linear presentation tool. The 97 and later versions of PowerPoint support branching navigation, including custom buttons and menus. These features make PowerPoint a powerful and flexible product for creating custom lessons. This tool is useful as an automated kiosk, or as an individualized tutor. It is easier than ever to incorporate multimedia elements such as sound, graphics, animation, photos, and movies into the show. In addition, a PowerPoint show can include Web links, and a variety of files created in other programs. Databases, spreadsheets, and charts are a few examples. Now PowerPoint streamlines the process of designing for the Web, when presentations are saved as HTML files.

Presentation software, such as PowerPoint, can be used for education in three general formats:

1. Teacher to Audience
2. Teacher to Individual
3. Student to Audience

Teacher to Audience presentations involve the teacher, as presenter, sharing information with a class or group, in the classroom or even across the web. A presentation can be used to do more than just transmit information. Other applications include brainstorming, organizing, and reviewing. Benefits of interactive presentations include sensory engagement through multimedia, and easy reuse and updating of saved files.

Teacher to Individual presentations are often delivered by way of a hands-on computer station. Here students or small groups can work on tutorials, interactive lessons with feedback, review, and even testing. Using this approach students, can work at their own pace, and can experience individual remediation or enrichment. This type of program can be run in a computer lab, through a school's network, or via the World Wide Web.

Student to Audience presentations allow a student or group of students to share their learning with their class, their parents, their community, and even the world. By developing a

presentation, students gain extensive experience with organizing information, and they experience the real-world task of communicating knowledge to others.

Design Basics

When creating PowerPoint shows, some design considerations should be kept in mind. These characteristics will make presentations easier to comprehend and make the presenter appear more professional. First, on any slide it's best to use a maximum of six text items as phrases or bullet points. Any more than will cause the text to be too small and to present so many points that it is hard for the audience to keep in mind. With more than five or six points, consider grouping them into subtopics, then present the list for each subtopic as its own side. For purposes of presentation, it is recommended to use clean fonts and large font sizes. Avoid using decorative letter fonts, and instead use the classic Arial or Roman font types. When presenting, a 20-36 point font size is effective for distance reading. Avoid writing in all upper case, even for titles. The shape of a word can make it much easier to decode, and all caps cause all of the words to have the same block shape. Also, since web use has become very common, be sparing in your use of the underline and limit it to URLs and references only. Always choose a few high-contrast colors for the presentation: too many colors can become confusing, and a lack of contrast between the text and background can render the presentation unreadable. While people prefer to read dark text on a light background, light text and dark backgrounds are also acceptable. Ensure that the contrast is sufficient. Finally, consistently test the display of the presentation, along with testing microphones, speakers or any other associated equipment that is needed.

Multimedia

Visual media are extremely effective in education, and their proponents claim that they have great potential for further affecting learning. Many consider that visual media (including audiovisual) hold the greatest hope for the future of education. Regarding the use of multimedia including visual based media Barron and Orwig (1993) discussed reports that the use of multisensory delivery methods are more appropriate than single sense methods as some learners learn better under specific modalities. Since the use of multimedia provides instruction that is delivered to the student through numerous sensory channels, it allows for students of various learning styles to benefit. Others also support this viewpoint by suggesting that the educational setting should be providing a multi-disciplinary approach. In a large review summarizing methods for improving interest in the classroom, Bonwell and Eison (1991), state that the use of visual-based instruction, coupled with opportunities for responses from students, produced significant positive changes in students' attitudes. A multimedia presentation approach can involve the use of a variety of technological components such as video, audio, imaging, and other such materials. Use of multi-sensory multimedia approaches in the classroom has been shown to improve student learning. Studies also seem to indicate that the use of images and video in a presentation presents material within a framework that promotes better recall (Beaver, 1995).

The use of multimedia is an excellent way to enhance a presentation. Use graphics, sound, video, animation, and charts to emphasize the message. Whenever possible, keep multimedia files small, since they will have to load into the presentation computer's RAM before being displayed, and therefore may cause delays or pauses in the presentation. Don't include picture or sounds without purpose. An image or sound that has no bearing on the presentation can often be confusing or distracting. Avoid using repetitive sounds. A short tone is usually acceptable, but something longer that repeats often can be disruptive and distracting.

Multimedia Examples for Inclusion

- Virtual field trips
- Displaying items students need to recognize
- Displaying photos of student performances
- Simulations of processes or events

- Stills from movies
- Scans of documents
- Views through lenses
- Spoken instructions
- Reinforcing feedback
- Vocabulary pronunciation

Interactive Presentations

Educators such as Chickering and Gamson (1987) have stated that "learning is not a spectator sport. Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers." In active learning, students must talk, write, and relate to what they are learning. Overall, a need exists for a modification to the lecture, which has been the historic standard for instruction. Bonwell and Eison (1991) made the point, in their monograph summary of active learning at the higher level, that a major failing point of the traditional lecture is that students remember material presented at the beginning of a lecture better than information presented at the middle or the end. This result means that large amounts of information presented to the students are being lost. To overcome this loss and make instruction better, many are suggesting a shift from the basic lecture to a presentation that is more interactive in its approach. Meyers (1993) considered that active learning derives from two basic assumptions: (1) that learning is by nature an active endeavor, and (2) that different people learn in different ways. Others consider that, simply put, active learning is more likely to take place when students are not only listening; but are also engaged in activities. Students must do more than just listen in active learning: they must be engaged. According to Sims (1985), activities requiring active participation were found to be associated with higher levels of attention than were more passive types of activities. All of these results lend credence to the inclusion of interactivity into presentations.

A method that has been found to be effective in teaching is to shift from a lecture format to one of active learning, where the student has some level of interactivity with the material being presented. Two very easy types of interactivity that can be included in any PowerPoint presentation are navigation and feedback. For navigation, use onscreen buttons and hypertext for a branching structure, allowing the user to visit the sections as they wish or to provide the option to gain more information on topics of interest. For feedback, slides can present questions and offer choices of answers. With proper scripting, when students make choices they are either given feedback on the slide or are taken to new slides that provide information. Benefits for the user of this structure include increased engagement, control, and interest along with immediate response.

A teacher can go even further with interactivity with the use of Visual Basic for Applications (VBA). With VBA, it is possible for a PowerPoint presentation to not only ask and evaluate questions, but also track responses, store information, provide feedback, and generate reports.

How to add interactivity with buttons for navigation or answers:

4. From the Slide Show Menu choose Action Buttons
5. Select button appearance
6. Then choose the action for the button
7. Locate and size button on slide
8. Double-click button to change color
9. Right-click on the button to add text or change action

How to add interactivity through hypertext for menus and links:

10. Highlight text
11. Right-click the selected text to choose Action Settings
12. Select an action for the text, such as:
    link to another slide
    link to another PowerPoint
    open a file

open a specific web page (URL)
run a program
run a macro (or VBA application)
play a sound or video

PowerPoint is capable of more than a linear presentation. By including branching, relative navigation, custom buttons and menus, you can make PowerPoint become so much more than just a presentation application. Understanding how and when to incorporate multimedia elements (sound, graphics, animation, photos, and movies) creates a more interesting and effective presentation. Through the application of Web links, and files created in other programs, information presented in PowerPoint becomes much more dynamic and current.

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Networked Software Support of Staff Development.

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Abstract: We have developed a searchable on-line database of staff development material relating to electronic teaching resources, which operates across the University network. The database is searchable via a simple interface and offers staff with little experience of computing the ability to locate general or subject specific information and then use the resource directly using a simple point and click procedure. This facilitates the distribution of information via a one to many approach and eliminates the redundancy inherent in personalized data mining. The database contains a pool of local resource material, which can be shared between teaching staff. Each item of material is catalogued according to predefined search terms, and single database field allows web links, shortcuts, images and program links to be "dropped" into it. Such an approach makes the database a more personalized information delivery mechanism.

Introduction

The major reasons why the use of computers to deliver teaching material is not more common in university education are well documented but have not yet been fully addressed at least within the United Kingdom. There is a significant lack of knowledge on the part of academic staff as to the pedagogical and technological changes which computers bring to higher education. There is an urgent need at least within the UK for staff development programs that can provide information on this subject and can hasten the management of these changes. Information on, and access to such programs must in our opinion be available from the user's desktop and must take cognizance of an individuals computer skills, teaching style and lecture content.

While the WWW is in theory the obvious delivery mechanism for such information, in its current state it has three restrictions when considered for this task. Firstly the teacher entering this field for the first time will need to acquire information on topics relating to both the teaching/pedagogical role of computers and then to his or her subject specific material. The organization, grouping and indexing of this material can be done in a limited way using the "bookmark" approach, but rapid retrieval of such relatively unstructured information demands some skill and commitment from staff. Secondly, many examples of for example interactive software need to be demonstrated locally and in a manner which allows a high degree of user interactivity. To convince staff that for example a simulator program may be a useful teaching tool needs more than an interactive web page demanding a plugin the user may not have or may not understand how to use. Finally the web approach does not facilitate the sharing of resources and information in the same immediate manner as for example a LAN based application. The situation is changing rapidly and the wider introduction of databases using the web as a query and delivery mechanism will improve information flow. However, we feel there is still a place for a computer program which presents a structured, user friendly approach to the dissemination of validated resources and allows their immediate on-line execution.

We have developed software which combines what we feel is the best of these two approaches. We use a server-based database to collate/index/ and present a simple search interface to staff. The database stores web links, links to server based demonstrations of interactive CAL, non-copyright images, sound and video files, rich text formatted information and links to examples of spreadsheet, presentation and database material. This allows any member of staff to profit from the data mining of another and to share resources.

The program is essentially a word processor/database into which active links can be pasted, grouped where required and indexed. Formatted text on a particular subject can be displayed within a record together with "shortcut links" to relevant web sites, documents, images, etc. As a staff development tool this allows us to deliver a coherent collection of several information resources relating to information on a single subject. Random browsing of the web by staff is reduced since if for example they require information on for example "Computer Adaptive Assessment" they simple key in the phrase and ALL the material which ourselves AND their colleagues have previously researched and entered into the database is available to them.

Operating across the network, staff can either run or download the material. Image files, presentations etc. can be is linked to the staff member who produced them and thus staff can communicate with colleagues if they wish to borrow material for teaching.

We feel that until the use of web –driven database's are common and more staff have a higher degree of skill at downloading and installing software, the opportunity for them to browse or search through a comprehensive database of information will be a valuable asset to our staff development program.

Teacher Educators' Reflections on Using Group Response Technology

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Abstract: The study reported in this paper explored the use of group response technology (GRT) by teacher educators and their reflections on the use of the system with preservice teachers. Five teacher educators used GRT with undergraduate students and then reflected on how the system impacted student participation, class discussions, and instructional planning. Data for the study consisted of instructor interviews. The results suggest that GRT was an efficient means for all students to participate in class and for the instructor to monitor student progress during instruction.

Background

Recent federal initiatives call for the development of teachers who can meaningfully use technology to help students learn (U.S. Department of Education, 1999). Unlike instructional technology diffusion efforts of the past, the focus of the current initiatives is to prepare teachers who understand both the technology and pedagogy and can effectively integrate the two to create learning environments where K-12 students use technology to make meaning. Toward this aim, current initiatives integrally involve teacher educators from all disciplines and not just those in instructional technology. Moreover, current initiatives call for the regular integration of the technology into the teaching and learning activities of all aspects of teacher preparation (U.S. Department of Education, 1999).

In our efforts to move beyond using technology primarily to supplement instruction, we need to develop technology applications that that help solve current challenges in teacher education. One challenge in teacher education is the need to enable active student participation across large groups of students and provide efficient instructor access to student knowledge during instruction. The typical mode of instruction for large groups is lecture (Benjamin, 1991). Although lecturing may be an efficient means of information

dissemination, student participation is passive, at best. Another challenge is the absence of efficient means for instructors to monitor student progress during instruction. Instructors' questions in large classes generally are rhetorical or answered by only a few students. Even if the instructor receives input from some students, it is still difficult to efficiently monitor all students' progress during instruction.

In teacher education, the challenge of creating participatory learning environments and facilitating instructor monitoring is greater because the implications of not doing so are far reaching. Because teachers tend to teach the way they were taught (Lortie, 1975), it is imperative that preservice teachers learn about teaching in cognitively engaging environments where they are active participants.

Group Response Technology

To more fully engage all students during group instruction and provide an efficient means for instructors to monitor student progress, we explored the potential of group response technology (GRT) to support teacher education. GRT is one form of groupware that has potential to enhance the effectiveness of lecture-based instruction (Foegen & Hargrave, 1999). GRT supports efficient communication within a group by collecting input simultaneously from each group member; furthermore, that input can be accessed and reviewed by a single user (Foegen & Hargrave, 1999). Common examples of GRT include audience response systems used in the marketing and entertainment industries.

The GRT system used in our investigation was Discourse®. Discourse, which consists of individual student terminals networked to a teacher's workstation, is a text-based response system that allows students to respond in phrases, complete sentences or even paragraphs. Discourse enables the instructor to obtain feedback during instruction from each student in the class about course content (see Foegen & Hargrave, 1997; Robinson, 1994). The purpose of this article is to describe how teacher education faculty used GRT and their reflections on their use of the system.

Method

Our study examined the perceptions of instructors at a large, Midwestern university as they learned to use Discourse and incorporate it into an undergraduate course. This system was housed in a model "technology classroom" and was supported by a quarter time graduate assistant. During the 1998 fall semester, we recruited seven instructors to participate in the project. Interview data for five of these instructors formed the data set for this study. These instructors (four females, one male) taught a variety of courses ranging from a sophomore level introduction to teaching strategies course to a senior level student teaching seminar. All had graduate degrees (2 doctorates, 3 masters degrees), and each had taught their respective courses during previous semesters. Additional information about the instructors' courses and use of the GRT are presented in Table 1.

Late in the 1998 fall semester, the instructors participated in a Discourse training session. During this 90-minute session, instructors experienced (from the student perspective) several different models for integrating GRT into instruction (e.g., large group discussion, independent practice activities, cooperative group learning). At the close of this

session, the instructors brainstormed ways in which they might incorporate the technology into their 1999 spring semester courses. Each instructor was asked to use GRT a minimum of two times with at least one of his or her undergraduate classes.

During the first few weeks of the 1999 spring semester, the graduate research assistant met individually with the instructors to assist them as they prepared to use GRT with their classes. These activities included practice in operating the system, preparing specific lessons or questions to be pre-programmed into the system for use during class, and basic trouble shooting of the system. Each instructor taught his/her class using GRT at least twice during the semester. Within two weeks of the second use of GRT, data were collected on instructor perceptions.

We gathered data on instructor perceptions using semi-structured interviews. The interviews were conducted by a graduate student (not associated with the group response technology), who used a 17-question protocol to elicit the instructors' reflections. The questions were designed to elicit information regarding instructional purposes, instructional planning and preparation for using GRT, difficulties related to GRT use, and other instructional issues. Sample questions used in the interviews included: What were your expectations for using GRT? What instructional issues did GRT cause you to address when planning your lesson?, and What effects did GRT have on the flow and focus of class discussions? Each interview was 40 to 60 minutes in duration. At the end of the semester, each of the interviews was transcribed.

The purpose of our inquiry was to describe how teacher education faculty used GRT in their courses and explore their reflections on the use of this technology as an instructional tool. More specifically, we wanted to explore their expectations for GRT use, comfort in using GRT, and evaluation of the GRT system. To accomplish this task, we carefully reviewed each instructor's interview, noting instances in which their comments related to the three topics of interest.

Findings

We began our analysis of the data by examining the frequency and manner in which the instructors chose to use GRT. Four instructors used the system two times during the semester; the fifth instructor used GRT three times. A review of interview transcripts indicated that the instructors used the system most often for whole group discussions (N = 4), followed by demonstrations of the system and multiple uses (N = 2 each). Multiple uses referred to class sessions during which the instructor used the system in more than one manner during a single session (e.g., whole group discussion and individual work). The instructors, who used the GRT system in multiple ways, each reported that they used GRT for small group activities and individual student work.

Most commonly, the instructors chose to use GRT to introduce new material. In two cases (Instructors B and C), this was new content related to the methods course; in two other cases (D and E), the "content" of the instructional session was the technology itself. Instructor A chose to use GRT to reinforce previously taught content in preparation for an exam.

Instructor	Course	Lesson Content/Structure by Use of GRT
A	Teaching Strategies (sophomore level)	1) Reinforce and review material for an exam; 2) Instructor provided brief review, asks question, students respond on GRT, answers displayed for all and

		discussed
B	Social Studies Methods (junior/senior level)	Three different lessons, each to introduce a new topic to the class. 1) Modeled a social studies lesson involving group discussion, students used GRT to respond to questions, view others' responses, and discuss responses; 2) Small group activity (one terminal per group): groups respond to questions, followed by public display and discussion of responses; 3) Group and individual responses to activities involving formal reasoning
C	Secondary Reading Methods (junior level)	1) Introduce a new topic (promoting discussion in the classroom); 2) Combination of instructor lecture and student responses to open-ended questions (responses displayed for the class and discussed).
D	Instructional Technology (junior level)	1) Demonstrate features of the system for students pursuing a minor in educational computing; 2) Demonstrate features of the system for students pursuing a minor in educational computing
E	Student Teaching Seminar (senior level)	1) Demonstrate features of the system for student teachers; 2) Provide student teachers an opportunity to experience GRT as students

Table 1: Instructors' courses and use of GRT

Expectations and Instructional Purposes:

Prior to their use of the system, the instructors possessed expectations for the GRT. That is, they expected the technology to contain certain features that would allow them to access and manipulate input gathered from students. Based, in part, on these expectations, the instructors had specific instructional purposes they wanted to achieve through the use of GRT.

Four of the instructors reported that they expected the GRT system to alter class discussions by allowing more students to participate. Instructor A noted, *"... I thought this might be a good way to better hear form those students in my classroom ... who don't speak up regularly in whole class discussions."* Instructor C concurred, *"..I thought the [conversational mode of Discourse] would really assist me in reach[ing] those silent students. Because they tend to be there in our courses."* Instructor E anticipated GRT might alter class discussions because students would read other students' responses as opposed to hearing them. She hypothesized that students might generate higher quality answers when responding in written form, and that this, in turn, would alter class discussions. *"What I was hoping would happen later is students' responses would be more thought out because there*

was that forced automatic wait time. ... so I was hoping it would slow some of those students down to really think of well thought out answers instead of quick answers" (Instructor E).

In addition to altering class discussions, several instructors reported that they wanted to demonstrate new technology to their students and model how the technology can be integrated into regular teaching and learning. As an example, Instructor C remarked, *"I want students to experience technology as a natural part of whatever we're studying."*

Comfort

Of particulate interest to us was the degree of comfort the instructors experienced in preparing for and using GRT for group instruction. For the most part, the instructors reported that they were comfortable using GRT with their students. The greatest source of discomfort stemmed from technical or structural issues with the system. Instructor C reported that her biggest challenge in using Discourse® was remembering specific system commands and to switch between various modes in the system.

Two instructors indicated that the physical structure of the classroom with the GRT system was somewhat awkward and required them to adjust their instructional style. Instructor A commented, *"I felt I had my back or side to the class too much. Because I'm looking at the screen... with more practice I think it would be seamless between me changing the question and talking to my class."* Similarly, Instructor B noted, *"I might be in the back of the room talking and I want to change what's on the screen, so I have to quick run back up to the front of the room.... That alters my style a bit."*

Two instructors indicated that using the GRT changed their planning or preparation for class. Instructor A noted, *"The active participation of students was something I was cognizant of as I was... thinking about how .... I should be using [the study coms] in a way that helps student learn the most they can."* Instructor B also experienced changes in her preparations: *"It impacted the way I presented directions and tasks and information."*

Three of the instructors indicated that use of the GRT in class did impact the pacing and focus in their classes. In the student teaching seminar course, Instructor E was surprised to find that using GRT caused students to focus more on the mechanics of their writing. *"When we have worked on these questions before it was a very intimate close conversation and a lot of positive reinforcement between students. ...the focus changed from being a very cooperative learning and sharing to one of individual thought. ...The students become much more focused on their writing than on each other."* Two instructors reported that the pacing in the course changed because of GRT use. Instructor C found the pace of her class slowed: *"The pacing ... was affected because my students weren't using Discourse on a regular basis. ...they're not all very fast keyboard users. They are really careful about how they say what they say.... So they need more think time before I expect them to start typing."*

Evaluation

Consistent with every type of technology used in the classroom, each of the instructors stated that s/he experienced minor technical problems with the GRT system. The majority of the difficulties stemmed from a lack of familiarity with the system. Other limitations cited by the instructors included becoming proficient in teaching with GRT and

the physical layout of the classroom. Instructor A noted, *"It's hard to practice [teaching with GRT] without an audience unless I'm hitting a study com and also working at the* Instructor B found GRT required changes in her usual patterns of movement within the classroom: *"It's a little bit cumbersome to have to go over to the computer. ...it takes you away from wandering around the desks. ... [Discourse] pretty much glues you to the front of the room so you can manipulate the computer."* The difficulties with the physical layout of the room were also noted by Instructor A, who commented,*" I felt I had my back or side to the class too much."*

Other challenges identified by the instructors included a shift away from focus on content and limited flexibility. Two instructors reported that when using GRT the students began to focus on minor writing concerns and not major subject matter issues. Instructor E indicated that GRT changed class discussions and *"brought out a lot of students' insecurities [about] their writings."* Instructor A pointed out that the GRT system limits spontaneity in the classroom: *"If students come up with a divergent idea, ... [GRT] didn't let us explore an option that could have lead to more learning."*

The instructors cited several positive aspects of using GRT, including monitoring students' responses to instruction and engaging a larger number of students. Instructor A noted, *"It's just a real easy way to scan, see who answered and who was off track, and see who I might have to do so teaching with later."* Instructor B also found the monitoring features to be beneficial: *When I was able to put up samples of students' comments, ... it allowed me to focus on specific things that were said and build off of them and make connections and have the comments visually in front of the students... it provided an accurate representation of what the students said rather than me trying to rephrase it and may be putting my own twist on it unintentionally. I think it influenced [my ability to lead discussions] in a positive way."* In addition, Instructor B found the ability to include all students' responses to be significant: *"..Everyone got to have a say. Whether everybody's [comment] got up on the board or not, I got to see that everybody was things and what they were thinking."*

Conclusions

The purpose of this study was to describe how teacher educators used GRT with undergraduate students and their reflections on their use of the system. Consistent with their expectations, the instructors reported that the use of GRT effected class discussions by increasing the number of students actively involved in class. Two instructors stated that using GRT allowed them to hear from all students and monitor their thinking during class sessions. In addition, two instructors reported that their pacing was slowed due to GRT use.

The instructors stated that, for the most part, they were comfortable using GRT, although it did cause them to alter their instructional style slightly. In their evaluation of the system, the instructors cited several limitations of the GRT system that impacted their instruction. It should be noted that some of the technical limitations cited by the instructors were due to the instructors' lack of experience or fluency in using GRT. As the instructors become more experienced, their perceptions of system limitations may change.

It is clear from the data that the instructors were generally positive about the use of GRT. It is relevant to note, however, that the instructors who participated in this study were first-time users of GRT. Thus, the researchers are cautious regarding implications of the study. In this exploratory study, GRT appeared to meet the challenges of teacher education by providing a participatory learning environment where instructors can efficiently monitor student progress during instruction. To more fully understand the potential of GRT for group

instruction, faculty will need to become more familiar with GRT systems and make them a more natural part of the classroom structure.

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Understanding Graphics for Effective Communication

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Abstract: The use of graphics in screen design by students and teachers alike often fails to achieve real communication. Today's authoring tools allow designers to randomly select and place graphic imagery virtually anywhere in presentations, tutorials, etc. Some graphics are useful and important, others are basically neutral in their effect while others can detract or interfere with messages and ideas being presented. It is important to better understand graphics and how graphics affect screen design in order to improve communication. This paper reports recent research on teachers' use of graphics in HyperStudio screen displays. Graphic displays are analyzed and the use and application of graphic imagery is categorized into discrete levels based on their level of communication.

Introduction

Advancements in computer graphics technology, especially hypermedia, are changing the language of visual communication and defining multidimensional communication models that require new perspectives in information design (Search, 1993). Virtually any screen presentation is now considered passé poorly designed if lacking icons, graphics or other visual imagery. Icons can be used to represent information, concepts and ideas (Borg & Staufenbiel, 1992) and linkages (hotspots) to other information sites. Graphic symbols may only decorate screen displays yet can be used to convey or identify information, summaries or overviews, supplying instructions, and indicate position, size, representation, and more (Pettersson, 1993).

It has been said that a picture is worth a thousand words. In fact, graphics have been described as so information-rich that it is difficult to fully account for the content. Structured or systematic classifications of the communication, information or effectiveness of graphics is even more difficult. Tiemens (1993) provides seven categories to account for visual imagery: (a) duration, (b) transition, (c) framing, (d) view angle, (e) orientation, (f) motion, and (g) content. While this classification system might be useful, Tiemens calls for the need to organize or classify the use and application of graphics and visual imagery to better analyze their value. Communication value, the conveyance of ideas through visual representations, is difficult to analyze and catalog without rules and codes for the application of graphic imagery. Misanchuk and Schwier (1995) further attest to the problem of lacking protocols for guiding the design of graphics and screen imagery for instructional purposes.

Graphics are among numerous important components of screen displays (Schaefermeyer, 1990) from text style to scrolling effects and graphic line design (Aspillaga, 1992). Overall screen design and graphic appearance are also important variables in effective communication and user-interface for hypermedia of all types including web page design (Descy, 1995; Van Brakel, 1995). Research has shown that computer screen displays can affect learning (Costello, 1995; Hathaway, 1984) and retention (Aspillaga, 1991). Even the early years of computer technology in education called for software that would more fully utilize the visual versatility of the medium. Graphics and graphic imagery do affect the learner's understanding of material and provide additional meaning to text displays. But, the role that graphic symbols play in screen design of educational products should also account for the needs of specific audiences (Emery, 1993).

Graphic Appearance

Ready-to-use clip art is available in many software packages and respectable graphics are easily created with drawing tools available on virtually any machine. Yet, graphics can be poorly applied and reduced to achieving a mere decoration or, in worse cases, even distraction from the primary content. There is a need to

actually think visually in spite of current limitations of the medium (Gibbs & Fewell, 1997). Graphics can be abstract lines and figures, or pictures, logos, etc. any of may be intended as realistic or merely representational (Eugenio, 1994).

Philleo (1993) looked at using graphics on buttons and hotspots in HyperCard with middle school kids. He looked at (a) graphic appearance, (b) user curiosity and attention to buttons with graphics, and (c) the relationship between graphic and content. However, the research yielded no significant conclusions other than the general usefulness of the hyper- medium. It left many questions yet to be explored.

Graphics can provide clues to trails and pathways through instructional hypermedia and help to structure the information presented. Graphics may be considered in terms of their design and appearance as well as how well they may be understood (Kearsley, 1988). The cognitive impact of icon design (Lee, 1996) addresses issues of color, size, placement and the inclusion of text in terms of how these elements actually affect understanding. The complete setting, including the background, can affect the recognizability or retrievability (meaningful understanding) of graphic imagery (McNair, 1996).

While graphics can be analyzed intrinsically, it is a common concern of computerized presentations that graphics be considered in terms of the human-computer interface. That is, looking at graphics beyond their mere physical characteristics and considering attention value versus learning and recall, the relationship between packaging and content, and therefore the overall effectiveness of communication (McFarland,1995). Knupfer (1997) examined the use of graphics and icons in web page design as tools for communication, including aesthetics and functionality. Educational and school web sites tended to use text rather than images to present information; sometimes overuse of backgrounds interfered with the overall message. Non-educational sites were similar except that professionally developed commercial sites contained a greater use of animations and more sophisticated graphics

A system for understanding graphics in terms of their communication value is needed. The study below outlines a structured approach in which graphic imagery is categorized into 6 levels of communication from meaningless abstractions to conveying conceptual relationships and compound notions.

The Study

The Course

In-service teachers (n=30) participated in a summer workshop on using HyperStudio. While approximately three-quarters were beginners in using computers, all were new to using HyperStudio and hypermedia in general. The teachers were to create three stacks (hypermedia presentations) during the 6 week course. They were (a) a linear presentation, (b) a virtual tour, and (c) an instructional stack. No specific topics were assigned and no specific parameters were assigned about the percentage of graphic imagery versus text in screen design. The communication value of graphics with examples across all levels described below was presented as well as other communicative aspects of overall screen design.

The linear presentation project called for students to design a relatively brief presentation of 5 to 7 cards (hypermedia screen views) arranged linearly with no hyper-jumps included. This "slide-show" concept was to be consistent with making a presentation to a passive audience in a lecture format. The sophistication of screen design was completely up to the ingenuity of the teachers. Other than small, one-card activities to review tool use and other functions, this was to be the first actual assignment to be completed early in the course.

The virtual tour project (second in the course) called for teachers to create a virtual world of some geographical spatial area that could be toured by the reader. The virtual world was to provide information and a realistic sense of being in that place in terms of geographic locations (forward, back, left, right, in, out, etc.). For example, one might enter the door of an art museum and walk through the rooms or halls to view the exhibits contained inside. This project did not call for an animation component for creating the actual sensation of movement. In other words, this was not to be a simulation of motion and travel. It was instead to be an exploration or expedition through both a topic and a geographical space in which that topic might normally be found. Another example, might be a walk along the boardwalk next to the beach. One might move forward or back, left or right to move from one shop or attraction to the next. Depending on the map or physical orientation involved, one might turn and see the beach as well. The goal of their project was to present information about the sites, attractions and points of interest in that virtual area. Whether that information was to be primarily graphic or textual was left to the teacher.

The instructional stack was intended as a self-guided tutorial or instructional presentation, but in any event, to serve in the process of teaching. Too, it was not to be merely linear as in the first assignment and would thus

need a multidirectional, hyper-linked layout. This assignment was to be more substantial overall, communicate more and better than the first because this was their final work in the course.

Exclusions and Limitations

Many issues are faced in the development of effective screen display: too much or too little, black and white or color, clip-art or hand-drawn, scanned or downloaded, and more. The term graphics is often used to refer to everything from buttons to full-motion video. For this report, the term graphics is meant to include geometric shapes, clip art, drawn or imported images, including black and white, color and even animated graphic images. Furthermore, the term "graphics" addresses generally discrete images as separate entities and thus ignores the potential of combining graphics into a composite or a choreographed symphony of interaction for a combination design or communication effect. Sound, while often an issue in screen design, was not considered except to the extent that a graphic symbol or image may be associated with that sound. Video per se is considered categorically separate from the graphics drawings, images, pictures and icons of this study.

Certainly there are different types of graphics. The distinctions between object-oriented, vector or bit-mapped graphics is irrelevant in this study and more appropriately relates to how such graphics are created than the role they play in screen appearance. Various methods of drawing and creating graphics have both merit and limitations depending on the application and one's personal skills. Sources of graphic imagery are basically irrelevant in this study as the focus is instead on its use and on-screen role and communication value. Distinctions between drawing original images versus using commercial clip-art or downloading imagery from the Internet also have no bearing on display uses and more appropriately relate to issues of availability, ease of acquisition and such.

This paper does not address the operational function of graphic images as programmed objects to perform tasks or as mapped hotspots to execute actions. It is the role of the graphic object and its application to the screen design and communication value that is of interest here. Certainly, programmed functionality can be applied, depending on the software used, to any graphic or portion of a graphic at virtually any level of screen application. For example, a simple 3x5 card frame or picture frame line or image that might be used to contain text or another graphic image, low in communication value, can itself be programmed as a hot-spot in HyperStudio, in HTML Web-page programming and other software packages. Also, an image of gears or pulleys for a display about industry (higher in communication value) might be programmed to execute specific actions, again depending on the software. Nevertheless, the functionality is irrelevant to the role of the graphic design and communication value. There are many important issues about programming functionality into hyper-media applications for graphics as well as text. These issues are better left to another discussion and have little or no real bearing on the levels of graphic use outlined in this paper.

Graphic Communication System

The system involves six levels of use or application of graphic imagery in screen design and communication. These levels represent a hierarchy of sophistication and complexity in the graphic's communication value in screen design. These levels do not rate the sophistication or complexity of the graphic images themselves. Graphics are identified and classified into one of the 6 levels with the notion that higher is better in terms of conveying and representing clear and useful ideas.

It may be that more complex graphic designs would serve better or might be more functional at any of the various levels to achieve the prescribed purpose while the role in communication remains the same. For example, a simple black box frame (level 1) might be sufficient to delimit text from the surrounding screen area. However, a box with gradient color and varied line thickness might somehow serve better in the aesthetics or general appeal of the screen appearance. Another example, a simple, two-dimensional triangular shape (level 5) might be sufficient and effective in instruction, where as, a three-dimensional triangular object with shadow effects might be preferred. In each case the use or application of the graphic object - the role the graphic image plays in the display - would be the same: level 1 versus level 5.

The six levels are detailed below and include a description of examples to assist in evaluating screen designs. Of course, different observers might interpret these descriptions differently.

Level - 1

Includes the most basic, abstract geometric shapes such as boxes, lines, circles, arrows, etc. These graphics are used primarily to establish abstract separations, to delimit screen areas, to create borders, separate text, provide some color, etc. These graphics have no particular appearance other than general geometric shapes and may often decorate screen appearance or focus attention on other screen components.

Level - 2

Includes shapes, clip art and images for purposes similar to level 1 above. These graphics would more likely be specifically designed for the role they play in the screen design. It may be that they're commercially designed (clip art) and thus, their quality may more clearly establish their role and purpose. For example, a picture of a notebook, window or stage, courtyard or patio, etc., which might be used to delimit screen areas, to create borders, provide some color or provide on-screen containers for text or other material.

Level - 3

Includes shapes, clip art and images, drawn or commercial, provided for purposes of decorating the screen. The decorative effect is likely limited to random, ambiguous or very general purposes. For example, the inclusion of a smiley face, stick figure, a star or the sun, etc., all of which serve no specific communication purpose.

Level - 4

Again, this level includes shapes, clip art and images, drawn or commercial. These graphics would be used to decorate a screen display consistent with or to establish a theme. The primary difference from level 3 above is that these graphics seem to focus attention on a particular or specific idea and thereby serve to further that notion. For example, an apple or school house on a screen for teachers, a car or stop light on screen for drivers, a compass or sextant on a screen about explorers, etc.

Level - 5

Again, this level includes Include shapes, clip art and images, drawn or commercial. But; more than merely establishing a theme, these graphics tend to convey ideas and are often objects used in instruction. That is, they may instruct or be referenced in instruction. The images themselves are not mere decoration and are intended as the focus of the display. For example, triangles referenced in instruction on geometry, a clock image for telling time, component parts for constructing machines, etc.

Level - 6

Again, this level includes Include shapes, clip art and images, drawn or commercial. This highest form of graphic imagery is used to communicate specific and more complex ideas and concepts important in the communication. The notion that a picture is worth a 1000 words. Such graphics might include conceptual relationships conveyed in the imagery itself but somewhat more sophisticated than level 5 above. For example, a turning earth used to illustrate planetary rotation, etc.

Results and Discussion

In general, most projects were under developed and involved fewer cards than expected. Hand-drawn graphics were poor in appearance as skills with tools and mouse control were weak. The virtual tour project was somewhat misunderstood and many of the instructional projects were little more than linear presentations and thus lacked sufficient multidirectional linkage. However, these findings were incidental to the graphical classification system being employed in this study.

Graphics were tallied and classified while observing presentations of their completed projects. Figure 1 illustrates that teachers make frequent use of simple shapes like lines and boxes in their screen displays an average of 4.31 times per student across their three projects. This is an interesting comparison with the significantly less average of 1.31 occurrences of level 2 graphics, which can achieve a more or less similar purpose but at a higher quality.

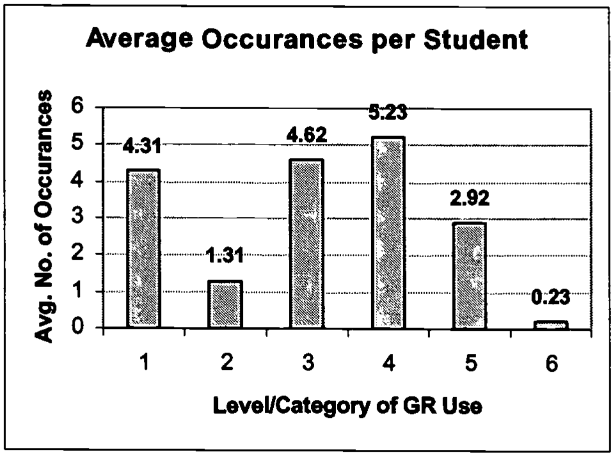

Figure 1: Average occurrences of graphic levels in student HyperStudio projects.

Levels 3 and 4 proved to be the highest occurrences of 4.62 and 5.23 respectively indicating that graphic imagery was typically used for purposes of decorating the screen. There seems to have been a balance between the general or random application of miscellaneous graphics and those used to emphasize or support a theme or topic.

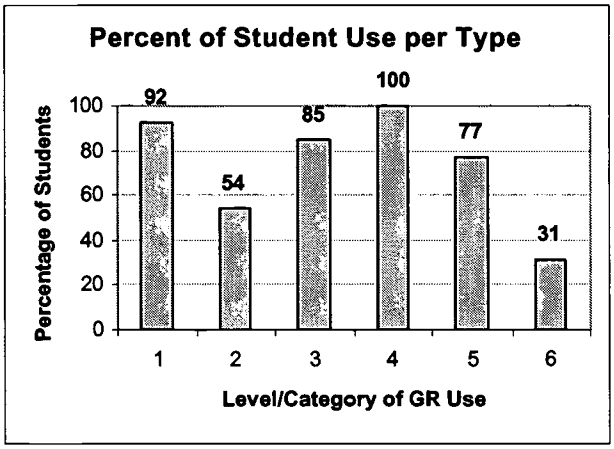

Figure 2: Percentage of students using a graphic level in HyperStudio projects.

Much more infrequent were level 5 graphics (2.92) that might have been referenced in instruction or been used to convey actual ideas. Of course, at 0.28 level 6 graphics were practically nonexistent and the least used out of all categories.

As shown in Figure 2, the quantity of teachers who designed and used graphics of the various types (at least one instance across the three projects) is quite similar across the categories to the averages per student. With 100 percent of the students using type 4 graphics they all thought in terms of using graphics to support a theme or topic. Of course, a low 31 percent of teachers used any graphics that conveyed actual concepts and notions intrinsic to the graphic itself. It is encouraging that 77 percent of teachers had at least one instance of level 5 graphics - imagery used to instruct or assist with instruction.

This study of course provides no standardization or inter-rater reliability and different observers might judge the same screen displays differently. The judgments made in this study, while consistently applied from a single observer, are nevertheless subjective and debatable. This largest form of graphic use from these teachers - levels 3 and 4, decorative graphics - is still considered weak in communication value. Graphic use generally failed to make the shift to becoming functional tools of communication.

The notion that graphics can intrinsically convey complex notions and ideas seems lost on most amateur designers. Teachers almost presume that the very purpose and intent of graphic imagery is merely to decorate in support of a general theme. It may be that these teachers tend to seek a comfortable balance, a kind of moderation, between text and graphics without much effort toward communicating with graphics. Text is readily available and easily applied to virtually any screen area and thus tends to become the preferred method of communicating ideas. As most of these teachers were beginners with computing and hypermedia, a simpler explanation might simply be that their history of communication was predominantly words.

There are of course many interesting questions that can be examined using this categorization method. For example, how do art teachers, who may be comfortable with and experienced in designing graphic and pictorial imagery, compare with language arts or literature teachers in designing hypermedia presentations? Of course, it would be important to examine how teachers can be directed or influenced to think in terms of graphic communication. Virtually any prompt or treatment can be examined with control groups using this system of classifying and understanding how graphics can be made to communicate ideas.

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A Study of Two Online Learning Innovations: Implications for Teacher Education and Professional Development

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Abstract: This paper reports on a study of the implementation of two telelearning projects based on different pedagogical models and using different delivery systems. One of these projects was perceived to be more successfully implemented than the other. By means of a comparative analysis of teachers' reported experiences with the two programs, we illustrate what factors beyond training and support contributed to their relative success and failure, and to describe how these factors interacted with the traditional elements of implementation. A theoretical model of telelearning implementation is then articulated and related to traditional views of program implementation. The paper concludes by considering the implications of the analysis for effective teacher training and professional development in the use of online learning environments in schools.

Introduction

When planning the implementation of technologically innovative classroom projects in schools, administrators and project leaders tend to believe that a project will be successful if teachers are provided with enough training and support for the innovation. Yet, the process of implementing such projects is often not as straightforward as proponents of the technology thought it would be. As Kerr (1996) notes:

> [C]ontrary to the expectations of some pro-technology advocates, the process of adopting new devices and the approaches they make possible is neither rapid nor easy, nor does it automatically lead to the sort of revolutionary restructuring of teaching that proponents have predicted (pp.115-116).

While studies do indicate that traditional support for teachers in the form of training and *in situ* coaching are crucial to a project's success, another consideration has been found to be equally important—the educational practices and contexts within which the use of the technology is embedded.

According to Thérèse Laferrière and her colleagues at Canada's SchoolNet: "effective use of the technology is embedded within practices and activities that realize its functionality for specific purposes and situations…[T]he potential of new technologies is immense, but many conditions are required for this potential to become a reality in classrooms and schools" Bracewell, and Laferrière, 1996). Similarly, Plomp, Brummelhuis and Pelgrum (1997) claim, "…the integration of technology in education depends upon not one factor, but on interconnected elements that will vary according to the level of implementation of technology" (p. 468).

Without consideration of the many interrelated factors associated with the implementation of a new technology, there can be no significant impact on students' learning. As The U.S. Office of Technology Assessment states, "it is becoming increasingly clear that technology in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction" (U.S. Congress Office of Technology Assessment, 1995, p. 57).

The Study

We investigated teachers' perspectives on the implementation of two telelearning projects based on different pedagogical models and using different delivery systems. One of these projects was perceived to be more successfully implemented than the other. By means of a comparative analysis of the two programs, we illustrate what factors beyond training and support contributed to their relative success and failure, and describe how these factors interacted with these two traditional elements of implementation. A theoretical model of telelearning implementation is then articulated and related to traditional views of program implementation. Finally, the implications of this analysis for effective teacher training and professional development in the use of online learning environments in schools are discussed.

The two telelearning programs studied were the Satellite Network Schools (SNS) and Writers in Electronic Residence (WIER). The SNS company links schools via digital satellite to a commercial curriculum content provider headquartered in the United States and offers a collection of over 12,000 videos indexed to the K-12 curriculum. The service included a two-way interactive television channel, development of "custom curriculum", printed curriculum resources, and a selection of interactive software.

Only three Canadian schools were connected to SNS and all were studied during their first and second year of program implementation. A company consultant trained teachers on-site via one and two day workshops on the technical, operational, and (to some extent) pedagogical aspects of the system, and several options were made available for resolving technical problems and providing curriculum selection and development assistance.

WIER, a university-based telelearning project at a mature stage of development (it has been in operation for about ten years), involves up to 120 classes from all across Canada ranging in level from junior elementary to senior high. It uses a network conferencing system to link writing and language arts students to Canadian authors, teachers, and each other for the exchange and discussion of original work. Students "post" drafts, an assigned author reads and responds with comments and revision suggestions, and students also read and respond to work posted by other schools. Teachers are encouraged to do the same.

Training for WIER use consists of an initial two-week online orientation for teachers. Only online and written materials are made available—no in-person training or support is provided. Experienced teachers act as teacher-moderators through an online forum WIER provides for trouble-shooting on technical and program issues.

Method

Semi-structured interviews with school staff were conducted to glean information on the process of program implementation, and its effects, from the teachers' perspectives. For SNS, interviews were held at the beginning of the project and followed up one year later (n=38). For WIER, teachers using the program from eleven participating schools were interviewed. All interviews were audio taped, transcribed, qualitatively coded and analyzed. The focus of analysis for this study was on the teacher-related dimensions of attitude and behavior that contributed to the success or failure of the online program.

Findings

SNS was perceived by most of the interviewees to have had very limited success. In sharp contrast, WIER was praised as having been a very effective online learning experience. Two key factors beyond training and support emerged from our analysis as central in determining a project's perceived outcome: (1) the teachers' perceptions of the value of the program, and (2) the congruence between the pedagogy implicit in the program's design and operation and the teacher's own practices. Our contention is that these two dimensions, together with training and support, played the major role in determining the ultimate success and sustainability of the program.

Initially, SNS appeared highly attractive to most teachers. In practice, the system was complicated to learn, technologically overwhelming, appeared to make too many time demands on teachers relative to the results obtained, and was lacking in quality. The content was often irrelevant, too diluted for the level requested, and often contained errors. The service support staff, although described as friendly and helpful, did not always call back or answer the phone, did not acknowledge or correct errors, had difficulty fulfilling

custom video requests, and were found wanting in subject area expertise. All in all, SNS seemed burdensome to incorporate into the curriculum and practice.

As for WIER, teachers found that the training material and two-week orientation proved sufficient to access and use the conferencing system. Technical support provided by computer teachers or technicians and WIER's forum for questions and issues filled in gaps experienced by teachers. Uploading and downloading material was time intensive; teachers preferred to undertake or closely supervise this task to ensure the appropriateness of all material being posted to conferences. The fit of the WIER timetable to school schedules sometimes made posting difficult and limited extended dialogue between authors and students over several revisions. Also, these posting deadlines or class priorities set by teachers limited time available for reading other students' posted stories.

The perceived value of SNS and WIER also differed. Regarding SNS, teachers felt that the investment of time and effort made to use its resources was generally not worthwhile. Occasionally, the system was useful for the teaching of typically difficult or boring topics but it was mainly employed for learning reinforcement purposes. Lack of Canadian content (accents, metric, word spellings, terms and definitions, law and history, and authors) and grade appropriate material proved significant concerns. The perceived educational value of WIER, however, outweighed the difficulties and limitations it presented. According to the teachers, students of all levels demonstrated an increased motivation to write. The WIER program was seen as offering students a broader and more meaningful audience for their work, heightening the authenticity of the writing process. It was also perceived as allowing students to learn the value of giving and receiving constructive criticism and to absorb new approaches to considering their work on the basis of the comments made by professional authors.

The degree of congruence in pedagogical approach between the teachers' own teaching style and that of the programs also played an instrumental role in the teachers' willingness to incorporate SNS and WIER into their classroom activities. In the case of SNS, senior school board personnel made the decision to adopt the program, and teachers, particularly those teaching mathematics and science, were expected to make use of the service. This pressure coupled with the problems encountered that were discussed earlier, produced frustration— especially since teachers simply were not happy with the fit of the materials to their curriculum and teaching styles. SNS did allow for varied learning opportunities, concept repetition, and support and practice in learning concepts taught by the teacher, but the resources was consistently noted as being pedagogically and curricularly weak. Conversely, the perceived program worth of WIER outweighed the burden it imposed by its rigid scheduling and time demands. The process-writing orientation and professional development it offered was in harmony with ongoing teacher practice— teachers saw that it supported, augmented and increased the efficacy of their pedagogy. Comments by the professional authors validated the teachers' own responses to student work, and teachers appreciated the greater opportunity WIER afforded them to assume more frequently the role of writing facilitator (as opposed to writing grader).

Discussion

Implementation success—or the lack of it—could be attributed to the dialectic relationship amongst the following teacher factors: (1) training and support, (2) the perceived value of the telelearning network in promoting desired educational outcomes, and (3) the congruence of the network with teachers' pedagogical practices. WIER offered educational depth and meaning to both teachers and students. SNS offered some student motivational value but its educational merit was perceived to be lacking and its pedagogical approach was seen as divergent from those practices considered desirable by teachers..

A sequence of events appeared to influence the success of implementation: at first, teachers' initial perceptions of the program determined the amount of time and effort initially devoted to its use. Following the initial experiences with the program in the classroom, continuing use was dependent upon (1) whether the program did or did not match what were considered desirable teaching practices and (2) whether the perceived program value was high or low. The pivotal issue surrounding the extent to which teachers were willing to put the time and effort into developing a mastery of the technology appeared to be the opportunities the program offered for new possibilities for learning and teaching in a manner that the teacher found pedagogically acceptable and practicable.

Our analysis suggests several implications for teacher education and ongoing professional development. First, teachers must be active participants in any decision to participate in online learning initiatives.

Without their active and willing support, implementation is bound to fail, regardless of what support structures and processes are in place. But teachers cannot be expected to make considered decisions without being given the opportunity to develop a thorough understanding of the basic principles, potentials, and limitations that these new learning media present. Both pre-service and in-service teacher education programs need to provide teachers with opportunities to study about and learn with these technologies. Prior acquisition of operational competency can significantly reduce the learning curve for teaching staff when such new learning resources are introduced, decreasing their resistance to innovation. And successful experiences with online learning in conjunction with exposure to a range of potential in-class applications during pre- or in-service education will allow teachers to make more informed decisions about online learning implementation.. Teachers will be better prepared to both contribute to the deliberations when a district or school considers acquiring a new online technology and to make effective use of these new resources. Recent research reviews make it clear out that teachers must have a significant level of knowledge and skill to effectively use online learning environments (Grégoire et al., 1996; Bracewell et al., 1998).

Another implication of this study is that the pedagogy associated with a telelearning network should be largely congruent with that of the vast majority of teachers who will use it, since the degree of congruence appears to be related to implementation success. Significant divergence in pedagogical perspectives can seriously impede implementation. As the Schoolnet review points out, technology infusion "does not diminish the controversies and conflicts that pertain to school improvement efforts. On the contrary, it illuminates existing debates from new positions. It acts as a debate catalyst, as individuals bring to the debate their own perceptions of what technology can do or not, and of what school is about" (Bracewell et al., 1998, p. 22). If (as is often the case) the implementation of online learning is being used as a "Trojan horse" to foster the adoption of a more constructivist or knowledge-building pedagogy, our results indicate that even a well-supported program is unlikely to succeed unless the culture of teaching and learning in the institution is first addressed. Formal and informal teacher education can play a major role in helping teachers become aware of the value of these new perspectives on practice prior to the introduction of new technologies and programs, fostering their willingness to try new approaches and providing them with the more general pedagogical skills that are the necessary foundation for online program success.

A final, related implication is that providing teacher support and assistance is a necessary but not a sufficient condition for implementation success. The necessity of such support is not in question; it has been found in numerous studies to be critical in fostering innovation (Maddin, 1997; Benton Foundation, 1997). But regardless of the amount of support available to teachers, they need to see that a distinct advantage for their students will accrue for the implementation to proceed smoothly. In the present study, we saw that SNS teachers had an abundance of support, yet they were loath to take advantage of it because they did not see sufficient benefit in network use for their students. On the other hand, WIER teachers had a modest level of support, however they took it upon themselves to learn the system because they felt that their students would profit. Therefore, when a telelearning network is implemented, a wise strategy would be to structure network activities so that teachers obtain perceived educational successes with their students early on during the implementation process. This approach would encourage teachers to learn more about the network, either from taking advantage of formal support services or from collegial discussion and sharing. And it would provide a window of opportunity for professional development, by providing staff with the knowledge, experience, and motivation to gradually begin experimenting with variations in their traditional practices and roles.

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Teaching Old Dogs New Tricks

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Abstract: Previous research into classroom life exposes the difficulty of integrating new technologies into teaching. Professors of teacher education courses should prepare students for technologically advanced classroom expectations, but to often these professors do not model the requisite new behaviors. By exploring the relationship between teacher beliefs and teacher resistence to change, a teacher education professor examines her own practice. An action research methodology provides a self case study of a teacher education professor who investigates how to reconcile beliefs about classroom life with the implementation of technology. Teacher beliefs about the nature of the student-teacher relationship, the importance of particular learning experiences, and the context of the classroom impact technology implementation. In the final analysis, the professor-researcher models to students her beliefs, hoping to shape the students' beliefs as future teachers confronted by innovative practice.

Introduction to the Question

Research into life in the classroom exposes deeply traditional dynamics (Lortie, 1975; Lieberman & Miller, 1984; Rosenholtz, 1989). The university classroom is seldom an exception (Schuttloffel, 1998b). Occasionally undergraduate teacher education students who arrive steeped in traditional classroom culture may resist or feel threatened by technology, but more often technological resistance comes from the professor (Cummings, 1995; Schuttloffel, 1998a, 1998b). Professors who have little teaching experience with newer technologies, or have not attempted to explore their usage in their courses, personify this reluctance. This paper presents my latest investigation into how to reconcile teacher beliefs about life in the classroom with the implementation of technology (Robinson, 1995; Schuttloffel, 1994,1998a, 1998b; Zachariades & Killingsworth, 1995). And, in the final analysis, this teacher education professor recognizes a need to model to students transformed practice, thus shaping the student's beliefs as future teachers working in an era of innovation (Smith *et al* 1986; 1987; 1988).

Over the last ten years my investigations into the contributing factors of successful school reform, the acceptance of innovative practice, and change in classroom practice consistently reverts to the beliefs teachers and school leaders treasure as integral to their practice and their being. Beliefs are those undergirding values and philosophical dispositions that provide the basis for decision making about practice (Sergiovanni, 1992). The beliefs of teachers and school leaders either facilitate changes in practice, or by comparison, those beliefs may impede innovation. Mindful decision making is what teachers and school leaders do (Zumwalt, 1989; Schuttloffel, 1999). During the decision-making process, teachers and school leaders who choose to incorporate an innovation into their practice connect the innovation to their belief system. Also, teachers and school leaders may choose to reject an innovation if a change in practice contradicts their fundamental beliefs.

The proposed purpose for technology implementation takes several forms. First, technology provides educators another tool to reach students and serve their needs. Or the integration of technology proposes to expand educational possibilities by transforming learning from the teacher-dominated classroom to a more student-centered environment (Dwyer,1991; Nickerson, 1988; Perelman, 1988). Next, reminiscent of the earlier futurist promises (Papert, 1980), technology serves as a vehicle for the visionary reform of educational institutions at all levels. Lastly, business leaders suggest that by increasing technical knowledge schools graduate a more productive worker for the marketplace. If today's technology promise centers around utilitarian motives, without ever questioning how technology confronts substantive teacher beliefs, how will its successful implementation be determined? The university classroom is an example of this struggle with the purpose for technology implementation.

Pressure for increased integration of technology is an example of an innovation pushing for change in university classroom practice. Sophisticated web technologies challenge the core of traditional teaching practice, including the very concept of a classroom. Uncovering those teacher beliefs that support, or impede, the integration of technology are key to successful change in practice. Numerous studies of innovative practice focus on the technical elements of implementing new methodological approaches evidencing new classroom practice. Often overlooked are the more subtle reasons for the failure of reform efforts, such as teacher beliefs. Could beliefs about the role of teacher and learner, the worthiness of content knowledge, and the ideal of the student product impact a teacher's willingness to undergo the inconveniences demanded by changing their teaching practice? Seeking an answer to this question led me to scrutinize my own beliefs and practice. I recognized that I was doing little to model a change in practice for my teacher-education students. My case study documents my adventure with an innovative technology as an example of connecting my teacher beliefs with my teaching practice.

Methodology: Action Research and a Case Study

Action research bases its methodology on the premise that teachers investigate problems that arise from their classroom practice (Kemmis, & McTaggart, 1982). The question of changing my teaching practice due to new available technology emerged from my own university classroom. Since the education department's teacher-preparation program incorporates numerous action research strategies, this methodology seemed a logical choice. It also facilitated discussion with students and other faculty about what I was attempting to accomplish in my class.
Standard qualitative data collection methods (Wolcott, 1995; Eisner, 1985) were used in the study. For nearly one year I kept a journal account of my experiences including: the development of the course, the problems encountered, solutions or potential solutions, and interactions with assisting individuals. This article shares my self- case study as a teacher education professor with no prior experience with web-based instruction, who seeks to implement a new technology into an undergraduate course.

The Case of Dr. Mimi

The Catholic University of America is a medium size university set in northeast Washington, D.C. The most notable historical fact about the university is that it was created by the United States Catholic Bishops as a research university to provide scholarship for the Church and the nation. Although there exists today a thriving undergraduate college, research is the dominant identity of the institution. Recently there is clear direction from within and without the university to integrate technology into courses and to expand various courses into a web-based medium. Within this environment remarkably little has actually been done within most departments. My suspicion is that while some professors feel inadequate in using more complex technology, others experience an inherent conflict. These professors perceive that technology interferes with their deeply held beliefs about the role of teacher, the teaching-learning dynamic, and the meaning of attending a university.

An apparent dilemma for teacher education professors is the positive endorsement of new technologies for teacher education students while maintaining fairly traditional practice within the teacher-education program. The importance of preparing beginning teachers with a belief system that incorporates a critique of the available technologies seems obvious. This approach is consistent with a reflective framework which underpins the department's teacher-education program (Van Manen, 1977). Providing students model experiences in how one confronts these technologies within their teaching practice has been less readily achieved.

Beliefs. Providing the framework for my case study analysis are five core beliefs about teaching and learning. This list is not exhaustive, but its broad shape comes from my experiences as a student, those of my children, and my diversified teaching career. My twenty-five years in education cross the continuum from preschool to graduate doctoral students, public and parochial schools, as a teacher, school counselor, principal, and professor.

First, I believe students need teachers. Teachers bring knowledge to the context of learning both from their life experience and from advanced study. This rule generally applies to all levels of schooling and in all content areas. In other words, teachers are necessary to help students learn what, when, and how to learn.

My second belief is that students and teachers need to interact with each other. My own teacher training took place during a surge in student-centered classroom practice. Long before constructionism was identified, I learned its substance. For me then, teaching is not just relating information, but creating a learning environment that develops the whole person. Teachers guide students in their search for knowledge by providing maps, directions, and markers. It is fair to say that required undergraduate survey courses are not typically a hot-bed of student-centered learning. Often these classes are too large and impersonal for holistic student growth.

Thirdly, I believe knowledge is both eternal and changing. I accept that there are classics in literature, art, and music that are timeless in their ability to portray the human condition. I also recognize the growing body of biological, geophysical, and psychological knowledge available for exploration today. Even the topics of history and political theory, which might appear as constant, challenges a discussion to questions previously thought to be settled. Consider only the effect of the concept of human rights and how it has evolved and impacted the world in the twentieth century.

Fourth, I believe that students learn from each other. Students often have the ability to clarify concepts so that classmates comprehend. Students working together learn to compliment each other and learn to respect what each person contributes to the learning endeavor. Collaboration is key to problem solving in most settings.

Finally, I believe teaching and learning may take place in a variety of contexts. K-12 teachers readily admit the importance of explorations that take students outside the classroom. Curricular goals are often met in parks, museums, and historical sites. Practicum and student teaching experiences in teacher education programs are typically where students begin to connect theory to practice.

Events. My case study began with my introduction to the potential of web-based technology through a faculty orientation session. I was intrigued with the possibility of making my undergraduate course more user-friendly and supportive of student learning. From my experiences with the nature of sophomore behavior, outside classroom supports seemed like a practical way to meet their many needs. A web-based system of teaching was offered as a tool to meet my needs.

My experiences with learning the web-based technology had five phases: 1) great enthusiasm for what I potentially could accomplish with the web-course, 2) the belief that if I had enough information I could accomplish the task,
3) the bitter realization that even with assistance the task would be time consuming, 4) qualified hope that more time and assistance would allow me to take on a realistic form of the task, and 5) a sense of satisfaction that something had been accomplished and learned

Great Enthusiasm. I first contacted the Center for Planning and Information Technology in February of 1999. Those professionals are in charge of moving campus personnel toward total technological literacy. The director was enthusiastic to assist me in whatever way possible. He assured me that the process was very simple and that after an introductory lesson to the template program, I would be ready to go. I was given a password and my new course was entered into the system. After my discussion with the technology center I was extremely confident. I decided to jump right in and begin putting together my course.

Information is the Key. After I spent an afternoon trying to figure out the directions for beginning the web course I was both annoyed and humiliated. I decided that I needed some tutoring on the process. George was assigned to me. He is a veteran of the university and an experienced technology expert with numerous areas of expertise that more than qualified him for the task of helping me.

Our first session began with my explanation of the unproductive "loop" that I had been caught in while trying to begin the first task in the program. Two and one half hours later George resigned himself to our failure. He admitted that the program was new to him and he thought it would be easier. He apologized profusely about the difficulty of the task and assured me that he would help me get this course up and running by fall.

In April George focused on helping me set up my "welcome page" for the course. More work on the course made it increasingly clear that this was not going to be an easy task, even with George's help. My biggest set-back was realizing that I could not simply enter information into the web-course, each file had to be translated

into a programming language. Then once they were uploaded, these files were not easily changed. To prepare for this process, I returned to my office with a more new information about the program and a 500 page manual.

No Easy Solutions. May arrived and I went to see George in a computer lab where he had an office. I had brought one copy of my syllabus that I had saved in HTML When I opened the file, there were numerous formatting errors. George also pointed out that I should adjust all the material exactly how I wanted it to appear, (scheduling changes, assignments)as changes were difficult after the information files are on the web site. George also told me that he was pretty sure that I could not use my test bank without a means to translate it to HTML

I met with George in early June with all my files sorted and changed to HTML. I believed that it would be a simple process from then on and I would finally see some results from all the work. George was showing me how to upload the files when we came to a roadblock. He worked on it for a long time and then in frustration sent me home. He informed me that he would find out the answer and upload the files. The next time I heard from George, he was very pleased to tell me to look at my web course. He had loaded all my files. The site looked rather impressive to a novice. George assured me that he would be able to teach me how to upload files for myself.

At our next session in late July I brought the rest of the files to complete my course. George admitted that it would be harder than anticipated to upload the files. But, in spite of the loss of three key people, he would be available to do so. He also informed me that it would be helpful to continue to learn more about HTML to assist myself in this project. I then asked George about my other looming concern, the test bank. He informed me that there would be no way to upload the test bank into the template system. Questions would have to be individually entered. George suggested that I convert the files to HTML and circumvent the program's testing module. The new link would not be as efficient ,nor have all the features, but it would be simpler at this stage of the project. I had to take George's advice.

Qualified Hope. When I went to see George in August, I had good news. My old test bank files would not convert, but I had received from my textbook publisher a new test bank that could be converted to RFT and then to HTML I was very excited. George was now convinced that I would be better off to construct the quiz with this system and by-pass the template program's own testing process.

My Foundations of Education class met in late August in a "smart" classroom. I went through the usual introductions, but I added that I was trying to learn more about web-based technology. I pointed out that I would be experimenting with various elements of the process during their course. I wanted them to be aware that this was a learning process for me. They were intrigued by the idea of a web-site with support for the course.

In early September I forwarded my first quiz for George to post on the web-site. I told my class that we would not assemble in the classroom for the quiz. They would take the quiz off the web-site within a set period of time. Students seemed enthusiastic about the freedom. I urged them to use their textbook and notes to thoroughly complete the quiz. George posted the quiz on a Thursday morning.

On Thursday afternoon I received an email from a distraught student. He was concerned because I had posted the answers to the quiz as well as the questions. I contacted George that I needed to make a correction on the quiz upload. Fortunately, he was available to make the correction very quickly.

Learning and Satisfaction Shared. The next time my class met I informed them that the first quiz had answers posted for the first day. I also chided them for procrastinating and missing this golden opportunity! Then I shifted my discussion to my own difficulties with trying out new technology that I was not completely familiar with. My intention was to raise in students' consciousness the belief that teachers continue to learn by investigating new knowledge throughout their careers.

Throughout the remainder of the semester there were no more startling events with the quizzes. Students learn to use the information I provided, but more importantly I learned how to communicate any difficulties I was having with the web-course or the other available technical equipment.

Reflections on the Case Study

Reflection is a key element in action research (Ross, Bondy, & Kyle, 1993). Building upon Van Manen's three levels of reflection (1977) as a framework, I encourage my teacher education students to investigate inherent dilemmas in teaching practice. In the same manner, by reflecting critically on my teaching beliefs, the influence of values and educational philosophy reveals its impact on decision making that affect my teaching practice. The connection between beliefs as isolated theory or ideals and daily practice takes place at the interpretive level of reflection. My case study experiences exhibit my desire to communicate a clear message to students about the role of teacher and the teaching profession. I wanted my students to see teachers as persons who grow throughout their careers by exploring new knowledge and practice. At a technical level of reflection, I wanted my students to see teaching as a profession that requires continual updating and renewal in order to give students the benefits of current research and technological advancements, for example, my learning how to use web-based technology. My actions characterized my beliefs, sent messages, and attempted to create a particular meaning for teaching. My beliefs also required me to do something that was new, difficult, and ultimately changed my teaching practice.

An analysis of my introductory experiences with web-based technology provides some insights into how the web-based technology interfaced with my five beliefs about teaching and learning. First, I believe that teachers are necessary. This belief was exemplified in two ways during the case experiences. I desperately needed George as my teacher. He made it possible for me to leave the safe haven of my known terrain in teaching and move into a less familiar landscape which required new information. I also believed that my students needed me to teach them about life long learning as a role model learning a new methodology. I wanted the students to be aware of my experiences as a vehicle of my beliefs. I hoped that my actions would assist my students in identifying with me as a learner.

My second belief, that of the importance of teacher-student interactions, was given a boost by my emphasis in the usage of the course bulletin board and my own email address. I encouraged and received numerous communications from students. I was forced to consider the possibility that some students preferred the anonymity of email to visiting with me face to face. Interactions were supported through this experience and I was comforted.

My belief in the nature of knowledge as both eternal and changing, was less challenged by this experience than the methodological choices that determine how that knowledge is taught. The content of the course remained substantially the same, but the focus of attention shifted more accurately to reflect my curricular priorities. I believe further refinement of the web-based course will reinforce my efforts to arrive at the core material for this course.

I do not believe that I fully explored how to better create an environment within the classroom or within the web to facilitate peer learning. I think there are many possibilities and students are eager to consider them.

By allowing the students to take their quizzes out of the classroom I hoped to communicate my belief that learning takes place in many settings. The school site visits supported this belief. Again I think there is much room for growth in this area and it requires some imagination on my part to expand the classroom even further.

This case study points to the importance of continuing research on teaching and learning in technology-rich environments, the implications of transforming the traditional university, and the impact of professorial beliefs on such a transformation. A more thorough reflection on these complex issues is required before making university-wide decisions about technology implementation.

It is possible to teach an old dog new tricks, with care and treats.

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Frustration Among Educators About IT Use

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Abstract: In this paper we describe a research project in progress about IT use in education. Today educators feel frustrated about the way IT is adopted. In the paper we suggest how to initiate a discussion among educators to facilitate the start of a more substantial adoption of IT in educational practice.

Introduction and Background

An information society is emerging and information technology (IT) is an important part in this new society. The importance of IT is of course recognized in the Swedish education system. Community leaders, school boards, legislators, parents, etc., proclaim the value of this technology. Therefore, a large number of schools have an advanced infrastructure of computers and networks. By this, schools ensure that students are exposed to information technology since it will be a major part of their future lives. However, many teachers have no chance to assimilate and explore the technology on their own terms, and as a result of this, the use of IT in Swedish schools is limited. This is a problem.

We have a tough economy to deal with within the comprehensive schools, in Sweden. The resources allocated to schools depend on how many pupils there are and if the school has a need for extra money due to different kind of problems, e.g. dyslexia. Despite the advanced infrastructure it is a fact that each school still has to deal with choosing whether to buy new books to the pupils, or see to that there are enough pencils.

This is hardly anything unique for Sweden, but Sweden has come quite far when it comes to using IT in education. This means that the schools now also have to deal with how to afford to use the existing infrastructure with their already limited budget.

Schools receive funding to ensure that computers and networks are installed at the schools. However if the educators do not know how to use the new technology, it might even happen that the computers remain unpacked. Too often computers are used in the same way as typewriters.

The problem

The form of schools and education has remained fairly unchanged over hundreds of years, and so has the technology used in teaching, despite both pedagogical and technological influences.

Today the culture of the educational system and its technology is challenged. IT is here the main vehicle for implementing change and may help bring about some important reforms (Barker and Dickson, 1996). Just providing schools with an infrastructure, of computers and networks, will not have the desired effect.

It is not only IT itself that makes the chances. Educators need to know *how* to use IT, in a pedagogical well-grounded way. With the rapid development of IT this is certainly a dilemma and it is a *growing*

frustration among the educators. Those who are very enthusiastic about using IT also have to convince those who are skeptical about IT.

The educators are also instructed by the government to use IT, but the government does not say anything about how to find the time needed for reflecting upon this. Today, with the already heavy burdens for educators, there is certainly not enough time.

What has been done?

Below we give four examples what has been done in schools, about this undesired situation.

- There are several successful pilot projects that are working very well. Unfortunately they tend to be only pilot projects, not having a broad impact on the regular educational practice.
- Often the educators at a school are requested to take a *course* in the basic use of a computer, like word processing. Even though the educators learn something themselves, it is difficult to find that course relevant, compared to how you want to use IT as a pedagogical tool with your pupils. There are few courses made for educators with a pedagogical aspect on how to use IT with the pupils.
- Commonly one person at the school is appointed to be responsible for IT. This person is to be the link between IT, the field of applications and the educators. Normally that person has very limited education about IT and the support is therefore often quite poor. There is also a lack of time for working with these issues, even though it is well known that this area is very time wasting working with.
- Outsiders have tried to introduce IT into schools. After proclaiming its potential in the classroom, the educators use IT only slightly, if they do not really burn for using IT as a pedagogical tool. If they have not much knowledge about IT, it is reasonable to think that they find it time-consuming trying to understand IT while they have to do the daily work to. Above that they have to find out the pedagogical possibilities with IT.

What should be done?

With a situation as described above we claim that awareness of the problems with information technology in schools is necessary and that a structured interaction among teachers is a fruitful starting point. To gain commitment and firmly establish a constructive climate, all decisions must come from the educators themselves.

Therefore we suggest PIER (Nuldén and Scheepers, 1999a, 1999b) as an appropriate methodology to approach the problem.
PIER is based on four concepts: Problem based learning, Interactive multimedia, Experiential learning and Role-playing.

1. In problem based learning (PBL) the starting point of learning is a real world phenomenon or problem the learner wishes to understand or learn more about.
2. A great deal of attention has been focused on interactive multimedia, especially within the educational domain. Many educational institutions have produced different types of educational interactive multimedia courseware to replace or enhance educational activities.
3. Experiential learning refers to an encounter that the learner experiences and from this encounter learning is initiated.
4. By role-playing the participants use their own experiences and their assigned roles, while understanding problematic situations.

PIER follows four phases as outlined below. How PIER is applied in this research is described in the next section.

Phase one.	Experience. A group of people experiences a problematic situation through role-playing in a multimedia scenario. The duration of this activity is three hours.
Phase two.	Individual reflection. Duration one week.
Phase three.	Debriefing and discussion. The group meets together with the facilitator and discusses the situation presented in the scenario and further action is outlined. Duration two hours.
Phase four.	Using their experiences from phase 1 to 3, to start creating a change of the phenomenon or problem the learner wished to understand or learn more about e.g. how to use IT in the pedagogical best way at their school. A continuous learning-process.

Table 1: The framework of PIER.

Reflection is an important aspect of the framework for PIER. There are three different types of reflections that apply to the PIER methodology. First there is reflection-in-action, reflection that is made during the enacting of the scenario in activity one. Reflection on what happened during activity one, i.e. reflection-on-action, is done during activity two and is discussed at the seminar in action three. Reflection-for-action, i.e. thoughts about how to use the knowledge gained by the experience in a future situation are initiated during activity three.

PIER – in this research

PIER can be used to get the educators to engage in constructive discussions about IT use. In this section, we describe how PIER will be used with educators in Swedish schools.

Phase one - Experience

Between five and eight persons are role-playing guided by a multimedia-scenario. The participants can choose whether they want to play themselves in the scenario, if they want to hide behind their role character or a combination of those. The scenario is created specially for this group of participants, with their problematic situation about IT use, as a background.

The scenario begins with giving the group some information about where they are, what time it is and their role-character in this scenario; e.g. you are in your school where you work as the headmaster. It is in the beginning of the term and your school has been given 20 computers. Now you should use them in the best way. How?

The entire situation is similar to the reality at the participants' work place and by that the participants have to discuss together and try to find solutions about the same questions, as they have to confront every day. They also have to make a lot of choices during the scenario. For instance if they should use IT in every classroom or in a certain room? Who are allowed to use IT and what purposes should IT be used for?

During the scenario, multimedia is used to make things clearer; e.g. a video to show more information and guidance, virtual persons are saying controversial things and photos are shown to create a certain feeling in the group.

The scenario does not give the participants any solutions and it ends in a cliffhanger, abruptly, with more questions than answers.

Phase two – Individual Reflection

After the scenario the participants are left by their own, for about a week, to reflect on their experiences.

Phase three – Debriefing and Discussion

After a week the participants meet again to discuss the scenario – how they felt during the role-play and what happened. They also talk about their own daily situation at work and what can be done to change it. After the scenario the participants have got many ideas how to continue, and a plan for the future can easily be made.

Phase four - The Evolution of the Experiences Based on the Earlier Activities.

Further on, the plan for the future is the starting-point for using their experiences in their daily life.

How to continue

The scenario is not a solution by itself. It is a starting point for further discussions. When the questions the participants might have been thinking about for a long time, are raised during a three hours scenario, new questions are evolved and probably the further discussions will help them to find alternative solutions of the problems.

The effects continue to develop further discussions and less frustrated educators, but also that the participants have found new areas where IT is very useful as a pedagogical instrument.

Future work

The motivation for our research project is the fact that a large number of schools in Sweden have an advanced infrastructure of computers and networks, but the use is limited. In this paper it is suggested how to initiate a discussion among educators to facilitate the start of a more substantial adoption of IT in educational practice and by that making the educators less frustrated about IT use.

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The Impact of Information and Communication Technology (ICT) on Job Characteristics of South African University Academics

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Abstract: A study was recently carried out on the use of Information and Communication Technology (ICT) by South African University Academics. The impact of ICT on job characteristics of academics - teaching, research and to a lesser extent, administrative duties was investigated. Academics at the University of Fort Hare, South Africa's oldest and first historically black institution (HBI) were tested in this exercise. Realizing that South Africa's HBIs exhibit a lot of commonalties in structure, operation and management, no doubt, this study strongly reflects the general situation with this country's HBIs. Academics across all disciplines and hierarchy were included in this questionnaire survey supplemented by interviews. Results indicate an established need for ICTs, a general lack of adequate computer facilities, low level of computer literacy among academics, a need for training in ICTs, high level of unreliability in networking allowing access to the use of the INTERNET, and the non-existence of ICT policies for computer equipment upgrades, hardware and software purchases and training. Albeit, it was evident from the study that academics with adequate knowledge of the use and application of ICT in their jobs did record significant improvement in the discharge of duties.

Introduction

The organisational world has over the past twenty years witnessed a revolution in work practices, brought about by developments in Information Technology (IT). Drucker (1986) describes present organisations as "information based" and those who work in them as "knowledge workers". The new IT, either computer-based, computer-related, or computer-influenced - today reaches into all kinds and sizes of enterprises, in every conceivable industry and specialized activity and with a multiplicity of options from which a user can choose whatever suits his particular needs. For many years, it has been quite clear that technology not only changes the structure and nature of organisations but also change the way people do their jobs and to some extent the way individuals in organisations view themselves in the context of the society (Irving and Higgins, 1991). Irving and Higgins (1991) went further to affirm that IT affects the nature, quality and perhaps the frequency of communication in an organisation. They explain that as more people become oriented toward terminals, communications may tend to be more impersonal through the use of the electronic mail.

Universities have been major users of computing since the latter first appeared. In recent years, they have also become leading users of networking. In the UK for example, the creation of JANET (Joint Academic Network) in the latter part of the 1980s encouraged a diversity of networking activities. At the end of the 1980s, a discussion of the "electronic campus" in the UK found no difficulty in reaching the conclusion that information technology (meaning especially the combination of computers and networks) would have an increasing impact on all the main strands of higher education - teaching, research and administration - during the 1990s (Brindley, 1989).

Several studies have been carried out in the past decade to look at the role ICT plays on University campuses. The way academics react to their institutions' ICT changing environment and the role this technology plays generally in University affairs have been issues researched in the past and still receiving attention. In developing countries, however,

the obvious problem of insufficient finances for the purchase of computer equipment cannot be overlooked. Many institutions cannot afford to provide either the equipment or the infrastuctural support, nor do they usually command the necessary resources of skilled manpower. However, some developing countries (sometimes distinguished as "third world", rather than the "fourth world") do have the potential for overcoming these obstacles in the foreseeable future (Bukhari and Meadows, 1992). Like Universities in developed countries of the world, many South African Universities are making the same kind of transition to ICT. The present paper investigates the impact ICT has on academics' job functions - teaching, research and administration - in South Africa's Historically Black Institutions (HBIs).

The Method

A survey was carried out at the University of Fort Hare with the use of questionnaires supplemented where necessary by interviews to determine a number of issues relating basically the University of Fort Hare academic, his/her job characteristics and role ICT plays in this regard. Specifically, the study determined:

- the level of accessibility of academics to ICT in the form of computers and internet connectivity;
- the level of use of ICTs;
- know-how regarding the use of ICTs;
- to what extent (if at all) ICTs influence their job functions - teaching, research and administrative.

This study we believe couldn't have been better timed, especially considering the financial state of tertiary institutions in South Africa, especially the HBIs. Its interesting to know also that donor agencies: the European Union, Cannon Collins Educational Foundation of the UK, Community H.E.A.R.T foundation of the UK, America's Andrew Mellon Foundation are among those actively contributing computer hardware among others products towards the development of tertiary institutions in South Africa. The significance of these technologies in the South African educational sector cannot therefore be over-emphasized. The questionnaire survey carried out by Igonor and Makalima(1999) involved the distribution of 40 questionnaires with a 95% response rate. Academics ranking from Professors down to Junior lecturers and tutors were surveyed in the exercise. The questionnaire tested areas such as -

- Information Technology available, in use and the extent of use;
- Information Needs of University Academics;
- Computer Literacy among academics;
- Relevance of Information Technology (computers and networks) in academics' operations and its impact on teaching, research and the performance of administrative duties.

The University of Fort Hare -
South Africa's First Historical Black Institution (HBI)

The University of Fort Hare has a strong missionary background. In 1878, there was a proposal by James Stewart of the Lovedale Institute for the establishment of a college of higher education for South Africa's black students. Due to the Anglo-Boer and World wars, the formation of this college was not until 1914. The college was taken over in 1946 by the Rhodes University in Grahamstown and was named the University College of Fort Hare. After the 1948 elections, Bantu education was extended to tertiary level and the college was

placed under the supervision of the University of South Africa. In 1970, the University College became autonomous and then named the University of Fort Hare. The institution is located in the rural town of Alice, in the Eastern Cape province of South Africa.

University Academics' Job Characteristics and ICT

Job functions of University Academics involve basically teaching, research and the performance of administrative duties. It is important that academics not only keep abreast of developments and current trends in their various fields, but also facilitate qualitative and up-to-date learning processes and produce lifelong independent fully baked graduates.

It is a cliché to say that university academics are by nature information-oriented. The quest for information is not new, it is characteristic of all people whether the need be articulated or not. In the words of Coggin (1979), access to information can be a matter of life or death for an individual. Information needs do not arise in a vacuum, they are constant, persistent by-products of life in modern society. Day-to-day need for information is always the child of a specific situation. With a changing, complex society, formerly simple solutions to information need become more complicated. Where to turn for expert information and how to determine which expert advice are questions facing many people today - academics inclusive. Saying that every society needs a basic minimum stock of usable information to survive will be understated. Every society needs to acquire, store and exchange this basic stock of information to allow it to survive. Similarly for the academic to carry out its obligations - teaching, research and administrative - access to reliable information is not negotiable. The means to getting access to this information is yet another challenge. Access knowledge and use of ICT in developed countries is seen as part of normal scenario in almost of every societal sector. In developing countries, including South Africa, the situation presents itself differently. Of particular interest is the case with South African black institutions that have suffered from apartheid government. Many Universities in developing countries, including these South African HBIs cannot afford to provide either computer equipment, or the infrastructure support; nor do they usually command the necessary resources of skilled manpower. However, coupled with the growing quantity of information are the development of technologies which enable the storage, retrieval and delivery of more information with greater speed to more locations than has ever been possible. Computer technology makes it possible to store vast amounts of data in machine-readable files and to program computers to locate specific information within data files. Telecommunications developments enable the sending of messages via tv, radio e-mail to bombard people with multitudes of messages. The Internet, a vast storehouse of information covering various subjects is also a by-product of this computer technology. Universities have in fact been users of this technology for a long time now. In fact, Woodworths (1991) argues that academic departments in colleges and universities have diminishing needs for typists and filing clerks as Local Area Networks, universal access to word processing, electronic mail and desktop publishing are introduced. In the words of Jungk (1972): In this world of change and complexity where the need for information upon which to base personal decisions is of greatest importance; in this world of huge amounts of information and sophisticated technology to help in retrieving and delivering the exact information needed; in this world which is entering a post-industrial age or knowledge-based era; in this world of the 1980s, "information, its lack and availability, its use and misuses, its treatment and transfer and last but not the least, its possession may well be a crucial factor in our evolutionary crisis".

The importance of information for the survival of the university academic cannot truly be over-emphasized and the means to having access and succeeding in this regard very well depends on the capabilities of information and communication technologies. Those people who have accurate, reliable and up–to-date information to solve day-to-day problems, the critical problems of their business, social and family life, not to mention academics' need for research and teaching, will indeed survive and succeed. "Knowledge is Power" - the truest saying of the 80s may well be true for the 90s, and access to information (thanks to ICTs) may be the most critical requirement of all people.

Result

IT available and in use

The available IT tools and in use from the result of the survey is summarised in table 1 below:

IT Tools available	Number of users	%	Number of non-users	%
Computers	31	81.6	7	18.4
Telephone	38	100	0	0
Mobile phone	32	84.2	6	15.8

Table 1: IT available and rate of use.

While the above table reveals IT tools available, the state of these technologies is yet another issue which might just not be part of the scope of this report. 81.6% of academic staff members make use of computers in their jobs. The percentage of non-users (18.4%) may be due to a number of reasons; notably - no access to computers, or that they possess their personal computers and would rather prefer to work from them, or do not possess sufficient knowledge to use computers and are therefore not bothered. No doubt, academics need computers in order to function effectively and efficiently. Eraut (1991) well supports this arguing that IT has several effects on teaching, because of the availability of vast amount of data and also increasing need for proper education in putting the information to intelligent use.

The computers available to academics are used for a variety of purposes. The survey revealed that academics need computers

- for teaching purposes; word processing lecture notes, calculating student scores and r administrative purposes;
- for Internet connection; the Internet is indeed rich in a lot of information and academics need access to this fastest growing database. Information on research done in various parts of the world and teaching methods can all be accessed here;
- to link library online public access catalogues via telnet;
- access CD-ROMs and also other online journal databases;
- to communicate with the use of the electronic mail system. Electronic mails are used for exchanging information between colleagues, friends and families within and outside the institutions;

- Computers linked to the Internet provide a fast and easy access to reliable and up-to-date information.

Mwawenda (1997) clearly states that research; publication, teaching and administration are some of the functions of academics, with research being the most important. Atkin (1991) further stresses this, arguing that research has been identified as not only a primary function of a university but also an integral aspect of the work of academics. In a world where research and publications are used as criteria for promotion and the determination of the best academics, the potential of the computer in making available information tappable cannot therefore be over-emphasized.
The table below quickly indicates the proportion of work done by academics using computers.

Task	No.	%
Exchange of e-mail messages within the university	26	68.4
Exchange of e-mail messages outside the university	29	76.3
Exchange of data with colleagues within and outside the university	21	55.3
Statistical analysis of data	13	34.2
Word processing	26	68.4
Searching online databases	21	55.3

Table 2: Proportion of work done on computers and the rate of usage.

The value of the e-mail to the academic is most reflected in the following ways:

- an enhancement of the freedom of expression among employers and employees;
- saves time;
- saves costs;
- fosters communication between staff and students;
- unlimited in potential audience size;
- breakdown of bureaucracies associated with communication.

Computer Literacy among Academics

Table 3 below gives an indication of computer literacy among academics surveyed in this study.

	No. of respondents	%
No knowledge of computers	1	2.6

Little knowledge	4	10.5
Basic knowledge	23	60.5
Extensive knowledge	10	26.3
Total	38	100

Table 3: Level of computer literacy among academics

The table above indicates that academics have a slightly above average knowledge level of computers and their use. Basic knowledge in this case refers to performing of basic tasks such as word processing with Ms-word and Word-perfect, use of e-mail and very little knowledge of information searching and retrieval form the World Wide Web. As already mentioned, most developing nations lack the required capacity to train and develop adequate human resources. Computer literacy training among academics is a necessity otherwise they 'd be left behind as new computer technologies evolve. Computer literacy skills are essential skills for academics especially as the society has come to depend on electronic text. Skills such as finding, manipulating and scanning electronic documents as well as word processing, Internet use and typing are basic training components to be covered here.

ICT and its relevance in teaching, research and the performance of administrative_duties

The relevance of ICT in the operations of academics is manifest in a number of ways. ICT has made it possible for academics to have access to online journals, the online public access catalogues (OPAC) of libraries, the world wide web and also CD-ROM accessible databases. Some of the questions we sought answers for relating this section of the study included:

- In what ways has ICT influenced individual access to information?
- Does ICT in any way influence academic-related decision-making issues?
- How does ICT then impact on academic performance in terms of job efficiency and effectiveness?

Questions of this nature are quite unlimited, but we do know that it's an established fact that academics' do need information to survive. The relevance of the World Wide Web in meeting the needs of academics cannot be totally explored. The Internet which was initially developed by the United States Military, has now grown from a tool of small group of scientific researchers to development of substantive sites covering a breadth of topics useful for teaching, research, entertainment, to mention a few. Types of materials covered include secondary, teaching, and reference and news sources. With the availability of scientific journals, online, several functions or observations could be emphasized -

- it makes it possible to build a knowledge base. Journals serve the most basic functions of science; the creation of published core of knowledge for public availability.
- easy communication of information. Everyone publishes his or her work to be read, confirmed, praised, cited, analysed and commented on in future works. By so doing, the functions of building a knowledge base and communicating information become a part and parcel of one whole function.
- helps in the validating of quality and the distribution of rewards.

Without ICT, the academic does not have access to all these. Academics generally accept and identify with electronic journals due to their credibility, accessibility and permanence made possible by the wonders of ICT. The evolution of new ICTs has led to the development of web-based teaching, the emergence of fully dedicated web courses and course homepages that provide links to supplementary materials.

Conclusion

The relevance of ICT in academic teaching, research and the performance of administrative duties is no longer an issue of debate. Major problems facing developing countries include the lack of adequate funds to acquire these technologies, a shortage of skilled manpower to run and train people in this technology and poor maintenance of existing technology.

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Building the Capacity for Systematic Integration of Technology in Teacher Education

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Abstract: Funded through the U.S. Department of Education, Project PICT (Preservice Infusion of Computer Technology) was developed to enable preservice teachers to fully utilize modern technology for improved learning and achievement in their future classrooms. To achieve this goal, the Bowling Green State University (BGSU) Technology Consortium developed a model grounded in the collaboration between teacher education faculty, arts and sciences faculty, and K-6 teachers. Primary project outcomes are: revised teacher education curriculum that reflects the ISTE technology standards; faculty Technology Training Model that prepares faculty to infuse technology in their teaching, model effective technology uses, and provide opportunities to observe technology-rich K-6 classrooms; Teacher Education Technology Infusion Model that systematically integrates technology in teacher preparation courses; system for assessing preservice teacher technology competencies; evaluative data on the impact of the pilot programs; collaboration with technology-rich K-6 schools, expansion of consortium partners; and grant proposals for future funding.

Introduction

A mission of the College of Education and Human Development at Bowling Green State University (BGSU) is to prepare reflective, creative and competent teachers for the new millennium. Essential to this mission is the development of preservice teachers who are not only technology literate but able to integrate technology into their instruction so their students will develop the ability to use technology throughout their lives. Currently BGSU teacher education programs produce approximately 750-800 graduates per year, many of whom are from rural Ohio and often return to the same rural areas to begin their teaching careers.

For the past decade, Bowling Green State University has struggled to educate the preservice teachers so that they will gain the competence needed to utilize technology in their classrooms. Due to the rapid advance of technological changes and limited financial resources, for many years, the major effort to achieve this goal has been restricted to a required technology methods course typically taken during the junior year. This course has most often been taken in isolation of any clinical experience that would provide the opportunity for students to utilize the skills being learned in an instructional setting with children. Additionally, most preservice teachers have not experienced technology integration in their other education courses and have not had the opportunity to observe and teach in technology-rich K-12 classrooms. Barriers that have impeded such technology infusion include: inadequate resources to purchase hardware and software for university classrooms and surrounding K-12 schools; lack of technology competency and professional development opportunities among teacher educators and classroom teachers; and lack of programmatic alignment with the International Society for Technology in Education (ISTE) standards across the curriculum, both at the university and elementary/secondary school levels. Another issue that has complicated the matter is the lack of technology experiences that many of BGSU's teacher education students bring to college as many of these preservice

teachers are from technology-poor rural/low income areas in Northwest Ohio. Since many of these same students return to these areas for teaching positions, BGSU has a unique opportunity to impact these rural/low-income schools by returning these students as technology-using educators.

Recently, the lack of hardware in K-12 classrooms has been addressed by the Ohio SchoolNet Initiative while BGSU is investing in more equipment on the university campus. Ohio SchoolNet has installed typically three to four computers in most elementary classrooms throughout Northwest Ohio with plans to expand installation to secondary classrooms in the near future. BGSU recently has committed to installing three permanent and one portable electronic classrooms to promote faculty infusion of technology. These classrooms will be located in the College of Education and Human Development and will serve as models for the university. Unfortunately, while technology access has increased for education faculty, most instructors lack the skills and understanding to adequately infuse technology into their teacher preparation courses. In addition, the current teacher education programs do not facilitate the systematic infusion of technology throughout the curriculum. Consequently, both program restructuring and professional development training have been needed to facilitate technology infusion throughout the preservice teacher experience. The BGSU Technology Consortium is currently implementing Project PICT (Preservice Infusion in Computer Technology) that will address these needs by restructuring the current teacher education programs, piloting a faculty technology training program, and piloting a technology infusion program.

Project Design

The overall goal of Project PICT is to enable preservice teachers to fully utilize modern technology for improved learning and achievement in their future classrooms. To achieve this goal, the BGSU Technology Consortium proposed a model grounded in the collaboration between teacher education faculty, arts and sciences faculty, and K-6 teachers. (Note: First year implementation has focused on the elementary education program since equipment acquisition for Ohio K-12 schools has been primarily limited to elementary schools). Consequently, representatives from these three entities have worked in teams to restructure the current teacher education programs and begin implementation of a technology-rich teacher preparation curriculum. Participants for this first year included: six (6) university methods faculty, ten (10) K-6 teachers, and two (2) arts and sciences faculty. Participating faculty and K-6 teachers were required to attend the following: 1 day workshop on ISTE standards, 2 day workshop on technology planning and infusion, team meetings, and 5 training sessions. Participants were also expected to create team and individual technology plans, revise curriculum, and implement at least 2 technology lessons/units in the Spring 2000 semester.

Objectives that guided Project PICT include:

1. Conduct a needs assessment of faculty technology competencies and level of integration;
2. Restructure existing teacher preparation curriculum to systematically fulfill ISTE/NCATE technology standards for all teachers;
3. Develop a system for assessing preservice teacher competencies of ISTE/NCATE standards.
4. Establish consortium partners that will enable BGSU to fully implement its technology integration program;
5. Facilitate cross-disciplinary collaboration between BGSU faculty and K-6 schools;
6. Pilot technology training program:
    a. Create teams of instructional and clinical education faculty;
    b. Provide educational (instructional and clinical) and arts & sciences faculty with training on ISTE/NCATE technology standards for all teachers;
    c. Provide educational (instructional and clinical) and arts & sciences faculty with training on how to integrate technology in course instruction and model effective technology use;
7. Pilot technology infusion program:
    d. Provide preservice teachers with opportunities to observe and experience technology rich K-12 classrooms that represent a variety of socio-economic and population levels through video-conferencing and field placements;
    e. Provide preservice teachers with opportunities to observe, experience, and use technology within their college courses;
    f. Provide preservice teachers with technology mentors in their K-12 field placements (clinical faculty/participating K-12 teachers will serve as technology mentors).

Evaluation

Project PICT has been subjected to rigorous formative and summative evaluation in order to establish clear benchmarks for documenting impact of pilot implementation and future improvements. Quantitative and qualitative methods have been conducted to permit periodic assessment of progress toward achieving outcomes. Specific variables to be measured among teacher education faculty, both instructional and clinical, are: technology competency, level of technology integration (frequency, type, and quality), perceived barriers of technology integration, training preferences, impact of training program, perceived impact of Technology Infusion Model on preservice teachers. Specific variables to be measured among participating preservice teachers are: technology competency, experiences with technology in courses and field placements (frequency, type, and quality), perceived barriers of technology integration, training preferences, impact of Technology Infusion Model on preservice teachers, and changes in one's vision of a technology-rich classroom. Measurement of these variables will occur through the following data collection methods: pre/post surveys for faculty and preservice teachers, focus group interviews with faculty and preservice teachers, observation of technology-rich lessons in the education and K-6 classroom, content analysis of preservice teachers' products (course assignments, lesson plans, unit plans), content analysis of faculty products (revised curriculum, course syllabi, lesson plans). Control groups have been developed to allow for comparison between participating and non-participating preservice teachers as well as participating and non-participating faculty.

Integrating Technology into Preservice Teacher Education Method Courses: A Unique Business/University Partnership for Staff Development

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Abstract: Recognizing that changing teacher education is a key requirement for changing K-12 teacher practices, Apple Computer developed the Apple Summer Institute for Teacher Education, more commonly referred to as "Camp Apple" by the 42 participants who represented faculty teams from 17 universities. This panel discussion is focused on the results of this novel program in promoting institutional change within participating universities, including results of the project-based learning sessions, reports on how the training influenced classroom practice and institutional change by participants, and recommendations for improving faculty development programs based on evaluation of this first-year effort.

I: From Camp Apple to Classroom Practice: A New Model for Staff Development

Recent studies have indicated that the best predictor of the skills that teacher education graduates have in infusing information technology (IT) into instruction is IT use in coursework throughout their preservice program. As a result, these studies have included strong recommendations to ensure that technology is a key part of methods classes so that future teachers understand and are able to integrate technology within the disciplines that they will teach (Cooper & Bull, 1997; International Society for Technology in Education, 1999; National Center for Education Statistics, 1999; National Council for Accreditation of Teacher Education, 1997; Willis & Mehlinger, 1996). Meeting this challenge requires new models of faculty development that deal with the barriers which have been identified as inhibiting past efforts in changing practice through training: motivation, resource access, and time.

Recognizing that changing teacher education is a key requirement for changing K-12 teacher practices, Apple Computer developed the Apple Summer Institute for Teacher Education, more commonly referred to as "Camp Apple." In July 1999 Apple Computer conducted a one week, residential professional development institute for teacher educators which attempted to address this challenge. Deans from schools and colleges of education had advised Apple that the professional development of their faculty, particularly of the methods faculty, was a primary concern. "Camp Apple" was designed in conjunction with 17 teachers' colleges in the U.S. and Canada to meet this need. While Apple has provided a camp experience for K-12 teachers, administrators, and technology support professionals in previous years, this was the first camp program that was aimed at higher education faculty.

The goals of Camp Apple were (1) to develop technology skills among faculty who rated themselves as novice computer-users, (2) to provide opportunities for them to consider how technology might enable more constructivist methods for their own courses, and (3) to give them time to reflect, share, and apply their new learning with colleagues from across North America.

Camp Apple was conducted in a rich technology environment. Participants had access to cutting-edge technologies like high speed Internet connections, three full labs of iMacs and G3 computers along with printers, digital cameras, scanners, authoring and educational software, and a wide variety of peripheral devices which are used in specialized disciplines for teaching and learning. The staff at Camp Apple were Apple employees and IT directors from Colleges of Education who had previously been recognized as "Apple Distinguished Educators."

Attendance at Camp Apple was "by invitation only." The deans on the Apple Advisory Board were invited to send teams of methods faculty from each of the four core curriculum areas (social studies, English/Language Arts, Science, and Math) to Camp. Each institution was responsible for the travel expenses of their participants; Apple paid for the training costs, room, and board. Forty-two methods faculty from 17 different institutions attended. Three deans also attended.

Apple's corporate goals for sponsoring this program were (1) to better understand the elements of successful professional development for teacher educators, (2) to cultivate a cadre of faculty who would apply the kinds of constructivist methodologies which are best supported by technology in their courses, and (3) to create a professional development model which could be easily replicated by other teachers' colleges at their own sites.

The Camp Apple Model

Several of the professional development strategies implemented at Camp Apple seemed to have combined to create a unique experience: a residential program in a scenic and secluded location with "24/7" access to cutting-edge technology; a reliance on collegial teams; and a focus on pedagogy. Finally, the longer-term effect of Camp Apple, as measured by the various dissemination activities of its participants, seems to have come from the "partnership" premise established between Apple and the participating institutions.

Location, Location, Location: Located in the Marin foothills just north of San Francisco, Camp Apple was conducted at Walker Creek Ranch. The ranch is an outdoor environmental education facility owned by the Marin County Board of Education. Cell phones cannot reach this canyon location and Walker Creek has no television. The residential aspect of the program promotes collegiality amongst participants in a way that "commuter" experiences cannot. Anyone who ever went to summer camp knows how powerful a "24/7" communal environment is on developing new friendships.

Focus on the Pedagogy, Not the Technology: The primary goal (and the greatest challenge) of Camp Apple was to focus on pedagogy, not on technology. While it is necessary for faculty to develop competence in the technology, it is more important for them to investigate the pedagogical relevance of these resources for teacher education. With access to expanded technology resources, faculty were free to experiment, explore new possibilities, and reflect on their teaching. Using the "Unit of Practice" (a curriculum development framework created by the ACOT research team), participants spent the week learning new technology skills, discussing teaching issues with colleagues, and developing a new teaching module for their methods courses. Finding the balance between these competing demands—developing the skills, considering the implications (of the technology), and creating a meaningful implementation was challenging and at times frustrating for both participants and staff. Further research will reveal whether these three ob-

jectives can be reached simultaneously or whether there is an evolution of thought and practice which is sequential.

The Importance of Teams: Drawing from our professional development research in the ACOT schools, we knew that teams were critical to the success of the program, both in the short and long term. Teams were used in two ways to achieve our goals. First, faculty worked in curriculum-area teams during the week on their curriculum development projects. Consequently, new collegial relationships formed around the common goals of learning and creating new materials for their courses. Participants were able to learn from new friends and share this learning with the team from their own institution. In order to insure participants would apply what they learned when the Camp concluded, individuals met as university teams before they left to plan follow up activities for the fall. Participants were asked to extend their learning to their students, to others at their schools, and to the broader teacher education community through new publications and research based on their Camp Apple experience.

Partnership: Apple's explicit goals for sponsoring this program relied heavily on the commitment of the participants to apply what they had learned at Camp to their teaching. It relied on their interest in continuing the conversation with others—in their own institutions and beyond. To achieve this, each participant committed to creating two more Units of Practice for their courses during the Fall semester and publishing them on Apple's online teacher network, the Apple Learning Interchange. They also committed to at least one dissemination activity. This could be new research, a publication, a conference presentation, or other leadership activity which would further the discussion of technology in teacher education.

Unlike many professional development experiences which are soon left behind in the wake of everyday demands, the follow up activities of these teams have been extensive. In addition to the individual work by faculty back on their own campuses, local teams have been able to draw on Apple resources for continued support. As a result, the Camp Apple program continues to produce ongoing change. Two of these are explored in the following sections by Joyce Morris of the University of Vermont and Christy Faison of Rowan University.

II. How I Spent My Summer Vacation and Ended Up Changing the World

Journey of a Thousand Miles

To many higher education faculty the prospect of learning new technology is a journey of a thousand miles. They are expected to use and integrate technology to increase their own efficiency and model it for future teachers even though these technologies were non-existent when they were students. Experts in their respected fields, they are often novices when it comes to using new technology, yet government and public mandates are calling for the infusion of technology in all preservice coursework (International Society for Technology in Education, 1999; National Council for Accreditation of Teacher Education, 1997; Thompson, 1999). In their national survey on information technology in teacher education, The Milken Exchange reported, "...the technology infrastructure of education has increased more quickly than the incorporation of IT tools into teaching and learning," and that "many faculty do not model technology use..." (International Society for Technology in Education, 1999, p. 2). There is a growing consensus that the integration of information technology into the teaching/learning environment can best be addressed through advocating and role modeling (Office of Technology Assessment, U.S. Congress, 1995). Advocacy implies showing others how technology can be applied to advantage in their teaching by role modeling the use of technology to achieve this objective as well as demonstrate the personal and professional benefit to be derived from its use (Wright, 1993).

People adapt to innovations in different stages (Hall, Louckes, Rutherford, & Newlove, 1975). Each level is characterized by observably different behaviors related to the user's development in acquiring these new skills and level of using the innovation. Research by ACOT discovered levels of use are also characteristic of adaptation of computer technologies by teachers in their classroom (Sandholtz, Ringstaff, & Dwyer, 1990). The Milken Exchange has aggregated these into five stages—(1) entry, (2) adoption, (3) adaptation, (4) appropriation, and (3) transformation—in a Professional Development Continuum (http://www.milkenexchange.org/pdc/pdcdocs/pdcII.pdf). To model technology fluency one must feel comfortable with basic computer skills, the focus of the entry stage. At the adoption and adaptation level, technology is somewhat integrated into existing practices. In the final stages, appropriation and transformation,

technological tools are used as a catalyst for significant changes in learning practices. At the adaptation level, technology is thoroughly integrated into existing practices. The final stage, transformation, uses technological tools as a catalyst for significant changes in learning practices. One advances to another stage through practicing skills, using the technology in a supported environment, professional development, and networking with colleagues to determine best practices.

To enable faculty to use technology at an adaptive and transformative level requires reallocating resources and providing time and support to learn the technology that will enable them to systematically redesign programs, curriculum, and field experiences that capitalize on the power of these tools. We know what to do, the problem lies in how to pragmatically implement a retooling of our faculty while we teach, research, and serve our local communities. We face many of the same problems the K-12 community has been facing—how do you redesign a machine without ever shutting it off?

From Camp Apple to Campus

When the opportunity for four elementary education faculty to attend Camp Apple was extended to our program at the University of Vermont in summer 1999, faculty jumped at the offer. They would give up a week of their summer vacation to learn, explore, and play with technological tools and think about how they could infuse technology into their teaching.

Faculty returned to Vermont energized with visions of ways to infuse technology into their teaching, assignments, activities, and presentations. Depending on their level of comfort in using technological resources, faculty are using their learned skills. One professor who coordinates the elementary education program and teaches a reading course to preservice teachers was the most insecure about her technological competence. Since her visit to Camp Apple, she has set up a listserv for our program that she is managing and facilitating, and for the first time, has prepared a presentation for a National Reading Conference using PowerPoint. She is in the process of designing a telecommunication project with her third year preservice students and Vermont elementary school children as an extension of the WEB project, a preexisting program connecting public school children with mentors. Next semester her preservice students and a group of elementary students will read selected children's stories and use a web board to discuss different issues surrounding the stories.

A second professor teaches a literacy course for third year students and a portfolio development course for seniors. In 1995 the State of Vermont implemented a results-oriented program approval process for teacher certification—evaluation by portfolio to be initiated at institutions of higher education that serve those preservice students (VISMT, 1995). In this professor's literacy and portfolio courses he has introduced Inspiration, a concept mapping program, to his students to help them visually and textually organize their portfolios through themes of practice. At the University of Vermont, professional portfolios must be organized as a text, via themes, with student selected documentation that describe the emerging teacher. State and Program criteria are located in appendices and cross-referenced with their documentation. Students collect, select, and connect their artifacts and caption the pieces to explain the context and relevance of evidence. Preservice students are expected to relate educational theory to practice, drawing upon their coursework, fieldwork, and community experiences to create personal profiles. Students are encouraged to use the power of multimedia to construct electronic portfolios to document this portion of their certification. It is anticipated that with increased resources, all students will establish their portfolios electronically.

The third professor to attend Camp Apple is a partner in the literacy team and had a fairly good level of computer literacy before her summer experience. She previously connected with a fourth grade teacher in one of our field sites and arranged a telecommunication project, where through e-mail, preservice students read and discussed multicultural stories in common with fourth graders. For her camp project she created a model for adapting literacy portfolios that preservice students create in their third year, to an electronic format. Through a local network, students document and critique elementary student work and share feedback with each other. In our fully networked transformable classroom, laptop computers are delivered to allow students to upload their files, practice file sharing, and create running records of student work that they examine in their field experiences. These are critiqued and shared by groups of students and incorporated into literacy portfolios.

The fourth professor is introducing a HyperStudio assignment for third year students into the Inquiry Block, an integrated science, social studies, and art methodology course in which she teaches. Our preservice students have previously used HyperStudio in a first year required computer course. In this assign-

ment students develop multimedia hypertext stacks that teach a science concept to accompany a science center that all inquiry block students build and leave in their field placement classrooms for two weeks. Science Centers must be self-sufficient with activities and assessments about science content and processes. Creating a multimedia based resource helps preservice students demonstrate their ability to develop grade-appropriate content, organize information in a logical interesting way, and use technology tools to present this to an elementary audience. Many of our neighborhood schools already use HyperStudio and for those that do not, the stacks will be uploaded to the Internet for viewing.

The Impact

The impact of Camp Apple far exceeds its effect on these four faculty. At the beginning of the semester thirty-two faculty throughout the college attended a set of three conversations about the Camp Apple experience and how we move forward with technology. Two of these meetings were attended by the College Dean and Vice Provost of Information Technology at the University. Faculty voiced their concerns about adequate resources and the lack of a clearly articulated vision and plan. This has resulted in a newly formed technology task force of faculty widely representing the college and being facilitated by a respected K-12 technology educator. The task force is taking a serious look at a number of issues and for the first time we are working together to define what it means to be a teacher of twenty-first century teachers. We are working together to define how this new literacy in technology and learning will help us develop practitioners that know how to use all the tools available to them and will be prepared to teach children brought up in the net generation.

Camp Apple provided the impetus for a number of changes we are already beginning to see in our college classrooms and administrative attention. This experience carved out the time to learn how to use new technology, to explore technology in a richly supported environment, and to think about what and how we teach and how technology could and should change that. There was structure to provide focus with flexibility to accommodate our special needs and interests. Our summer experience encompassed a definition of professional development that goes beyond the term "training" with its implications of learning skills, and incorporates a definition that includes formal and informal means of helping faculty not only learn new skills, but also develop new insights into pedagogy and their own practice. Camp Apple helped faculty see where their thousand mile journey could end and took us a few hundred miles towards our destination in a week.

III. Replicating Camp Apple Locally: A Professional Development Model

Starting with Camp Apple

Ongoing professional development for faculty in teacher education has been and continues to be an integral part of the climate and culture of Rowan University's College of Education. In the past five years, efforts have focused mainly on improving technological literacy and more recently, on the integration and modeling of instructional technology in the professional component of our programs. Past activities have included workshops on the use of productivity tools, specific software packages, and presentation programs. These activities have met with moderate success. However, those workshops/experiences that provided little or no follow-up, were 'demonstration only,' and/or involved technology that was not accessible or reliable were more frustrating than helpful. In a continued effort to enhance the technological abilities of teacher education faculty and keeping those concerns in mind, the associate dean attended the week-long summer institute for teacher educators known as Camp Apple during the summer of 1999. Using the 'Camp' model as a turnkey, professional development activities were planned that could be replicated for

Back at Rowan University

Many challenges had to be faced in replicating the Camp Apple model. These included: a) finding an appropriate time during the semester that was convenient for the majority of faculty, b) ensuring that facili-

ties/hardware were adequate to accommodate the number of attendees and types of activities to be undertaken, c) determining a topic that would be useful across various education departments (elementary, secondary, special education, health & exercise science, reading, and educational leadership), and d) motivating faculty to participate. We faced two additional challenges in planning an activity. First, an existing computer lab in the College of Education was to be upgraded during the summer of 1999, but as of the start of the semester, no action had been taken. The second was that the College was slated for an upcoming NCATE continuing accreditation review in the fall and all attention and effort was focused on the visit. Given these concerns and circumstances, the associate dean met with the instructional technology specialist several times during the semester to determine an appropriate course of action.

Fortunately, the computer lab in the College of Education was renovated and upgraded during the first week in October, and the NCATE visit followed two weeks later. Those two challenges being met, planning for the professional development activity continued. The January intersession was chosen as the time for Camp Apple since no classes would be in session, yet faculty would be returning to campus for registration and to prepare for the spring semester. The Camp Apple theme (i.e., casual attire, bag lunches, technology counselors, and give-aways) would be used as a motivator to attract participation. The focus of the professional development activity would be to introduce education faculty to WebQuests—inquiry-oriented activities in which some or all of the information that learners interact with comes from resources on the Internet (B. Dodge cited in Schrock, 1999). This activity was chosen because it could be used across all education departments by professors, and in turn, incorporated by education candidates for use with K-12 students.

In addition to the overall camp theme, other components of the week-long institute would be incorporated into the campus-based professional development component. One positive aspect of Camp Apple was the ready access to technology specialists during the hands-on workshops. This would be accomplished by having "technology counselors" available during the workshop to provide assistance as needed. As in the Camp Apple model, faculty members would be encouraged to work in teams on projects using their existing course syllabi. Faculty would be introduced to a modified Unit of Practice (UOP) as a model for incorporating technology into their education courses. The session would be divided into two components—a "minds-on" session where faculty would be introduced to, and discuss the value of WebQuests, and a hands-on session where faculty would develop WebQuests appropriate for their courses. Follow-up would be an important component to the success of the professional development activity. To that end, the instructional technology specialist will develop a web site where education faculty can share their WebQuests, and seek support and/or assistance in the integration of this technology strategy. The site will also be a resource for links to other WebQuest sites. In addition, the technology specialist who authored the text used by all of our teacher education candidates (Orlando & Levy, 1998) will add a new chapter on WebQuests to the revised text to encourage preservice candidate use with K-12 students.

In order to promote participation, flyers were distributed to all education faculty and announcements were posted on the College of Education web site. The Dean of the College of Education agreed to supply funding for refreshments and give-aways. The college instructional technology specialist, and a university instructional technology specialist (with an education background) volunteered to be technology counselors. The only perceived obstacle to success was the timing of the workshop. Although classes would not be in session, faculty would be on "holiday," so participation might be limited by those who already had plans for this particular timeframe.

The goal of the workshop, which is to be held January 10, 2000, is to explore with faculty meaningful ways to integrate technology into professional education courses using hands-on experiences. The specific objectives include the ability to: a) define and construct WebQuests, and b) evaluate existing WebQuests and Internet sites. The intended outcome is to increase the likelihood that education faculty would incorporate and model the use of technology in their education courses using the WebQuest activity as an instructional strategy. If this particular strategy is successful, participation in future workshops would be expanded to include all university faculty, so that the modeling of technology use would be evident campus-wide. Another potential strategy would be to replicate the Camp Apple experience for inservice teachers at our partnership and PDS schools.

Our education faculty have shown a consistent interest in enhancing their professional skills. Likewise, a culture exists which promotes and supports faculty professional development. Rowan University's Camp Apple will be another wonderful opportunity to assist the College of Education in the preparation of excellent teacher candidates, ready for the classrooms of today and tomorrow. Teacher education is touted as a

major factor in improving K-12 education. Skilled and talented teacher educators can be the catalysts in meeting this necessary goal.

IV. Evaluation: What did We Learn?

Participants were asked to provide Apple with a written reflection evaluating their experience at Camp at the end of the week. In addition, a follow-up survey was done three months later with plans for continuing evaluation in the future. Remarkably, evaluations were very consistent. Where the program succeeded, participants acclaimed its success. Where the program required more work, participants' comments were consistently critical.

Technology Integration: It's Not What You Think It Is: The most significant learning from the week was the realization that technology integration means different things to different people. It is really two issues.

When faculty think about "technology integration" in <u>their</u> teaching, they are usually thinking about things like using email to communicate with students, moving their lecture notes to electronic slides with software like PowerPoint, or putting their syllabus on the web. When educators talk about "preparing tomorrow's teachers to integrate technology" for K12 instructional use, they are talking about instructional strategies which use technology to promote critical learning processes in children. We discovered that one has to separate the <u>use</u> of technology for professional productivity by the faculty member and <u>modeling instruction</u> to promote new learning outcomes which employ technology. That a faculty member puts his or her syllabus on the web as a way to "model" technology usage for preservice students will not help those preservice teachers teach more effectively in their future classrooms.

Bringing Effective Practices to Teacher Education: There is a great opportunity for teacher educators to explore effective practices for their own teaching. Many of these effective practices are constructivist in nature, and <u>require</u> technology in order to make them most effective. While we erred at Camp Apple by presenting effective practices *in the context of K12 instruction*, it became immediately clear that faculty were very interested in exploring the potential of strategies like simulation, project-based learning, collaborative learning, and group learning within the context of their courses. Professional development for teacher educators should provide participants with the opportunities to explore these possibilities. If preservice teachers have these kind of first-hand learning experiences, they will come to implicitly understand the power of technology in teaching. This is the kind of "modeling" that needs to take place in teacher education when we talk about "technology integration."

Follow-Up Survey

A follow-up survey of all participants three months after the program asked them to assess how their Camp Apple experience was making a difference in their current teaching and practice, and what activities they had engaged in to fulfill their commitment to disseminate what they had learned. We received 23 responses to this survey (51% return rate). In their retrospectives, participants uniformly praised several aspects of the Camp Apple model, including the residential, secluded location, the outstanding staff, and the availability of cutting-edge technology.

Residential, Secluded Location: In their evaluations of Camp Apple, we learned that the residential aspect of the program was the most powerful strategy employed. Participants also reported that the secluded and scenic location created a wonderfully relaxing environment in which they were able to focus intensely on the subjects at hand. Faculty were unanimous in their evaluation of Camp Apple for giving them the opportunity to spend such a long period of time in the company of colleagues to discuss issues and share ideas.

The Right Staff: Camp Apple was staffed by Apple employees and instructional technology directors who had previously been designated "Apple Distinguished Educators" from several Colleges of Education. They were all experts in a particular technology or in a particular implementation of a technology for teaching, like simulation, multimedia authoring, or process-learning. Evaluations from participants ranked the staff as the single most significant factor in the success of Camp. We tried to provide both direct instruction as well as just-in-time learning. The broad technical expertise of each staff member made this possible.

Technology Immersion: Participants remarked that the technology-rich environment at Walker Creek made them feel like they were "kids in a candy shop." There were technologies and software products available to them that they did not know existed. The ability to have round-the-clock access to these resources combined with the expertise of the staff was one of the key points of feedback in favor of the program.

Teams At Work: Participants who attended in teams of three or more had a significantly different experience than those who came by themselves or even in a pair. Of the 42 participants, 40 reported that they would recommend Camp Apple to a colleague. The two who said they would not have attended came as "solo" participants, without a team. Of the 17 participating campuses, 11 were represented by three or more people.

More importantly, responses to this survey indicate that a wide range of activities have been implemented on campuses as a result of the Camp program. Three months later, the schools which sent more than two people are exhibiting more activity in preparing for and using technology. Of the 11 schools which sent teams of three or more, six have planned new faculty development activities for the current school year. Two have commissioned new technology planning committees, and three have asked Apple to help them run their own Camp Apples next summer. Two of these eleven schools have not had any kind of significant follow up. Of the 42 attendees, four papers/research/presentations proposals have been prepared in the four months following the experience. Eighteen faculty have indicated that they would like to return to staff Camp Apple 2000. Additional follow-up is planned at the end of the academic year to further examine the ongoing effects.

Camp Apple was a model professional development experience for many reasons. But perhaps the most significant one is that it truly represents a partnership. Apple provided the resources and opportunities for learning, and in return, many faculty members have followed up with outstanding activities which have extended their learning to students, other professors, and to other institutions.

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The Unified Elementary ProTeach Program: Impacting UF and Beyond

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Abstract: The Unified Elementary ProTeach program at the University of Florida is a new teacher education program with the potential to positively impact future teachers, public school children in the state of Florida, the UF community and beyond. The explicit and implicit use of technology is one of the program highlights dramatically affecting the teaching and learning environment for students and faculty in the College of Education. Several examples of changes in faculty and students are explored. Another major component of the program is the integrated teaching block students are experiencing. Faculties from the Colleges of Education and Liberal Arts and Sciences will team-teach academic areas and teaching methodologies. As the faculties of both colleges work together to improve the educational experience of teacher education students, the College of Education faculty have the potential to influence the teaching methodologies of the faculty from the College of Liberal Arts and Sciences.

Introduction

Walk through the halls of the College of Education at the University of Florida and you will hear conversations ranging from the use of electronic portfolios to how special populations benefit from a specific teaching strategy. The event triggering all this excitement is the beginning of the Unified Elementary ProTeach program for elementary and special education majors, which is a restructuring and revision of the original ProTeach program.

In the early 1980s, the College of Education faculty recognized that teacher preparation needed to drastically change. Classroom conditions faced by teachers are more complex and stressful than those in the past and teaching continues to become more difficult. Hence, faculty members developed a program to prepare teachers in elementary education, special education, early childhood, and secondary education titled ProTeach (from PROfessional TEACHer). This rigorous 5-year program was designed to culminate in a Master of Education degree. Since the implementation of ProTeach in 1984, hundreds of new teachers have been produced and hired in the state of Florida.

The Unified Elementary ProTeach Program

Regardless of the success of the ProTeach program, the teacher education faculty again recognized the need for a new conception of teacher education to meet the challenges posed by an increasingly diverse student population. The reexamination and revision of the preservice teacher education programs in elementary education and special education was prompted by factors such as the changing character of the U.S. population of school children (New Faces at School, 1991), the number of students with disabilities served primarily in general education classrooms (U.S. Department of Education, 1994), and the potential of inclusive education policy (Will, 1986). The College of Education has unified and restructured the special education and elementary education programs into a Unified Elementary ProTeach program which is designed to prepare teachers with a dual emphasis in elementary education and mild disabilities. Students who successfully complete the 5-year program will receive a recommendation for certification in elementary education, an ESOL endorsement, and an option for special education certification.

The Unified Elementary ProTeach program accepted its first cohorts of students in the fall of 1999. Although the program is successfully underway, there are still implementation issues needing

discussion and planning. One of the components of the Unified Elementary ProTeach program requiring considerable work is the integration of technology into the program. The faculty has made the explicit and implicit use of technology a program highlight. Faculty are focusing on the best ways to use technology in each course and to insure that students are observing effective methods of teaching and learning with technology. A second major component of the program is the integrated teaching blocks students will experience. Faculties from the Colleges of Education and Liberal Arts and Sciences will team-teach academic areas and teaching methodologies. These two innovative components have the potential to positively impact ProTeach students, the school population in the state of Florida, and the faculties in the Colleges of Education and Liberal Arts and Sciences. This paper will chronicle the process of the faculty as they strive to become outstanding models of integrating technology into their teaching, the changes in the students as they incorporate technology into their learning experiences as well as their teaching, and the impact the infusion of technology into the Unified Elementary ProTeach Program is having on the rest of the University of Florida.

Faculty Development with Technology

Data from over a decade of research from the Apple Classroom of Tomorrow (ACOT) research project indicates that teachers progress through five stages (entry, adoption, adaptation, appropriation, and invention) in their pursuit of integrating technology into their teaching (Sandholtz, Ringstaff, & Dwyer, 1997). While other stages have been identified (Becker, 1994; Berson, 1996), it is indisputable that it takes time for teachers to become effective technology users in the classroom. Hence the College of Education is using a variety of techniques to facilitate the learning process for all college faculty, and specifically, the faculty involved in the Unified Elementary ProTeach program. The Office of the Dean, educational technology faculty, College of Education technology committee, and the Office of Instructional Resources at University of Florida are using numerous strategies to provide the needed training. Brown bag lunches, workshops, individual consulting, and partnering with educational technology graduate students are just a few ways faculty are learning new technology skills and experimenting with previously learned skills in their teaching. The diverse methods of faculty development allow individuals to progress at a rate that is comfortable for their movement towards effective use of technology in teaching. The goal is for the faculty in the College of Education to be technologically fluent so that effective and appropriate modeling of the use of technology during instruction can take place. Being computer literature is not enough since there are additional issues involved in the use of technology in instruction. As a result, conversations are taking place about how to integrate the use of technology into teaching and how the role of the instructor and student changes.

The use of electronic portfolios is another area where faculty are becoming acquainted with technology in the learning environment. In order to comply with the Florida Department of Education documentation requirement for the state Accomplished Practices and to assist ProTeach students with developing a richer understanding of learning and assessment, the faculty has adopted the standard of students creating electronic portfolios. This also requires considerable conceptual and technical training for the faculty.

For a majority of faculty in the teacher education program, the first step in the implementation of electronic portfolios was to consider the various methods in which students could present their materials for documentation purposes. For example, to document that students have performed certain teaching strategies in a classroom, students were previously videotaped. Now students could using digital recorders or digitize videotape as another technique to include in their portfolio. The faculty must make sure students are aware of the wide array of methods to demonstrate the Florida Accomplished Practices and then provide instruction on how to accomplish the task. Faculty agreed that everyone could not learn how to implement each task due to factors such as time constraints and lack of equipment. Hence, instructors are primarily relying on educational technology graduate students to provide student instruction. Still, faculty members are learning to create various electronic portfolio elements. The College of Education faculty are adamant that we demonstrate to students that we are life-long learners just as they should be. Students can see that learning how to use different types of technology and that incorporating technology into teaching takes time and is a long-term commitment. By observing their peers and the College of Education faculty, students are seeing Rogers' (1995) diffusion theory in action.

The Impact of Integrated Technology on Students

As faculty are incorporating more technology into the classroom activities and are modeling teaching with technology, students' expectations for faculty and themselves are changing. The Unified Elementary ProTeach students have become accustomed to a great deal of electronic communication among the instructor and their peers. The use of email, bulletin boards, and web pages for dissemination of information and discussion of course materials and issues are commonplace and expected by students in a majority of their classes. Students are also requesting easy access to class instructional and activity materials, such as Power Point presentations, web sites, AppleWorks projects, HyperStudio stacks, and MicroWorlds projects. We are seeing this reciprocated when students give presentation and create lessons for their assignments and field placements. Students are discovering that when giving a presentation or teaching a lesson to a class reserving a traveling computer cart for a room that is not technology-equipped can be problematic. We have so many faculty and students requesting mobile computing carts for their classrooms that the college runs out of equipment. This will continue to be problematic until the renovation of the College of Education is completed.

Another change for students in the College of Education is their creation and use of electronic portfolios. We know from literature (Fogerty, 1996; Porter & Cleland, 1995) that portfolios allow students and faculty to express their strengths and understanding of concepts in a richer way along with encouraging reflection and collaboration among peers. Electronic portfolios are also a method students can provide districts with proof of mastery of Florida's Accomplished Practices as well as developing various products demonstrating their preparedness to teach.

Before a full-scale implementation plan was established, a pilot study using electronic portfolios was conducted. During this study, students were allowed to present his or her understanding of a task and proof of mastery for a Florida Accomplish Practice using on-traditional methods. Students in the pilot study had vastly different technical skills allowing novice and advanced computer users to be challenged. As students began to share ideas with each other and specific faculty members, the work of the students improved. Novice computer users began to learn from the advanced computer users and became excited at the potential of the electronic portfolio. Advanced computer users were constantly trying to find new computer techniques to implement their ideas. Several students incorporated videos into their portfolios. Frequently, students went beyond the scope of the assignment to add scanned pictures, animation, and reflection pieces to their assignment. In addition, the conceptual quality of the work improved as students began to demonstrate a deeper and richer understanding of the content. This finding is supported by literature (Kent, 1997). The instructor of the class noted that students expressed satisfaction in creating a product that would continue throughout their college career and beyond. This excitement is now spreading to faculty and students who were not involved in the pilot study.

Faculty members are discussing with students how to present evidence of mastery on the Florida Accomplished Practices. As mentioned earlier, it is critical that students learn from faculty that electronic portfolios allow multiple methods of expression. One concern for students is answering the question "Who will assist me in this process?" To provide assistance and instruction for students, a graduate student in the educational technology program developed a series of workshops and a help center web site for ProTeach students. Students were provided with three multiple-hour long seminars to create their initial web pages. As seen with the faculty, there was a wide array of ability levels among the students. Students also were given web sites to see samples of various methods of documenting each of the Accomplished Practices. These examples are separated by academic specialization area since a mathematics specialist might want to document a requirement differently than an English specialist. In addition, the doctoral student holds substantial office hours so students can have individual consulting when they encounter difficulties.

Faculty members are noticing differences in our students as they expand the integration of technology into their educational experience. First, students are beginning to view course content with a different perspective. Students consider the assignments in classes as more significant since they can see how this task truly relates to a valued teacher preparation experience. In the past, there was a tendency for some students to naively think that these assignments could be done with a half-hearted approach since it was just a college activity. Now, students are looking at how each assignment will impact their future job opportunities and experience. The idea of placing as many artifacts into the electronic portfolio as possible to demonstrate mastery of an Accomplished Practice is important to many of the students. Second, students are beginning to develop lessons that are becoming more technology-rich than the lessons of the past. Third, students are starting to recognize that the role of the teacher changes as technology is

integrated into daily teaching. It is encouraging to hear discussion in the hallways dealing with how technology-rich lessons could be implemented and the most effective strategy and role for the teacher in the lesson.

Impacting the University of Florida Community and Beyond

The University of Florida teacher education faculty realizes that the diffusion process occurring with respect to technology is not unique. Teacher education programs across the United States and globe are increasingly integrating the use of technology into the curriculum. However, the senior year experience in the Unified Elementary ProTeach program is distinctive and innovative. ProTeach students will have two semesters where their academic content classes and curriculum and methodologies classes are team-taught with faculty members from the Colleges of Education and Liberal Arts and Sciences. ProTeach students will take an integrated block of science, mathematics, and technology during the fall semester and an integrated block of language arts, social studies, and special education during the spring. Each semester, students will have a field placement experience in surrounding schools. As the faculties of both colleges work together to improve the educational experience of the ProTeach students, the College of Education faculty have the potential to influence the teaching in the College of Liberal Arts and Sciences. It is hoped that best practices in teaching will be seen throughout the University of Florida. In addition, it is hoped that these experiences will dramatically impact the public schools where the ProTeach students are placed. Conversations are taking place with the deans of the two colleges, department chairs, and the professors teaching the courses dealing with the content needed by the Unified Elementary ProTeach students and the modeling of effective teaching techniques for these students. We desire our students to constantly have best practices modeled to them and for them to acquire a strong foundation in content areas. A major element of these discussions involves the effective use of technology into daily teaching. Currently, the fall semester schedule allows for the team teaching of the science, mathematics, and technology areas. This structure has been established so professors from the Colleges of Education and Liberal Arts and Sciences can participate in all the classes. In addition, if one professor needs additional time for a lesson or series of lessons the block schedule allows for this. Another benefit of this scheduling is that students have extended time for their field placement experiences. The spring semester is similarly developed but contains a separate course devoted entirely to a field placement. This course has students in a public school classroom throughout the semester. This differs from the fall term where the field placement is a component of the semester block courses.

These two semesters of team-teaching and integrated academic subjects allow for faculty members within the Colleges of Liberal Arts and Sciences to see exactly what types of teaching methodologies are needed by teacher education students. In addition, as these professors have the opportunity to visit schools where students are doing their field placements, they can experience how critical it is for teachers to be well-versed in content and the ability to effectively and appropriately relay information about the subject area. College of Education faculty members benefit from working with experts in the subject matter areas to increase their knowledge and in developing curriculum materials needed in the public schools. The Unified Elementary ProTeach Program is truly allowing faculty from across the University of Florida to grow in new ways.

It is hoped that we will see change in the public school classrooms from the senior year experience. As the ProTeach students go into the classrooms for their field experience, ideas for teaching can be discussed with experienced classroom teachers. As the students and teachers critique lessons together, determine the appropriateness and effectiveness for that particular classroom, classroom learning environments could change. The College of Education faculty hope that this will allow some experienced teachers to gain ideas on implementing technology-rich lessons for their students.

Conclusions

The Unified Elementary ProTeach program has the potential to positively impact the University of Florida community and beyond. As faculty and students increase the integration of technology into the curricula, the learning environment of classrooms at all levels will change. ProTeach students will benefit

from seeing the use of technology modeled in daily teaching. College faculty will increase their knowledge with respect to using technology and in various subject areas as well as gain a greater appreciation and understanding of what colleagues from various parts of the University of Florida are doing. As the Unified Elementary ProTeach program continues, College of Education faculty desire to gain data and knowledge dealing with the changes in student work related to the infusion of technology into their work, how the Unified Elementary students will act as change agents throughout the state of Florida, and how team-teaching with the College of Liberal Arts and Sciences will impact the teaching across the University of Florida system. We look forward to great things!

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Faculty Development and Preservice Teachers as Agents of Change

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Introduction

Recent state legislation in Virginia requires teacher licensure programs to guarantee that graduating teachers are computer literate. Future teachers must demonstrate the ability to operate and integrate technology into the classroom. In an effort to accommodate this mandate, faculty within the School of Education at Virginia Commonwealth University are analyzing the use of technology in courses required for certification. Through this process, faculty recognize a need to enhance their own technology skills, and also acknowledge the importance of modeling effective uses of technology in their own methods courses. However, faculty report obstacles in integrating technology throughout the teacher education curriculum. Reasons include lack of time, lack of knowledge in the operation of hardware and software, and lack of clarity about how to infuse technology into the curriculum. Faculty also realize that infusing technology into courses is not enough; prospective teachers need to practice delivering instruction which incorporates technology into "real-life" experiences with K-12 students.

While there is a call for new teachers who are computer literate, there is also considerable demand to provide avenues for existing teachers to learn about technology. School of Education faculty maintain close contact with practicing teachers by supervising preservice teachers' field-based experiences. Practicing teachers report an increased demand to incorporate computer literacy skills into their everyday teaching, and they are turning to institutions of higher education for assistance. Thus the School of Education is faced with two challenges: to prepare technology literate preservice teachers and to provide technology training and assistance to teachers already in the field.

Grant Implementation

In an effort to assist university faculty with the tasks of incorporating technology into methods courses and modeling effective uses of technology for preservice teachers, a grant was awarded by the US Department of Education. The grant provides 1) funding for additional personnel to provide technology training programs for university faculty, 2) course release time to allow university faculty time to incorporate technology into their current methods classes, 3) portable equipment (laptops) which allow preservice teachers to practice newly acquired computer skills, and 4) a support system for faculty to prepare preservice teachers as "agents of change." As university faculty increase the use of technology in methods courses, a pilot group of preservice teachers are applying this knowledge during practicum and student teaching placements. These experiences provide preservice teachers the opportunity to share their

knowledge with practicing teachers in the field. Additionally, faculty and preservice teachers are working together to design learning activities that address curriculum objectives. This process allows the School of Education to provide technology training to students obtaining initial certification and practicing teachers.

University faculty participating in the grant are charging their students to implement practical, field-based technology experiences. One science education professor is training his students on the use of a computer-based laboratory system and the associated scientific probeware to engage students in investigative science. A national manufacturer, PASCO Scientific has donated teacher's guides, software, and probes. These materials are being used to equip five computer-based laboratory stations in each of two middle schools. There is a faculty liaison with each school who receives load credit for working with the teachers of the school. The teachers hold clinical faculty rank and serve as cooperating teachers for practicum and student teaching placements. A science educator and four secondary science students are working with the science faculty of both schools to infuse this computer based technology into the existing science curriculum in grades 6-8. The preservice teachers are studying the existing curriculum and the computer based activities to determine matches between the two. In addition, they are making suggestions on how to modify current labs to use the probeware to collect, graph, and analyze data. A correlation of the computer-based laboratory activities to the Virginia Science Standards of Learning for grades 6-8 has already been completed.

A Social Studies education professor is having students learn about digital imagery in order to create virtual field trips which can be accessed via the World Wide Web. The instructor's modeling of virtual field trips in a social studies methods class demonstrates the uses of multimedia, hypermedia, digital photography, and scanning devices. His "trip" through an exhibit at a local history museum was posted on a Web site. Students later visited the exhibit allowing them to understand both his decision making and the technical aspects of designing the "trip". The grant funded a technology specialist within the School of Education to assist with this project. During an introductory class session, the technology specialist showed numerous virtual tours of exhibits (dreamscape.com/frankvad/museums.exhibits.html), provided individual assistance for students, and demonstrated how to post trips to a Web site. Students were required to develop their own virtual field trips (http://www.vcu.edu/eduweb/newhomepage/proj.html), and reflect in writing about the following questions:

- How could you effectively use a virtual field trip in your curriculum to expand the walls of the classroom?
- What is the function of your virtual field trip, and how can it enhance social studies instruction?

The objective of this assignment for pre-service teachers is to engage children in activities that stimulate them to imagine realistically a museum exhibit, historical site, or portrayal of a historical event. Students are creating virtual field trips during their field-based experiences, and in particular, with inner-city children who have limited resources and opportunities. Based on an informal student survey, the instructor has decided to implement this project next semester with two classes.

Conclusion

It is a challenge to modify a teacher education program by encouraging university faculty to develop technology skills and devote adequate time, effort, and resources to infuse technology into the curriculum. It is a major task to ensure that preservice teachers graduate technology literate. Receiving a federal grant has provided much needed equipment and resources. The School of Education looks forward to expanding its efforts with more faculty and students.

Faculty Development in Technology For Teachers of English For Specific Purposes (ESP)

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Abstract:

Entering the global market in the age of information, Russia is in desperate need for experts in all areas of economy, highly qualified, competent, and capable of using foreign languages for handling professionally valid information, solving problems, and making reasonable decisions. To produce such graduates, Russian universities must reconsider their foreign language teaching concept. Constructivist university-level ESP teaching requires the instructors to possess certain specific competencies as a part of their technological literacy. These can be acquired through the system of on-site ESP faculty development. The paper considers the current practices of faculty development in technology in Russia=s universities and suggests ways of restructuring it to provide a high quality of university education in the new millennium.

Introduction

The link between faculty development and the quality of higher education makes the former a prerequisite for the latter. Today, while the tasks of the faculty remain basically unchanged and, on top of instructing students, embrace consuming and generating ideas and information, the tools used to fulfil these have changed dramatically. Tons of necessary and useful information simply cannot be produced, stored, retrieved, manipulated, and disseminated without electronic devices: Anew technologies . . . are guiding the information flow@ (Hyerle 1996). The capability to operate these, or *tech-literacy* (Baratta 1990), has become an integral part of literacy in the electronic age. Therefore, Afaculty and students must become literate in the skills of electronic information processing, both to accomplish the tasks of education better@ (Johnston 1986). The main task of Russia=s higher education is to train literate specialists for the national economy that is now entering the free market system; it is based on the revised concept of literacy.

Tech-Literacy in the University Curriculum

In the modern world, literacy is much more than just the skills of reading and writing as it has been traditionally understood:

1. reading should also embrace the skills of referencing and scanning for information;
2. writing is not only fixing what has been said on paper (or on a computer screen) but also engaging certain authoring and presentation skills;
3. such enhanced literacy cannot be exercised today without the skills of using certain types of computer software;
4. literacy in one=s mother tongue is far from sufficient today, when academic and economic success and social mobility greatly depend on one=s literacy in one or more world languages (Goodman 1987);
5. a university graduate should also be able to disseminate the texts he/she has produced not only as hard copies but also - and rather - through the electronic network which also requires certain specific skills, including such sophisticated abilities as using hypertext and multimedia authoring systems.

These activities can be included in the curriculum in two ways: first, as a part of the General Professional and Special Subjects cycle and, second, as a part of the General Humanities cycle. In the first, they either take the format of specific, professionally oriented courses or are integrated into the courses on the core subject. Meanwhile, the enormous potential of the second has virtually been neglected - because of the insufficient technological facilities as well as because of *tech-illiteracy* of the Humanities faculty, including foreign language instructors. This can be changed only through the successful system of faculty development in which the instructors should learn to understand the technology, practice designing and developing technology-based materials, and generate new concepts and ideas

on using technology in class.

The purpose of this paper is to consider the faults of the system of ESP faculty development in the area of technology in Russia and to suggest ways to bring it to concordance with the today=s needs.

Technology in the Constructivist ESP Classroom

Foreign Language Courses in Russian Higher Education

According to the State Educational Standards of the Russian Federation, a sufficient command of a foreign language is a graduation requirement for majors in any area (other than linguistics) and, as such, is mandatorily included into the curricula of Russian universities. Normally, it is one of the basic European languages, but English that Aoccupies a special position on the world=s market of languages@ (Coulmas 1992) dominates in the non-linguist curricula. The majority of students planning to take up occupations in international business, economics, management, or engineering consider English a good investment and a prerequisite for getting a good job after graduation. Therefore, they take courses in English for Specific Purposes (ESP).

The whole system of ESP instruction at Russian universities has undergone dramatic changes since the drop of the iron curtain; the major transformation was that of students= attitude: from just a graduation prerequisite of no actual importance, ESP became instrumental literally overnight. The wide involvement of computers and the introduction of joint ventures also contributed to motivating students= interest in learning ESP. However, it brought about problems, as well. First, the focus of ESP courses should be switched from passive language skills (e.g., translating scientific texts) on to active communication and information search which required great amounts of linguistic and extralinguistic information to be consumed; second, there was the lack of time, both in and out of class, which definitely limited the learning process and impacted results. The search for effective, efficient, and time-saving ESP teaching/learning techniques made the faculty turn to Intensive Language Teaching methods; so the advent of modern technology into the ESP classroom was predetermined, and the computer, Aan excellent learning device@ (Bork 1982), joined such old-timers as audio, TV, and even video; moreover, it managed to bundle these up in the format of multimedia.

Multimedia Technology in Teaching ESP

The State Standards require that the Russian higher school graduate be able to use a foreign language to converse both in professional and informal settings as well as derive significant and handy information from any source, including printed materials, electronic networks, and other speakers. This actually implies two groups of skills that must be taught on the university level: first, *language (linguistic) skills* based on the knowledge of the language structure and how it should be used for communication and information exchange; and, second, *specific (extra-linguistic) skills* based on the knowledge of the core subject and other areas to be communicated on. Therefore, ESP classes have to be specifically arranged: they are built on the use of professionally significant information which is retrieved from foreign sources and communicated in the foreign language. To be successful, they depend heavily on modern technologies specially designed for language learning.

The multimedia language-learning software has been incorporated into the ESP curriculum for several reasons. Multimedia as the blend of text, video, and audio provides sense-supported introduction of enormous amounts of information. Its interactive form not only stipulates presentation, as in video, but also simulates life-like communication engaging the learner as an active participant. The non-linear structure of presentations (hypermedia) facilitates multiple return to the information. These result in highly effective and time-saving multimedia-based classes. Besides, a student-oriented mode allows customization of learning regimes according to the needs of each student. Finally, its fragmented format supports incorporating multimedia into course units which also enhances the capabilities of constructivist ESP teaching..

Constructivist ESP Classroom

The search for successful ways to teach foreign languages, in general, and ESP, in particular, has been one of the constantly burning problems of Russia=s higher education system. Direct instruction, that results in having students acquire and reproduce factual knowledge and well-defined skills, has its limitations when it comes to

teaching high-level thinking skills (Zahorik 1995). Since the aim of university-level ESP teaching is the active and creative skills of using English in professional settings, the constructivist approach to teaching and learning appears to be of critical importance for securing the high-quality output from the higher education system.

The purpose of ESP teaching is to support acquiring declarative and procedural knowledge of both linguistic and extra-linguistic character: *declarative linguistic knowledge* embraces knowledge of the language structure (grammar rules, vocabulary, etc.) while *procedural linguistic knowledge* includes the skills essential for using the language structure for extraction, verbalization, and communication of ideas (listening, speaking, reading, and writing skills); *declarative extralinguistic knowledge* implies knowledge about professional communication venues, topics, and etiquette as well as of formats and tools used to present professionally valuable information (e.g. knowledge of a company structure, staffing policy, and workplace ethics plus knowledge of the format of a resume and what tools can be used to generate it) while *procedural extra-linguistic knowledge* comprises the skills of using technology for professional communication, information search, and idea presentation (e.g., the skills of generating various documents using special software, the skills of browsing the Internet for some information, etc.)

So, the use of language-learning multimedia supports only one, *the linguistic,* side of ESP classes. The *extra-linguistic* side needs the involvement of electronic sources of information, such as CD-ROM references and the World Wide Web, as well as special types of software capable of manipulating professionally significant information. This software includes word processors with document templates; computer dictionaries; speech recognition systems; machine translation systems; spreadsheets; computer presentation and desktop publishing programs for generating flyers, posters, leaflets, booklets, and slide shows; specific task software, e.g. business card makers, business planners, marketing campaign planners, accounting and finance software, web page generators, etc. To be productively integrated into the constructivist ESP classroom, this requires some sort of specific competence from the ESP faculty.

ESP Faculty Development

Faculty Specific Competence for a Technologically Enhanced ESP Classroom

Understood holistically, Acompetencies are complex combinations of personal attributes enabling the performance of a variety of tasks@ (Preston & Walker 1993). To perform the task of facilitating a highly successful, technologically enhanced, constructivist ESP class, an instructor should actually possess both general and specific attributes: the first comprise the command of English and of language teaching methods as well as of technology and instructional design basics; the second imply a knowledge of the core subject area basics and metalanguage, i.e. the specific terms used, as well as the command of specific software used in the area.

Russian Practice of Faculty Development in Technology

On-site language-teaching faculty development in Russian universities is arranged around one of three focal points: language, teaching methods, or technology. Each course is delivered by experts in the corresponding area, but the courses in technology appear to be the least successful, with the real outcome much lower than planned: the only skills acquired are typing, fundamentals of Microsoft Word and basics of Excel which is obviously insufficient for facilitating technology-enhanced ESP classes. There are several factors that account for this weakness:

1. The primary cause of development course failure is ignoring the needs of ESP faculty in the course curriculum, though the monolithic approach, that assumes supplying the same material for all teachers, irrespective of their particular areas and interests, has proved to be unsatisfactory.
2. Another drawback of the development programs is the inflexibility of technology instructors: having strong engineering background, they unconsciously assume that their faculty students have the innate knowledge of computer basics. This results in sophisticated explanations which are extremely hard for humanities faculty to understand.

3. The last but not the least fault of faculty development in technology is the coaches= ignorance of the specific needs of ESP instructors and of the specific software to be used at the ESP classes. As has been previously mentioned, the result is limited skills. Generally, faculty can do little more than prepare handouts for classes.

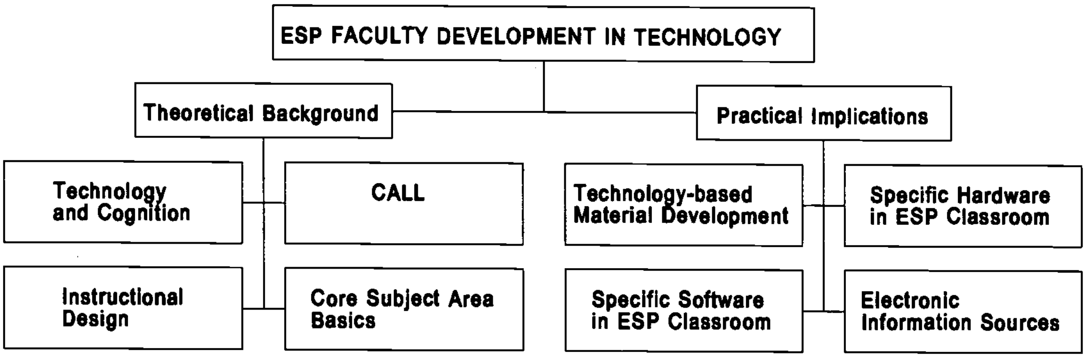
Thus, to rectify the current situation and to significantly improve the ESP faculty development system, it is vital to consider the three weaknesses when designing the course in technology for the ESP faculty.

Constructivist ESP Faculty Development

Constructivist faculty development suggests two basic approaches. The first, classified as psychological (Piagetian), focuses on individualization of the development programs; the second, situational (social), assumes that situated cognition and group interaction (Richardson 1997) is important. Considering these as well as the faults of the current faculty development system, one can conclude that successful on-site ESP faculty development in technology should be *focus-oriented*, which implies arranging the small groups according to the specific area of teaching ESP (e.g. technology in teaching Business English, Geological English, Automotive English, etc.); *task-oriented*, that is providing the faculty learners with the knowledge and skills to be used for doing their specific teaching practice tasks (e.g. how to use a Business Planner in class); *learner-oriented*, i.e. presented in the format that can be easily understood by humanitarians; and *outcome-oriented*, which is helping generate original technology-based course materials, from hard copies to interactive network assignments, etc. that faculty will use.

New ESP Faculty Development Course in Technology

Assuming that the new course should model the manner of involving technology in teaching ESP and thus



help the faculty understand its functions and capacities as well as the conceptional foundations of its use, I would suggest that the course be structured as is shown on (Fig. 1).

Since the course is focus- and task-oriented, it should be delivered by technologically competent ESP instructors assisted by technology and/or field experts. Based on solving the real classroom problems and elaborating usable ESP-teaching materials, the course should offer the faculty learners Aa wide array of learning opportunities@ (Liberman 1995), combining individual experiences and creativity with group collaboration and support.

The Concept of Life-Long ESP Faculty Development

Tech-literacy of the ESP faculty is not a once-and-forever competence: the acquisition of tech-literacy, as any other knowledge-accretion process, takes long time (Nickerson 1986). New advances in technology that finally enter university classrooms are never ending: to keep pace with technological progress and benefit from it, ESP faculty should enjoy a system of life-long development. This might be shaped as lectures on advanced technologies, such as fiber optics connections and digital TV, demo classes (e.g., in distance education), consultations on new software, and material-development workshops, as well as brainstorming sessions, round-table discussions, new ideas presentations, and journal publishing. The concept of life-long faculty development in technology should therefore become the basis for the ESP Department seminars.

Conclusion

Providing high quality ESP courses today is totally impossible without the wide involvement of modern technologies used both to support language learning and to bring the instruction as close as possible to the realm of students= future profession. This can be accomplished through the implementation of the new concept of ESP faculty development, essentially constructivist, life-long, focus-, task-, learner-, and output- oriented, and flexible in the sense of content. In Russia, such restructuring of the current system of ESP faculty development in technology is vital because it might significantly improve the quality of higher education through teaching students how to use the English language in their professional practices most efficiently and effectively.

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To Teach How Or To Teach With: Four University's Approaches To Technology Integration For Teacher Preparation

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Abstract: A recent ISTE report provides persuasive evidence explaining the shortcomings of older models of technology education in preparing tomorrow's teachers. New methods and models are needed to successfully prepare teachers to integrate technology in the classroom. The purpose of this interactive panel session is to highlight the models followed by four Colleges of Education at varying stages of the integration process. The Universities represented are: University of Illinois at Chicago, University of Nevada at Las Vegas, Utah State University, and the University of Connecticut.

The rapid influx of hardware and software into public and private school systems has placed sharp demands on teachers to know how to use and how to teach with technology. Yet, year after year, Colleges of Education (COEs) are sending new teachers out under- prepared for this task. As such, COEs are being challenged to re-examine the methods that they use to infuse technology into teacher preparation curricula to provide more information and practice for tomorrow's teachers before they enter the classroom. This is a particularly burning issue for those colleges wishing to maintain their NCATE certification.

The traditional model for technology education centers on a single technology competency course or multiple competency modules. A recent research study put out by the International Society for Technology in Education (ISTE) (Moursund & Bielefeldt, 1999) examined this model of technology integration and found it inadequate. The report clearly states no correlation between formal instructional technology courses and instructional technology utilization by K-12 classroom teachers. Instead the report supports the notion that infusion of technology throughout the entire teacher preparation is the key to classroom technology integration. As such, COEs are scrambling to find space and expertise among classes and faculty to facilitate the transition.

While all COEs are different in some respects regarding technology integration, some types of planning for technology are common across institutions. Technology planning includes equipment acquisition and maintenance as well as professional development activities that guide the integration of technology into teaching and learning. While COE technology plans run the gamut from formal to informal, the same key issues must be addressed by each university planning for the integration of technology into teacher education programs. These issues include but are not limited to:

- **Type of Coursework:** Coursework issues include how to accommodate for core competencies, modeling problem solving and critical thinking using technology, mediating learning/teaching through technology.
- **Technology Teaching Responsibility:** Whose responsibility is it to teach with/about technology? As we ask such questions, we become forced to address a serious issue: Are we asking methods teachers to introduce applications or technology teachers to teach methods?
- **University support:** For technology integration to occur, university support structures must exist. Administration and faculty in colleges of education must collaborate in order to identify and nurture administrative support and commitment to faculty and facilities.
- **Faculty Support:** This issue includes providing faculty with technical support, professional development and compensation for the added workload that they can incur through the technology integration process.
- **Student Support:** Students must also be supported as they use technology in course projects as well as within their practicum experiences.
- **In-service/professional development:** As graduates enter the workforce, the technology support that they recieved as students must be maintained.

While the ISTE report (1999) provides persuasive evidence explaining the shortcomings of older models of technology education in preparing tomorrow's teachers, the report fails to give guidance to colleges of education on methods or models that will lead to increased integration of technology in the classroom. Instead the report advocates that educators share and disseminate their successful models and lessons they have learned along the way. The purpose of this interactive panel session is to highlight the models followed by four Colleges of Education at varying stages of the integration process. The Universities represented are: University of Illinois at Chicago, University of Nevada at Las Vegas, Utah State University, and the University of Connecticut.

University of Nevada, Las Vegas
Neal Strudler, Department of Curriculum and Instruction

Project THREAD (Technology: Helping Restructure Educational Access and Delivery) was funded by the U.S. Office of Education's Preparing Tomorrow's Teachers to Use Technology grant program for Fall 1999. It was designed to build upon and expand the work done in previous years through the integration of technology into teacher education courses and field experiences for preservice teachers (Handler and Strudler, 1997; Strudler, Handler and Falba, 1998). The consortium for this project includes UNLV's College of Education (COE) and the Clark County School District (CCSD). In addition, it involves a new collaboration among various entities at UNLV, the project's lead organization, and a continuing collaboration with a K-8 private school, St. Viator's. The consortium's overarching goal is to to build the capacity of individuals and institutional structures to support the infusion of technology throughout UNLV's teacher preparation program. This is being done through: (a) a series of inservice workshops for university faculty, administrators, field supervisors and mentor teachers; (b) one-on-one follow-up support provided by project staff and advanced undergraduate students; (c) a "mini-grant" program in collaboration with the UNLV's Teaching and Learning Center to support the development of technology-based modules for teacher education courses; and (d) expanded opportunities for students to apply technology in their courses and field experiences.

Project THREAD staff have been working with COE faculty to plan for the integration of technology based on the ISTE/NCATE foundation standards for preservice teachers. A critical component of those standards involves the application of technology in practica and student teaching. The project is addressing this need by beginning to implement a system in which students can request technology-rich field placements. In addition an advanced undergraduate educational technology course will be created to include a field placement with exemplary technology-using mentor teachers.

While Project THREAD's main focus is on professional development, it has enhanced the COE's technology resources via: (a) the purchase of a mobile laboratory of laptop computers for use in courses; (b) the development of an online version of our undergraduate educational computing survey classes; and (c) the availability of CD-ROM based software for checkout for students and faculty.

Overall, Project THREAD is attempting to weave together a mixture of new and existing learning opportunities to prepare preservice teachers for tomorrow's technology-rich classrooms. It seeks to move from "pockets" of

technology integration toward widespread infusion in all aspects of our teacher preparation program. While the proposed initiatives are designed to be carried out within the one-year time frame of the grant, the interventions described mark beginning efforts in what we plan to expand via a further infusion of resources.

University of Illinois at Chicago
Kim Lawless, Department of Curriculum and Instruction
Louanne Smolin, Department of Curriculum and Instruction

In addition to NCATE/ISTE Standards for Technology Competencies, the Board of Education in the State of Illinois has developed additional guidelines for teacher certification programs in the state. These guidelines focus on in context technology application that move beyond technical skill to classroom integration. Challenges presented to UIC were great and included minimal technology infrastructure. Efforts to infuse technology into the education curriculum had to start from scratch.

Initial efforts focused upon the development of a framework that served as a guide for the infusion of technology within teacher certification programs, the acquisition of equipment and professional development . This model was created specifically to accommodate the set sequence of activities that all teacher candidates experience as a part of their program of study. Therefore, it places minimal additional burdens on students, faculty and technology staff.

Since most certification programs at UIC are two year sequences technology integration occurs across four semesters, the students junior and senior years. The model is as follows:

A. **Mandatory general competencies:** General competencies include such applications as e-mail, file systems, etc. This could be a course for as many as three credits or a series of competencies that must be met by all COE students prior to entry into the Junior year of coursework.
B. **Content/domain specific software integrated (Junior and Senior Years):** The methods teachers, facilitated by the technology faculty would model in context use of technology and subject related software applications. This would illustrate a sampling of what technologies are available within specific domains as well as demonstrate appropriate uses of technology.
C. **Culminating experiences (First Semester Senior Year):** Students develop and build a portfolio highlighting technology applications. For example, they can develop webpages, multimedia modules, or webquests. These applications become a part of a portfolio.
D. **Classroom integration project (Second Semester Senior Year):** Students take what they have learned and develop a classroom based project in which technology is seamlessly integrated. They will run this project with their students through their practicum experience.

University of Connecticut
Scott W. Brown, Department of Educational Psychology

The University of Connecticut' Neag School of Education is taking an integrative approach to addressing the standards and guidelines proposed by NCATE/ISTE and the Connecticut State Department of Education as we prepare teachers for the 21st century and provide professional development for inservice educators. The multiple guidelines and standards within an extremely dynamic field have led us to take a dynamic approach to address this challenge.

In addition to the national standards, the Governor of Connecticut has declared that all children will be technology competent by the sixth-grade in the year 2004. He further delineated a three-tier progression through which he expects Connecticut teachers to pass through, reaching the highest level of proficiency, also by 2004. At UConn we are involved in the training of future teachers and the development of inservice training and assessment for Connecticut's current educators. To this end, the United Technologies Corporation has awarded a significant contract to the Neag School of Education to develop training for inservice teachers, develop an opportunity for an on-site MA program in Instructional Media and Technology, and to develop an assessment system for measuring the success of this project. The UTC project specifically focuses on the Hartford Public Schools. Additionally, the new superintendent of schools for Hartford has started "the lap top program" in which 400 laptops were distributed to

selected 9th grade classes across the city. Many of our students will be working with these classes in their practicum and internship activities.

The assessment component of the UTC project involves three levels of the educational technology use. The first level is skill-based but the later two levels employ a problem-based format and portfolio format respectively. Our current students are involved in the development, field-testing and implementation of the assessment protocols. This has been an opportunity to integrate our students in a real problem involving educational technology.

The Teacher Preparation Program at UConn is a five-year program within which students are admitted to the Neag School as juniors and graduate with a B.A. at the end of four years and an MA at the end of five years. Prior to being admitted to the Neag School, juniors will have competed general education requirements, which include a limited number of technology, related courses, designated as C courses. Therefore, as juniors they take an educational technology course in the fall, but this course is integrated across several other courses during the fall semester: two courses in learning, a course in special education, and a seminar that is designed to specifically link the activities that students engage in will in their clinical placements with the course content presented in the above stated courses. These activities are specifically designed to emphasize the education in educational technology. Students engage in activities and projects that focus on the educational impact of technology across the content of the fall courses and provides the basis for further integration across the remainder of their program. As juniors, seniors and MA students, they continue to integrate their educational activities and experiences in a technology rich environment. Our courses and programs stress the integration of education and technology to solve problems and address the challenges and issues of providing the optimal educational environment for all students.

In order to achieve our goals, we have instituted professional development for all Neag faculty and staff involved in teacher preparation, we have raised the expectations of integration of educational technology in our own educational activities, and we have formed a school-wide advisory committee to develop the support structures necessary to meet our goals and provided them a funding basis to reach these goals. We have initiated an electronic portfolio process for our MA students in which their materials will be pressed on a CD for review by a faculty committee and also used to demonstrate proficiency as a teacher and as a proficient user of educational technology. The portfolio system is modeled after the national and State standards. Current plans include the expansion of the professional development to all Neag faculty and staff.

Utah State University
Steve Soulier, Department of Instructional Technology

The Department of Instructional Technology at Utah State University has been recognized as a leader in the field of instructional design for over 25 years. More recently however, the department has had to adopt a new mission, that of facilitating the use of technology in teaching throughout the College of Education. This has not been an easy task, but changing state and national technology initiatives have made it a must.

In an effort to prepare out standing teachers to use technology in mostly rural setting, the department has faced many logistical problems. Time and location constraints have made the delivery of instruction to many willing students difficult at best. As such, USU had to move to a distance-based model of teacher/technology training. Full distance education programs in educational technology and media endorsements were implemented in the fall of 1996. The programs are a mix of two-way interactive video, satellite broadcast and web delivery systems. Students meet in cohort groups around the state weekly to work on class projects and receive instruction.

The first cohort group within these programs has now graduated and students are now working throughout the state in technology related teaching positions. While the program can certainly be considered a success, a number of lessons were learned from the first technology cohort. First, the lack of standard equipment at the various sites made some of the more technical coursework difficult at best. Future cohorts will need to purchase personal equipment at program onset. Additionally, management over a number of the sites through the Internet proved challenging with server failures and lack of student support at the sites. These concerns and others will be discussed as part of the presentation.

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GRADUATE & INSERVICE

Section Editor:

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Research within the areas of graduate and inservice remain a predominant area of importance concerning the appropriate integration of technology into today's learning environment. Graduate and inservice learners have come to insist upon learning environments in which the sound understanding of appropriate technology understanding and integration is expressed; as a representation of this necessity, the outstanding articles within this section attest to the latest innovations and discussions pertaining to graduate and inservice learning environments. The authors offer the latest research and theoretical issues through which the future of appropriate technology integration will appear. For ease of discernment, the following research paper summaries are presented in alphabetical order by the author's surname.

Abate explores the relationship between numerous classroom learning activities and tools; specifically the integration of technology into the learning environment. Within Abate's paper the initial findings, based upon ethnographic field data and survey administration, is presented. Specific aspects of the survey data that is addressed are three points: middle school facilitator's classroom activities; technological level of such activities; and, any impediments that may occur to the integration of technology into the learning environment.

Bauder, Rossi and Mullick offer a discussion surrounding the integration of a supportive modeling technique and mentoring aspects within Internet inservice workshops. The integration of these aspects is meant to facilitate the integration of instructional technology into learning environments. As a reward for their efforts, the teachers reported an increased level of comfort when integrating the Internet and subsequent Internet tools into the learning environment.

Beam and Beam present a process and outcome description of a project that was focused upon the investigation of classroom instructors with a wide spectrum of technological experience who were shifting career goals. The learning the challenges faced during their learning curve as content authors within a commercial content authoring company are addressed.

Borras and Manriquez describe a procedural model through which teachers learn to conduct research studies through the integration of technology-supported instruction. The context through which this model is facilitated lies within the model's working relationship between the researcher and teacher. In conclusion, Borras and Manriquez offer a number of aspects that may positively affect the inquiry efforts and attitudes of the research and teacher.

Brownell and Brownell discuss the evolving concept of media literacy and digital literacy within a classroom technology masters-level degree program. Examples of resources are offered, the course participants' feedback is presented and an outline of the specific course under discussion is offered.

Butler, Martin and Gleason present a project wherein a collaboratively designed and implemented program pertaining to control technology for use with primary-level students is outlined. The project design, project implementation and the development of a learning community wherein support structures are enhanced are discussed.

Carlson, Repman, Downs and Clark document the methods implemented to increase the traditional face-to-face learning environment discourse effectiveness through the integration of Internet-based interactive activities. Suggestions for future instructors are presented.

Carr focuses upon an Introductory Astronomy for Educators course wherein the evaluation of the course efficacy towards meeting the predetermined goals of flexibility, critical thinking and cognitive interaction are addressed. Research-based findings and issues raised are included.

Cotugno and Kahn examine the theoretical implications and realistic pathways through which the appropriate integration of technology into classrooms is examined. Of interest is the overarching focus of Cotugno and Kahn upon the instructional process within the instructional unit, rather than at a classroom-by-classroom focus level.

Cox discusses strategies that instructors can implement to offer students the ability to locate necessary statistical information on the Internet. The efficient capture of statistical information and the ability to critically evaluate an Internet site, as well as the statistical information presented within the Internet site, are primary focuses.

FitzGibbon, Drury, Oldham and Tangney reflect upon the introduction of a modular inservice program, entitled Hero's Journey. The focus of this modular inservice program is pedagogical and cirricular issues and, therefore, relies upon the contribution of experienced classroom instructors.

Gallagher offers an alternative model for inservice teachers wherein technological training is provided within a classroom-based environment. The success of the alternative technological training model is apparent; however, the monetary amount necessary to sustain such an innovative program is also addressed.

Gibson and Kear analyze the importance of appropriate technological integration into a graduate teacher education program. The focus of this integration is to attempt a transformation of teaching practices towards a more student-oriented learning environment model.

Glatz presents information pertaining to the integration of technology into learner-centered foreign and second language teacher training programs. A discussion surrounding background information, important developments and problematic issues pertaining to the teacher training are addressed.

Headley and Carr offer a grass-roots alternative to traditionally designed and developed online course presentation and delivery models. The effectiveness of the grass-roots model is discussed, as well as early lessons within the process and recommendations for future grass-roots initiatives.

Heath describes the design and development issues pertaining to active learning environments for professional development sessions. Such innovative aspects presented within this paper are instructional strategies, classroom management models and the successful integration of technology into the learning environment.

Hegwer-Di Vita presents a summarization as well as a discussion of appropriately integrated technological modeling techniques within special education teacher training program coursework. A primary concern of Hegwer-Di Vita is the possible discrepancy between the level of technology that is available within the university systems and the availability of technology within the P-12 systems.

Hollon, McIntyre and Majdalani document an effective model for professional development wherein the appropriate integration of technology into classroom situations is imperative for the active engagement and use of existing and emerging technologies. The support structure within he collaborative technology professional development model for P-12 students, P-12 teachers, university preservice teachers, university faculty and instructional technology professionals is addressed.

Hutchinson, Verkler and Delius present a case study wherein the efforts of instructors towards an improved communication between fellow instructors are described. Of interest is the constantly shifting desires and needs of the instructors are being addressed due to the knowledge acquisition and expertise gained by the instructors.

Keefe and Tsantis present a work-in-progress report on metaphoric scaffolding. The use of digital video techniques aid in the reduction the teacher apprehension levels pertaining to innovative approaches to learning.

Larsen, Barry and Staud provide an overview of the creative initiative regarding the integration of technology into a holistic teacher education program. Further, Larsen, Barry and Staud offer an exploration of the role of technology within the current program, a description of recent adjustments within the initiative and the development of technology surveys. A needs-analysis report will be presented at the SITE conference.

Levin and Waddoups discuss the integration of a different, highly interactive online learning environment model. An in-depth effectiveness evaluation is reported.

Maeers examines the use of WebCT, an online course development tool, in two graduate-level technology courses. Data is presented and interpreted so as to address WebCT's effect and responsibility towards the enhanced learning of the students within the course.

Mullick, Bauder, Sarner and Carr offer successful results pertaining to an instructional staff development project. The goal of the project was to facilitate the appropriate integration of technology into the learning environment.

Odenthal and Voogt emphasize the design of learning practices as appropriate professional development activities for teacher educators. Of interest are the specifications for the design model and a description of the initial prototype is presented.

Plumer discusses a masters program that successfully prepares inservice teachers to appropriately integrate technology into the instructional environment. A focus of this paper is the use of information technology to its full potential.

Rhodes explores the impact of online interactive World Wide Web sites as integrated into graduate pre-service literacy education courses. A qualitative research aspect is chosen due to the key themes that emerged and which revolved around issues of teaching and learning. The responsibility of the university to appropriately prepare teachers is addressed.

Rodriguez, Perez, Garcia and Mompo describe an Intranet that has been developed for a teacher's lifelong learning international project. The focus is upon developing and interactive environment through which a supportive, fostering community environment may emerge.

Stephen, Gammon and Podleski describe a project that attempts to address barriers surrounding the integration of

technology into the school curriculums and thematic units. The authors emphasize curricular areas that necessitate strengthening, as identified by the United States of America's Department of Education.

Topp, Eshleman and Hirschfeld focus upon a successful model of inservice teacher training, which is designed to support teachers to enhance lessons through appropriately integrated technology. The focus of the inservice teacher training model is to engage the learner in the learning environment through teacher training in the areas of technology integration, lesson design and brain research

Wildner-Bassett summarizes a retrospective ethnographic and pedagogical theory analysis pertaining to key features of a computer mediated communication (CMC) environment within a course structure environment. The collaborative efforts pertaining to knowing, teaching and learning are emphasized.

Wilson, Phillips, Spence and Gibbons utilize a constructivist theoretical model approach towards the implementation of a professional development situation. The enhancement of learner-centered opportunities pertaining to information integration and conceptual frameworking develop a knowledge base and aid in the development of higher order thinking skills.

Yang, Shindler and Keen examine the bilinear problem-solving instructional strategy that was designed, developed and implemented within a graduate applied technology course. The authors provide conclusions and recommendations regarding the problem-based learning strategy model.

Zhang and Stacks present an article that documents the integration of a task-oriented training model in a Midwestern city within the United States of America. The task-oriented training significantly contributed to the technological competency and theoretical understanding of the learners.

Graduate and inservice research and discussions surrounding pertinent theoretical issues are imperative as the technological hardware becomes available to all levels within the educational environment. Only through the thoughtful reflection and rigorous research that the authors within this section have presented will the appropriate integration of technology into all levels of learning environments become a reality.

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Teaching Practice and the Design of Professional Development Activities

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Abstract: This paper explores the relationship among classroom teaching and learning activities, the design of technological tools, and technology integration in the classroom. Ethnographic field methods were employed to represent and understand the teaching and learning activities of a middle school community. Surveys were administered. Descriptive accounts of classroom interactions were recorded as field notes and follow-up interviews were conducted in order to develop a preliminary understanding of classroom / technology interactions. The preliminary study examined the teaching /learning activities across four content areas; Science, Mathematics, Social Studies and Language Arts. A suburban middle school participated in the study. This paper will present initial findings based on the survey data regarding the 1. types of learning activities employed by the middle school teachers, 2. level of technology use related to those activities and 3. perceived impediments to technology integration.

Teachers who integrate technology into their teaching on a regular basis still represent the minority of classroom teachers. (OTA, 1995) Despite considerable cost and effort the potential of technology has by and large remained unfulfilled in the classroom. This unfulfilled potential of technology represents a major problem for advocates of technology integration as questions regarding the efficacy of educational technology intensify (Stoll, 1995). What makes the current situation increasing untenable is that over twenty years of inquiry into the barriers to technology integration have led to an understanding of many of the key obstacles to integration. However, despite increased knowledge of the obstacles, widespread adoption of technology remains elusive.

Dias (1999) has identified resources, teacher time, training, and support as critical to technology integration. As more districts equip schools with computers, software and internet access issues regarding resources; hardware, software, and accessibility to technology have given way to questions regarding the nature and quality of professional development; teacher time, training and support (Ohio SchoolNet, 1999). Further, in spite of the adjustments in research focus, the integration of technology remains as challenging a problem today as it did twenty year ago. Research has identified other significant impediments to implementation. Prominent among these are attitudinal issues such as teacher beliefs (Ertmer, Addison, Land, Ross & Woods, 1999) and adoption of instructional reforms (Neiderhauser, Salem, & Fields, 1999). Neiderhauser et al have commented that traditional beliefs about schooling remain strong and stable and that dissatisfaction must occur in order for teachers to change their beliefs. Technology integration as a component of instructional reform requires that teachers change beliefs and practices. The question remains for many teachers whether the level of dissatisfaction is sufficient to institute technology reforms.

All of these documented obstacles are critical to the acceptance and widespread integration of technology into teaching. Underlying the analysis of these obstacles is the assumption that the technological tools currently available to teachers support classroom activities of teaching and learning. Although this paper recognizes the importance of the documented obstacles, it deviates from current lines of inquiry by revisiting the assumption that technological tools currently available to teachers are appropriate. The assumption of appropriateness is explored from a design perspective. Are the technological tools designed for teachers' work environment? This study considers this question in light of how currently available technological tools are implemented by teachers and students in a middle school setting.

Issues of usability

Interest in the usability of technological tools is a relatively recent phenomenon. This interest is an outgrowth of a technology market that has matured from one consisting primarily of individuals with technical orientations such as engineers, scientists, and mathematicians to a wider population representing all occupations. How the change in user audience has influenced computer usability is a significant attribute in assessing if current technological tools meet the needs of teachers.

Cooper (1999) has identified two categories of computer users. One category experiences frustration for failing at attempts to use technology while the other category feels powerful at overcoming the difficulty imposed by technological hardware and software. These two extreme emotions polarize people into being either a "survivor" or an "apologist". According to Cooper an apologist is synonymous with a power user. Someone who regardless of how hard or useful an interaction is will ignore the difficulty and use it. Video cassette recorders (VCR) provide a good example for an apologist. Most VCRs require a manual to program, the directions are typically poorly written, and the VCR does not respond gracefully when the user enters an inaccurate key press. The apologist will point out to a novice user that the VCR is really not all that difficult to operate. Simply enter an arcane list of commands in the appropriate order and you can record a program.

At the other end of the spectrum are the survivors. In most occupations the survivor cannot abandon technology. It is not that the survivor fails to grasp the difference between hard and easy but rather that the technology is required for their work. For example, a marketing executive's initial efforts at using a spreadsheet to create graphs may not be perceived as easy. However, the job requires the use of hardware and software, so the survivor learns to use enough of the operating system and the spreadsheet program functions to create a finished product. In the workplace the survivor is not in a position to choose whether to use technology or not.

Despite attempts to integrate technology into the curriculum, many teachers do not perceive technology as supportive of their goals (Abate & Jin, 1999). The majority population, the teachers that would be survivors in other occupations do not have a job imposed requirement to use technology so their level of technology integration is low. To simply require the use of technology in education as it has been required in other work setting assumes that the work of education is commensurate with the work of business.

Historical Perspective

Sutherland's *Sketchpad* a graphical design program was one of the first programs to make it possible for users to implement a direct manipulation programming environment. It was twenty years later that Sutherland's ideas became refined, elaborated, and widespread with the introduction of graphical user interfaces (Hutchins, Hollan, & Norman, 1986). The underlying principle behind the graphical user interface was to make computational media available to a wider audience by making it more intuitive to the casual user. The idea was to make technology user friendly. The graphical user interface was a significant step from the command line orientation of early computer systems.

Ease of use reflects a dynamic construct. What made the original Macintosh interface successful was the perception that it was easy to use. This ease of use was based on consistency of the graphic user interface across applications. (Winograd, 1996) Guidelines were created for developers to insure that standardization of the interface was maintained. (Apple Computer, 1987). Standardizing simplified use. When something can't be designed without arbitrary mappings and difficulties, the option remaining is standardization (Norman,1983). A standardized system only needs to be learned once but the conditions of standardization still require training. If the standard is set while the technology is still primitive problems inherent in the mappings and difficulties become locked into the design. Based on the rapid advances in hardware, software, and networking, current technological tools though powerful appear primitive at least in regard to usability. This issue is born out by personal experience. The Windows and Macintosh OS interfaces are based on pull down menus and windows but the mappings across the two systems are different and so are the standards. When instructing students familiar with one system, it is quite common to hear the complaint that whichever system was learned first is better than the one learned second. (Abate, 1999). Neither operating system is intuitive to the novice user. Currently, ease of use is based more on user familiarity with a standard than on natural mappings.

Work and Technological Tools

The effect of technological tools on people at work is linked to assumptions about the work they undertake. How well those assumptions correspond to the reality of what those individuals do on the job influences the individual's productivity and job satisfaction (Kuhn, 1996). The considerations that must be made in building technological tools for professionals in a business setting require a different set of design requirements then those made for teachers who employ the tools in a setting for learning and teaching (Nicol, 1990). This connection of design to work task speaks directly to the assumption of the appropriateness of the technological tools currently available to teachers. Have design principles been applied to the creation of educational hardware and software? An argument supportive of software specifically designed for education can be made solely on the basis of the hundreds of software titles currently available in K-12 education. Regardless of the quality of these titles, they are marketed directly for classroom use. The same argument cannot be advanced for hardware. With minor exceptions, hardware tools have historically been designed for the business or home markets and then adapted as tools for education

Survey

Limitations

The procedures and methods adopted and implemented in this design emerged from a non-standard view of why the integration of technology into K-12 teaching falls below the standards promoted for educational technology. The research problem from this viewpoint proposes that factors other than professional development and accessibility to technological equipment are influencing the levels of technology integration in the classroom. This viewpoint is supported by prior experiences with professional development in the integration of technology (Abate, Atkins, Hannah, Benghiat, & Settlage 1996). Instead, the technology integration problem is considered with respect to the design of technological tools. This viewpoint of a tool design problem evolved from a pilot study that suggested that many of the technological tools currently available to teachers may not match the learning activities commonly implemented in their classrooms (Abate & Jin, 1999). The tool mismatch problem presumably influences technology integration by teachers regardless of their level of expertise. As such, the problem considered in the study was the role of technological tools and the classroom environment on the integration of technology in teaching.

In explaining the specification of the problem, after analysis, it is tempting to make the research approach appear purposeful and conscious. However at the outset there was not a well formulated rationale for the approach. Rather, while in the field the 1. environment of the classroom and 2. functionality of the tools made explicit a rationale for concentrating on certain kinds of phenomena. An assumption was made early in the inquiry that matters of importance to these two key issues would reveal basic understandings regarding the integration of technology.

Not all participants in the study were considered equally. The classroom teacher, the technological tools and the aspects of the classroom environment as they impinged on the teacher were of central concern. Emphasis was placed on studying issues that mattered most to teachers regarding the implementation of technological tools with students.

Method

The method of investigation involved a form of participant observer employing three methods-participant observation, interviews, and enumeration/sampling. For participant observation the author directly observed classroom teachers in a middle school setting and played a quasi participant role by providing technology workshops for the teaching staff. Interviewing occurred following observations of classroom teaching. Since field observations are still underway, this preliminary analysis considers only the survey data.

A four part survey consisting of 47 items was distributed to 44 teachers at a suburban middle school. The first section consisted of six questions that contributed background information on the respondents. Included in this section were questions on teaching experience, grade level, subjects taught, technology expertise, and student expertise in technology.

The second section provided a list of eighteen possible learning activities along with a four-point scale indicating the anticipated frequency of the learning activity. Traditional and technology based methods for implementing the activity were listed below each learning activity. The teachers were directed to rate all items

that applied. The eighteen activities represented a range of learning activities including; writing, collecting data, organizing data, analyzing data, presenting information, classroom discussions, reviewing instruction, and developing projects. Ideas for the learning activities were based on sample activities included in assignments submitted by teachers enrolled in a graduate level instructional development course during the past ten years.

Fifteen different technologies were presented in the third section. The teachers were presented with a four-point scale to indicate how often they modeled or directed their students in the use of the fifteen technologies. Included in the technologies were: Internet, email, word processors, spreadsheet, databases, statistical software, video tapes, simulations, graphics, hypermedia, drill and practice, teacher utilities, presentation packages, overhead projectors, and other.

The fourth section of the survey included eight questions pertaining to students use of computer based tools. These statements were also scored using the four-point scale. In addition, the teachers were asked to select the reason(s) for the score. Twenty-four reasons were provided. The teachers were encouraged to select all reasons that applied or to choose "Other" and explain this choice. The respondents were informed that this was a pilot survey and that comments were welcomed.

Results

Approximately ninety-five percent (42 of 44) teachers returned the surveys. Section one focused on general background information. Of the forty-two, twenty-nine respondents taught one or more of the four content areas; Language Arts, Social Studies, Mathematics, and Science. The median years of teaching experience for this group was in the ten to twenty year range with grade levels five through seven represented. Nineteen of twenty-nine teachers taught more than one content area. Less than one-third of the content area teachers (8 out of 29) considered themselves to be experienced with technology.

Section two of the survey was included to ascertain what learning activities are commonly implemented in the classroom and to discover what if any technologies the teachers employ with the learning activities. A four-point scale; 1- never, 2- rarely, 3- occasionally, and 4 - frequently was employed. Seventeen of the eighteen learning activities had an median score for one or more methods of implementation at or above the "occasionally" level suggesting that the learning activities listed for analysis did occur in these classrooms. The exception was "writing correspondence" whose median score was "rarely". In retrospect this category could have been incorporated into one of the other writing categories.

Section three considered the teachers' modeling of technology. Again a four-point scale was employed. Of the fifteen items listed only word processing and use of the overhead projectors received scores of 3 signifying occasional modeling by the teachers. Video tapes received a median score of 2 or rarely. Other was never selected. The median score of the eleven other technological tools (spreadsheets, E-mail, Internet, databases, statistical software, presentation software, simulations, graphics, teacher utilities, hypermedia, and tutorial software) was 1 (never) with and mean score of 1.40 across the items.

Section four posed eight questions regarding students' current use of computer based instructional tools. The four point scale was used and respondents were encouraged to identify the reason for their selection from a list of twenty-four possibilities. The median score across the 8 questions was 1-never with two items word processors, occasionally and calculators, frequently. The most common reasons for calculator use was that they were inexpensive, useful, and easy to use. Common reasons for using word processors included "easy to use" and "professional looking".

Conclusion

The survey portion of this study provided a snapshot of the learning and computer integration activities of the middle school teachers who teach Language Arts, Science, Mathematics and Socials Studies. The distribution of technology skills reported by the teachers may be unique to this middle school.

The responses confirmed that the learning activities listed in the survey were representative of the learning activities that occur in middle school classrooms. As such, the activities offer a starting point for examining an activity-oriented view of middle school teachers and students as technology users. In particular, it advances a framework for further examination of the field data currently being collected at the school site.

What remains open to question are the reasons influencing the use and non-use of technologies in learning activities? Several variables proved confounding. Lack of equipment was identified as a key reason for student non-use of tools. Yet, two computer labs were available, several of the science classrooms were equipped with ten computers, and most classrooms have one or more computers available. Comparing the results of the science teachers who have access to ten computers in the classroom with the entire group there were differences. Whereas the eleven technological integration items averaged 1.4 for the entire group, they averaged 1.8 for the six instructors who taught science. The science teachers were less likely to list "not enough equipment" but listed "not useful" as a as a reason for not employing computer based instructional tools. Also, presentation packages received a median score of three from this group so questions regarding technology access will require further consideration during the collection of field data. Lack of student training, and time needed for student use was also noted as a problem by several teachers.

The primary arguments listed against tool use were "not enough equipment" and "lack of training". As such the survey results mirror the concerns identified earlier. (Dias, 1999 & Ohio SchoolNet, 1999) The studies concern regarding the assumption of the match of tool design to tool use remains open to question. The only locations where a response of "useful" appeared were with word processing and calculators. Why wasn't useful listed with other tools? This result is somewhat confusing as learning activities that might benefit from computer tools such as the activities of drawing maps, collecting data, and organizing data all recorded the relatively high median scores of three "occasionally" or four "frequently" as learning activities. Yet, databases, the Internet, and spreadsheets, technology integration tools that support the collection and organization of data averaged 1.28 with 1 signifying a use of never. This result reveals a more complex relationship between learning activities and technology than simply access to equipment. Based on the results of the science teachers, even when technology is available it is not perceived to be easy to implement.

The survey data provided a starting point for analyzing the connection between technology tool design and technology tool use at this middle school site. Without question, the issues already identified in the literature as pertinent to technology integration are evident as impediments to integration at this school site. Additional work is required to establish an understanding of how the teachers perceive the technology available to them and whether this technology supports the learning activities they employ in their teaching. The survey results suggest preliminary questions regarding technological tool design and tool use. However, ongoing collection of field data is required to establish if the design of technological tools is a key factor influencing the use of technology by this group of teachers and students.

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Merits of Mentoring and Modeling in Internet Technology Integration: Overcoming Operational Obstacles

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Abstract While most Internet inservice workshops include hands-on activities and opportunities for exploration, not all also offer the support found by modeling techniques and mentoring new users. The Targeted Instructional Staff Development Project was designed as a professional development project to facilitate the integration of instructional technology in the classroom. While the project consisted of nine separate workshop modules, the Internet modules focused on Web search strategies, Web page design, and instant messaging. In addition to teaching these skills to teachers, the Web design module also included a session with students and teachers so that teaching strategies could be modeled. Although the modules were designed with careful scope and sequencing, unforeseen difficulties presented challenges to success. In spite of the difficulties, the teacher participants reported increased comfort and interest in using Internet tools in the classroom. Materials provided by the instructors and modeling of techniques, particularly when teaching student/teacher teams, both were seen as important steps to success.

Introduction

While most Internet inservice workshops include hands-on activities and opportunities for exploration, not all also offer the support found by modeling techniques and mentoring new users. Modeling the behaviors expected in integrating technology into the classroom has been found to be an effective means of reinforcing skills taught (LeBlanc & Oates, 1997). Mentoring can be accomplished by training lead teachers, through telecommunications, development of mutually supportive cohort groups or faculty-student interaction (Planow, Bauder, Carr, & Sarner, 1993), (Bauder & Sarner, 1996).

The Targeted Instructional Staff Development Project was designed as a professional development project to facilitate the integration of instructional technology in the classroom. The ultimate goals of the project were to empower students to use technology in all phases of their education, to facilitate teachers as learners, and to achieve the New York State Learning Standards by developing interdisciplinary thematic units focusing on Mathematics, Science and Technology and English Language Arts and at the same time fully integrating technology into the curriculum. The Project involved a consortium of four local districts in a metropolitan area in Central New York.

The participants were 25 teachers in grades 3-5 from nine different schools within these districts. While the project consisted of nine separate workshop modules, the Internet modules focused on Web search strategies, Web page design, and instant messaging. In addition to teaching these skills to teachers, the Web design module also included a session with students and teachers so that teaching strategies could be modeled. The instant messenger service was

to be deployed for mentoring between workshop instructors and teacher participants and between college and elementary school students. The Internet modules were attended entirely by teachers from the Utica City School district and held at SUNY Institute of Technology at Utica/Rome.

This paper describes only the Internet portion of the comprehensive professional development program and the methods used to ameliorate difficulties faced by participants and instructors. At the time of grant writing, some assumptions were made concerning the audience, timeline, and scope of Internet modules. Teachers were to be chosen from grades 3 – 5, have some experience with computers and the Internet, and have access to the Internet on at least one computer in the classroom. They were expected to be teachers who had already been using the Internet in classroom activities and for professional development, but who wanted assistance in being more efficient in doing so.

Over the course of several months, teachers would attend, in groups of 12 – 14, a full-day session on Web searching and instant messaging. The Utica School Web Project portion consisted of a full-day session for these groups on Web page design followed by one more full-day attended by 4 – 6 teachers with two students each. Two instructors from SUNY shared the teaching load and team taught the session on Web design with students. As soon as the instant messaging was taught, teachers were expected to use it and email to keep in touch with each other and the instructors, and to teach their students to use instant messaging to communicate with mentor students from SUNY's Learning Center.

Challenges

Although the modules were designed with careful scope and sequencing, unforeseen difficulties presented challenges to success. The sponsor's timeline compressed the workshop schedule into a near impossible timeframe. The total time available for the entire project was six months, rather than one year and for the Internet modules was six weeks rather than 12 weeks. As a result of the teachers reported that there was too much to learn into short a time frame, and when combined with all of their of their responsibilities, they could not into internalize all of the information. . Shortages in substitute teacher availability made participation difficult at times. Some teachers are arrived at the training sessions only to be greeted by a message that they had to return to school because there was no substitute teacher for them. To miss one session of the total of three with no opportunity to make up for the session because of the tight time frame only added to the teachers' and instructor' frustrations.

Teacher participants did not necessarily have the skill or comfort level nor access to Internet resources that had been expected. During the web search course, the instructor found that she had to teach Internet basics before she could teach Internet search strategies. Although it had been expected that the teachers would not only have access to e-mail but would use it, neither of these true it proved to be true for the teachers. Unfortunately the tight time frame did not allow for a reorganization of the course to teach the use of e-mail to a degree that would have been optimal for the students. Adding a brief introduction to e-mail before teaching the Internet messaging, meant that the messaging portion of the course was shortchanged. Teaching Internet messaging was further hampered by the messaging service being accessible at the time of one of the classes.

Back in the classroom, it appeared that the technical services were not what either the teachers or workshop instructors had been promised. In some classrooms computers did not yet have Internet access, instant messaging had not been installed, and in many cases the teachers had no access to e-mail other than signing up for a free e-mail service on the web. Technical support was so slow in coming that some teachers never did have access to the instant messaging service in the classroom before the end of the spring semester. Only one or two teachers were able to establish the service and usage for the student mentoring portion of the project.

Although the web page design portion of the project progressed more smoothly, it turned out to that the school had no web hosting capability for the teachers. For some teachers the incentive to learn web page development was diminished by the inability to host and maintain their own pages. Fortunately the Continuing Professional Education department at SUNY and was able to provide web hosting on at least a temporary basis.

Overcoming obstacles

In spite of these difficulties, the teacher participants reported increased comfort and interest in using Internet tools in the classroom. What methods were used to overcome the difficulties presented and assist teachers in increasing their confidence and skills? As most technology educators know, flexibility is one of the keys to success.

Instructors utilized different techniques for presenting materials: overhead projections for live demonstrations, handouts, instructor exchange at key moments in the syllabus, but gained the most success by offering a genuinely safe environment in which to experiment, make mistakes and correct those mistakes for optimum learning. The instructors presented themselves as life-long learners dedicated to sharing that philosophy with other adults; the tone for mutual sharing and open learning was established at the outset.

Being able to adapt the workshops even slightly to the abilities, interests, and needs of the participants helped them to understand that they to have to be flexible in using technology in the classroom. For example, when it became apparent that most of the teachers in the workshops did not have e-mail addresses and had not used e-mail, an immediate shift was made to teach them how to set up and use Hotmail accounts. Less time was spent on Internet messaging, but a detailed handout was provided to the teachers to assist them when they went back to the classroom.

For many beginning Internet users, error messages are a constant source of frustration. Taking the time to explore and understand these error messages helped the teachers realize when problems were caused by their mistakes, and when they were caused by circumstances beyond their control.

The Utica School Web Project constituted one facet of the larger project described by this paper where modeling was most explicitly used to facilitate skill building and technology integration. The Web Project sought to engage teachers and students together in a learning process under the facilitation of SUNY instructors, where material was presented and interpreted by the instructors with the intent of teaching both content and instructional methodology to teachers. It was here that mentoring and modeling were most crucial to overcoming difficulties faced by the teachers. Attention is given to the details that made this portion of the project successful in influencing teachers' attitudes toward the entirety of the Internet portion of the professional development project.

The Utica School Web Project benefited from the teacher group's prior experience in learning to use Internet tools. Specific lesson plans for teaching teachers to design web pages began upon completion of the earlier project phase in which they learned to use the Internet and instant messaging. At this point, instructors knew where their skills were, had already experienced the way in which the group engaged in shared learning and were able to anticipate and plan for diverse reactions to new material.

Foremost in planning was the ensuing task of facilitating teachers back into their native teaching role with children. To that end, the instructor team planned for three outcomes:

1. Teachers will be comfortable using Netscape Composer to create a Web Page
2. Teachers will have ideas for a useful application of this skill in their classroom
3. Teachers will have an opportunity to give instruction to children under the guidance of SUNY instructors

At the end of their Web Design training session, teachers had expressed anxiety at the potential for ridicule by the students for being novices. Upon the teachers' return with their students, the instructors were careful to leave authority with the teachers and concentrate on the syllabus. Everyone needed nurturing. The instructors included sensitivity to that need in all planning and presentation.

Syllabus

The instructor team produced a syllabus geared to logical, yet organic learning modules. These modules included:

- what is HTML
- creating a web page with HTML

- designing a web page with an HTML editor (Netscape Composer)
- searching for copyright-free material to enhance the web page
- saving and printing web material
- uploading material to a server, and
- possible scenarios for classroom application of the training.

Materials

Three distinct sets of materials supported the Utica School web project: a Master Packet, Teacher Packet, and a Student Packet. The Master Packet included all Teacher and Student handouts plus instructor notes for timing, suggested moments for reflection on real world application of the current training, and assorted ideas and tips for breaking up student training modules or customizing the student learning modules.

The Teacher Packet, designed to recall the classroom training in subsequent off-campus settings, also included all the children's handouts. Particular handouts were specifically designated to be printed and used as lesson plans in the elementary classroom.

The Student Packets were the briefest. They consisted of several lessons:

- Looking at Web Pages
- Designing your own Web Page on Paper
- Use Netscape Composer to make your Web Page
- Find Clip Art for your Web Page
- Format your Web Page
- Make a Hyperlink
- Conclusion with summary

The teachers were encouraged to take the supporting materials and adapt them to their own teaching styles and settings. In this way, the SUNY instructors acknowledged that the teachers are the best arbiters of their own domains yet provided the support necessary for them to teach the new material.

Setting

Training took place on the SUNY Institute of Technology campus, a few miles north of the city of Utica, NY. The Continuing Professional Education lab, a state-of-the-art-facility with Pentium class machines, Ethernet connections, large monitors and ergonomic chairs (a real plus when sitting for several hours at a time!) provided an ideal training lab. Its décor and large windows enhance the lab's physical environment. In short, the setting encouraged comfort on the part of the trainees, which usually translates into decreased resistance to new ideas and greater willingness to learn. This particular factor in learning is hard to measure, but the teachers commented on the surroundings more than once! Incidental facilities, such as the computer laboratory building's cafeteria, beautiful campus and access to phones, restrooms, etc. further increased the teachers' comfort level.

Procedures

One session was devoted to designing web pages with each group of teachers. The teachers learned a little HTML to create a Web Page, created a Web Page with Netscape Composer, then saved and uploaded the file to the SUNY Institute of Technology server. Another training session followed the web design segment, this time with students. Teachers handpicked the students who accompanied them for training at this second session. These children presented a diverse group, culturally, in gender, in Internet experience outside of the classroom and in education level, including one special education student who experienced similar success to other students.

While the teachers had learned the basics of Web page design in their earlier training, the focus in the teacher/student session was on assisting them in teaching the skills to their students. At each step of the way, time was give to introspection of teaching technique, hands-on activity with students, and analysis of supporting materials. Sample web pages were analyzed for both content and design, and templates were provided to assist in the design of students' own pages.

With two instructors in the lab, there was at least one instructor available to any teacher/student group in need of further assistance. Discussions of security and privacy issues, copyright, and citing sources were imbedded into the lessons. To preserve password security, the instructors uploaded the children's pages to the SUNY Institute of Technology server during a short break. Prior to the training session, the instructors created a home page for the Utica School Web Project; the home page included a table of links to student pages, one table for each of the training sessions. The students returned to class and discovered that the Instructor's station was now able to see their pages, their classmates' pages and other student pages from the Utica School Web Project via the World Wide Web. As certain pages still contained minor errors, the children also were able to witness some of the updating process.

Conclusion

Teachers considered these workshops an opportunity to see the potential for Internet tools in the classroom and gain some initial skills to use in ongoing integration projects. Materials provided by the instructors and modeling of techniques, particularly when teaching student/teacher teams, were both seen as important steps to success. Teachers felt successful in guiding their students through this (now less threatening) process; students felt terrific about creating a page for cyberspace.

The pre and post-test questionnaires used to determine the effectiveness of each of these three modules yielded significant results (Mullick, Bauder, Sarner & Carr, in press). The results of the t-tests for dependent (paired) samples showed that participants rated the modules significantly more favorably on the post-test compared with the pre-test, indicating that they believed the modules to be effective. Open-ended responses further supported the finding. When asked to indicate the single most valuable feature of the module participants said : "All the hands-on, make and take, the resource materials and the Internet Web Page design". "Having the children involved in the Web Page construction." "The Web Page Development". When asked to indicate the single weakest feature of the module, participants said: "We are not connected to the Internet in our classroom. The Internet ideas are great, if I had access." Until we have technical support to post our own Web Pages, this seems to have little merit for usage". "The time- too much information in too short a time".

These comments support the observations made by the instructors during the workshop sessions. In spite of the difficulties with time-frame, accessibility to resources, availability for training sessions, and insufficient prerequisite skills, the workshops did provide the teachers with opportunities to explore and learn to use Internet tools in the classroom.

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Educating the Educators: Reflections from a Mature Public Sector ISP

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Abstract: The Education Network of Ontario is a telecommunications corporation creating a network community for and by Ontario's elementary and secondary educators and funded with assistance from the Ontario Ministry of Education. ENO provides industry-standard ISP services, web-based Intranet services, professional development opportunities and model classroom projects. This paper describes the process and outcomes of a project to investigate a small group of teachers with a wide spectrum of experience in technology as they became content authors at a specific level of sophistication with a commercial content authoring company, watAGE Inc.

Introduction/Context

The initial stage of the Education Network of Ontario (ENO) was a UNIX-based, cross-platform, TCP/IP protocol distributed network application which provided bilingual (English and French) electronic mail, moderated conferencing (facilitated newsgroups), and database and Internet access across Ontario. It started with just eighteen members in 1993 and has grown to register more than seventy thousand teachers, administrators, trustees and education faculty, well over half of the K-12 education personnel of the province. The organization, a public sector Internet Service Provider has moved from project funding from the government to an independent not-for-profit corporation with an active and informed Board of Directors selling services to various levels of government.

The project has retained dial Internet access from any home or school location in Ontario and mail and conferencing services. However, ENO is fully retooled to enable browser-based moderated Intranet newsgroups, model classroom projects with interactive web creation scaled to suit the size of the province, and teacher development of industry-standard content. An industry-standard, no-cost, bilingual call centre supports all of the members and a web support site with automated tools for registration and access and service 'fixes'.

Teachers' Practices

Quantitative analysis tell us that our membership of 72,000 educators use the dial access an average of 9000 times a day with total connect time of 200,000 minutes a day in a summer or holiday month. The contention ratios on that access are the limits during the school year. In spite of that, a school month has statistics 50% greater to a total online time of nearly 9,000,000 minutes a month. However, the daily usage pattern changes from early morning through to midnight in the summer holiday to school times - late afternoon (after school) then throughout the night until leaving for school in the morning. Our servers handle as many as 100,000 messages a day. Some of our classroom activities sites register as many as 30,000 hits a day during peak activity times. This indicates a tremendous interest in and usage of the Internet and ENO resources; it also points out a real dearth of access equipment and time at the work site, at school.

Our anecdotal analysis and day-to-day experiences tell us a great deal about how educators use this suite of services. The major activity of the teachers continues to focus on the moderated conferences/newsgroups that they open to solve such endemic concerns as 'local' versus 'standardized' evaluation, reporting to parents, community work/learn programs, and general subject-based or level-based curriculum issues. A

second 'established' use occurs whenever a new provincial license for software is purchased. A conference is opened in which the technical support team from the vendor can discuss issues of use and technical implementation with teachers throughout the province. This 'mode' has expanded to include professionals from the Addiction Research Foundation who help teachers work positively with addicted students and the addiction resources regularly circulated to schools as a part of this agency's mandate.

Smaller groups of teachers voluntarily initiate a series of professional activities such as writing primary school curriculum units themed on ideas such as two-dimensions – measurement, journalling, drawing, electronic and snail mail. This arose from a typical and very successful example, the web-based project devoted to showing young students how to conceptualize two dimensions with a central fictional character called 'Flat Stanley' (http://www.enoreo.on.ca/flatstanley/). After the provincial collaboration, teachers mount the curriculum units on an ENO web site. Those who create the material then update and maintain it. The project is now international with hundreds of schools participating.

Administrators are creating a centralized resource of activities for teachers and administrators of northern schools who have no outside student recess for as long as six weeks in mid-winter. Teachers create a file of model parent letters and report cards for middle school students during a period of education reform. The network has a forum for school administrators in which teachers who wish to be administrators are mentored concerning effective career paths. Teachers, with education faculty and students, work on computer literacy curriculum units, plan professional development conferences, and hold meetings of subject-specific committee executives. One school of over two thousand students used the system for its internal electronic mail, information distribution and meeting scheduler. Another district's school custodians are working on practical identification and warnings about workplace issues and hazards.

Our largest project to date is an online environment to assist the Canadian National Marsville Program (http://mars99.enoreo.on.ca/index.en.htm), a project based on intermediate-level students creating a living environment for the pioneer astronauts and settlers of Mars. Students are uploading their air, water and food supply system drawings to their team's web pages. They access mentors' comments from Spar Aerospace and the Canadian Space Agency. They communicate with one another to prepare for the final 'link-up' day. Using this on-line environment prior to the main event enhances classroom learning activities.

Background for this Specific Research Project: Educating the Educators as Content Producers

In all of its activity, ENO enables personal, small group and even province-wide professional development. One of ENO's projects involved developing on an on-line course about telecommunications and writing for the technical environment for senior secondary students in English or Business Studies. ENO found that there are two distinct types of professionals at this time. The creation of even modules of a course requires a tremendous amount of design, content knowledge and technical skill. Many teachers could create small modules of engaging material. However, the ability to create usable modules for online and fact-to-face which would withstand scrutiny with respect to content objectives and be sufficiently technical to sustain students at a distance was not a part of every teacher's agenda. Those who had deep skills and interest were interested in markup standards such as SGML and XML that would produce a stable course, testing procedures that involved feedback from students, and Intranet applications such as newsgroups and chat to support 'classroom routines'. We engaged watAGE Inc whose content authoring model can be reviewed at http://www.online-learning.com/ptw

We began to focus on a smaller group, six teachers with varied experience and computing skills from a very advanced user with several years of programming in an insurance environment and a number of computer-based class initiatives underway, through members with some computer training and supervision of student projects to two neophytes with low key-boarding skills.

Because this was initiated as a research project, with a fixed set of objects, time frame and budget, the teachers involved were permitted to select their personal areas of lesson development and the depth and

scope of lesson materials. All projects run interactively in a Web browser, can be distributed via CD or server to students and other classes and all can be used in conjunction with other computer expressions within any parts of the Board's curriculum.

The six secondary school teachers worked with the staff from ENO and watAGE to:

- learn how to author online courses using Web editors and course authoring tools – specifically SGML-based technology, using an SGML editor, InContext 2.1
- learned how to convert these documents to either HTML or RTF and append "options" files such as HTML headers and CSS style sheets using the watAGE Converter
- create Cascading Style Sheets for HTML
- learn how to create projects for students, link modules of learning for other teachers and use shared resources amongst a group of teachers.
- learn how to instruct other teachers in some of the fundamentals of online learning, using the materials the group designed and built together

The tools available to the project consisted of:

- ENO's Conferencing site at server http://www.enoreo.on.ca. This includes all participants' accounts, the project's private conferencing area and the online basis for exchange of information, documents and access to each member's project, as well as group files and activities
- The GEAC Incontext2 SGML editor for the creation of all project modules
- 4 watAGE DTDs and converters to produce both HTML and RTF versions of all authors' SGML materials, including the CGI student questions for interactive surveys and online assessment of students
- watAGE's Course Administration Tool (CAT) to enable teachers to create and supervise accounts and locate and receive online assignments within the course structure.
- The 'Quiz' SGML software to enable instructors to develop interactive short-answer questions directly inside lessons, with the answers for correct and incorrect student responses and the abilities for student self-checking of progress and for the distribution of student answers to course databases for analysis and grading.

Teacher Projects: Creativity and Integration

SEPTEMBER 1999

Monday	Tuesday
6 Holiday	7 In-School
13 Log/Journal #1 In-School	14 In-School

Specific examples from the teacher projects will demonstrate their use of modularized and reusable components. We sought from the outset to initiate methods and subjects which seemed to encourage replication, both by their authors in related areas and potentially by other teachers and instruction groups.

DM developed an SGML-based Calendar, which converts into a simple HTML table with dates for the school year using the watAGE Converter. This Calendar feature, created by one individual, may be distributed easily and incorporated into any online course.

The Calendar, a portion of which is pictured on the left, enables teachers in any subject to outline

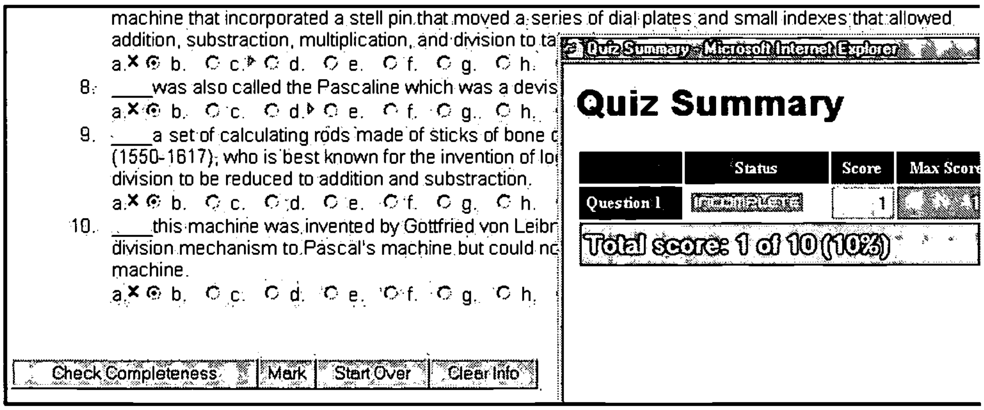
assignment due dates, important readings, and test dates for students in an easy to understand format.

In addition, students experience "just-in-time" learning through the live hyperlinks within the Calendar. For example, in the Calendar fragment pictured, a student may proceed directly to the "Log/Journal #1" assignment from the Calendar page. This prevents students from mishandling important information such as assignment and test dates.

watAGE has developed a Quiz facility that allows teachers to create interactive quizzes in SGML and render them as HTML through conversion. It enables instructors to generate interactive CGI scripts directly into lessons. These scripts allow a student to submit answers in a series of some eight short-answer formats – fill-in-the-blank, true/false, multiple choice, etc. The instructor combines these questions at any point in a lesson. The student's responses are displayed to the student for correction and support, used to initiate some remediation for the segment of the lesson if the results fall below a certain range and can be incorporated into the student's record for that segment of the lesson and course.

Teachers may select either "quiz" or "formal"; a "quiz" is marked on the desktop and the results are revealed only to the student for information (see the inset below for an example display). The "formal" test results are sent to the server to be marked, stored, and the results sent to a specified location such as the teacher's email address and the grade record.

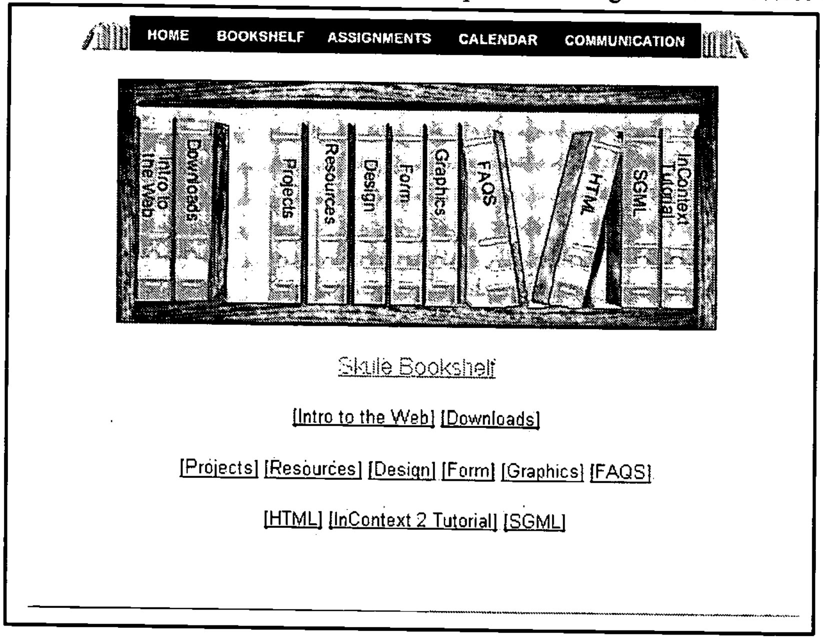
This is an example of **DD**'s History of Computers test using the Quiz software.



Quiz accepts questions of many kinds: multiple choice, matching, fill-in-the-blanks, true/false. The instructor can enter these questions and their ranges of answers or they can be easily modified from existing models to suit a particular lesson need or class. Students can be linked at the level of the performance display results directly to materials which explain the reasons for acceptance or rejection of their answers. In this way students can determine for themselves the levels of their understanding of particular information and they can choose the amount of additional study they wish to undertake to assure competency in that subject.

'Quiz' inquiries can also be adapted to elicit users' reactions to issues and situations so instructors can incorporate evaluation into lessons at any point. These results can be used to determine learners' satisfaction and perception of the effectiveness of the learning materials. These can then be adapted to better meet users' desires and hopes. This point is often ignored or underestimated in teaching generally, but it is a major contribution to the success of online instruction in the system's ability to identify and correct weaknesses and errors which can all too easily go undetected in the interchange and bustle of a classroom.

The BookShelf employs a familiar metaphor for the organization of course data. The modular units of the course, created by the teacher or many teachers, are stored behind a bitmapped image of a bookshelf. The books are coloured according to thematic threads or functionality – assignments as light blue, reference materials as dark.



Information may be created and shared with little imposition on individual teachers while the ability to collaborate increases immensely. MD1 and MD2 collaborated on their Web site and created a very extensive outline of the new Introduction to Information Technology in Business course:

Welcome to our section of the Waterloo Online Learning Project. We have created a number of lessons dealing with the **new Introduction to Information Technology in Business** course. We thought that since most schools would begin implementing this course in September 1999 and that they would be able to utilize new software (**Claris Home Page**) that this would be a practical application of online learning.

To date we have concentrated on Unit IV: **Electronic Communication** and in particular Activity 4: **Web Publishing.**

Activity	Time(Minutes)
Desktop Publishing	380
E-Mail and Voice Mail	76
Web Publishing	760
Office Presentation Tools	380
HyperStudio	760

- Activity 1: DeskTop Publishing
- Activity 2: E-mail and Voice Mail
- Activity 3: Web Publishing
- Activity 4: Office Presentation Tools
- Activity 5: HyperStudio

They used the structure of SGML to modularize their course according to Ministry requirements and sound pedagogy. In the figure on the left is an example of how their lesson plans are organized according to Ministry requirements and delineated for students with active links to each of the lesson activities. Using SGML helped focus the organization of their Web site and render the material in a logical, usable form for students.

Conclusions

We used this company's commercial content creation model as a research tool to 'tease out' the support necessary for a set of teachers to create sophisticated lesson and modular material. It was a great deal better and more productive than the HTML primer and training approach tried the first time. It was successful because the group was very hard working and compatible. However, the group required a great deal of time with highly technical personnel to move to a more sophisticated structure and content.

The process is not finished after three months with this level of support. This group will need to be supported and expanded over the next year to create and test online materials. To this point there is little or no board-level support for this steep learning curve and the resources to support it. This has proven to be a very expensive exercise that is not first on the funding list when so many educators need so may different kinds and levels of professional development.

Our deep concern is the ultimate cost to the public education system if teachers do not feel like 'producers' but are relegated as a group to the role of passive consumers of very expensive, dynamic web-based materials.

This research model should be created as a course and distributed to instructors and students via a CD which would include the course content on the BookShelf, all software in a program which installs it on the individual's PC, and reference materials for online processes and information retrieval. Links could be made as needed from the individual's machine to the course web server for the exchange of email, assignments and participation on group online activities. The CD could also contain instructions and tutorials in the authoring lessons and project modules. The resulting 'course' would provide a quite complete synthesis of teacher needs and course services. This professional development model works; it, or a similar model needs to be aggressively disseminated to foster Canadian educators as producers, not consumer of online materials.

Preparing Teachers to Investigate the Effects of Technology-Supported Instruction in Effective Partnership with Researchers

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Abstract: This paper describes a procedural model aimed at forming teachers to conduct research in technology-supported instruction within a context where researcher and teacher work effectively together to promote knowledge advancement. First the steps of the model and the roles of the teacher and the researcher within each one of them is explained. A study conducted according to the model is then summarized. In its final section, the paper suggests a number of variables that may optimize researcher' and teacher's inquiry efforts and attitudes within the model's framework.

Introduction

According to the document "NCATE 2000 Standards Revision" issued by the National Council for Accreditation of Teacher Education (NCATE, 1999) teacher candidates "should understand the importance of using research in their teaching" (p. 8). However, if teachers are to attain the Council's goal, they should be given the opportunity to actively construct such understanding through participation, as major players, in the research endeavor.

Two noteworthy efforts at providing such opportunity include practice-reflection and action research. A proponent of the former, Schön (1987) highlights the "need to create or revitalize a phenomenology of practice that includes, as a central component, reflection on the reflection-in-action of practitioners in their organizational settings." (321). Weighing the value of the practice-reflection stance, Bereiter (1999) contends that although individual teachers may benefit from taking a reflective stance their findings don't contribute to advancing the knowledge of the field and so achievements reside in the culture of practice.

The second effort is action research that aims at engaging teachers as reflective researchers of their own classroom decision-making processes, the learning of their students, or their interactions with them. In its early forms, practitioner-based research consisted of isolated cases of theory application to the specifics of a particular site and learning situation (Wallace, 1987). More recently, this type of research has been viewed as decisive for the generation, not just the application, of instructional theory (Miles & Darling-Hammond, 1998). Critics of the approach (Wells, 1994), however, contend that its possibilities to advancing knowledge are limited because, left in their role of researchers and in charge of identifying research topic and procedures, teachers are prone to address only their local needs and loose sight of the larger context of inquiry.

An alternative to the above efforts lies on what Bereiter labels a "hybrid culture" (1999, p. 4). A culture that demarcates the goal of the teachers, guiding students' learning about the world, from the goal of the educational researcher, understanding cognitive and social processes operating in classrooms. But, at the same time, a culture that encourages continuous dialogue between the school and research communities to promote symmetric knowledge advancement (Scardamalia, 1999).

How should teachers be prepared to contribute to research within the framework of this hybrid culture? For Bereiter, a possible answer resides in providing teachers with "intensive *training* in teaching for understanding" (1999, p. 32). However, the training that Bereiter suggests should encompass not only teaching for understanding but also *researching* for understanding research. It is through appropriate research practice that teachers may gain

insight to recognize and promote the type of classroom ideas and experiences that researchers can make to serve more principled kinds of knowledge integration.

This article takes a first step toward normalizing a way by which to provide teachers with that type of training. To this end, a research procedural model is presented first. A k-12 study developed according to the model is summarized next. Finally, a reflection on some of the variables that may improve teacher' and researcher's efforts within the model framework is provided.

The Procedural Model

Diagrammed in Figure 1 there is a six-step procedural model that contemplates the interest-, skill-based distribution between researcher and teacher of the variety of tasks involved in an educational research project.

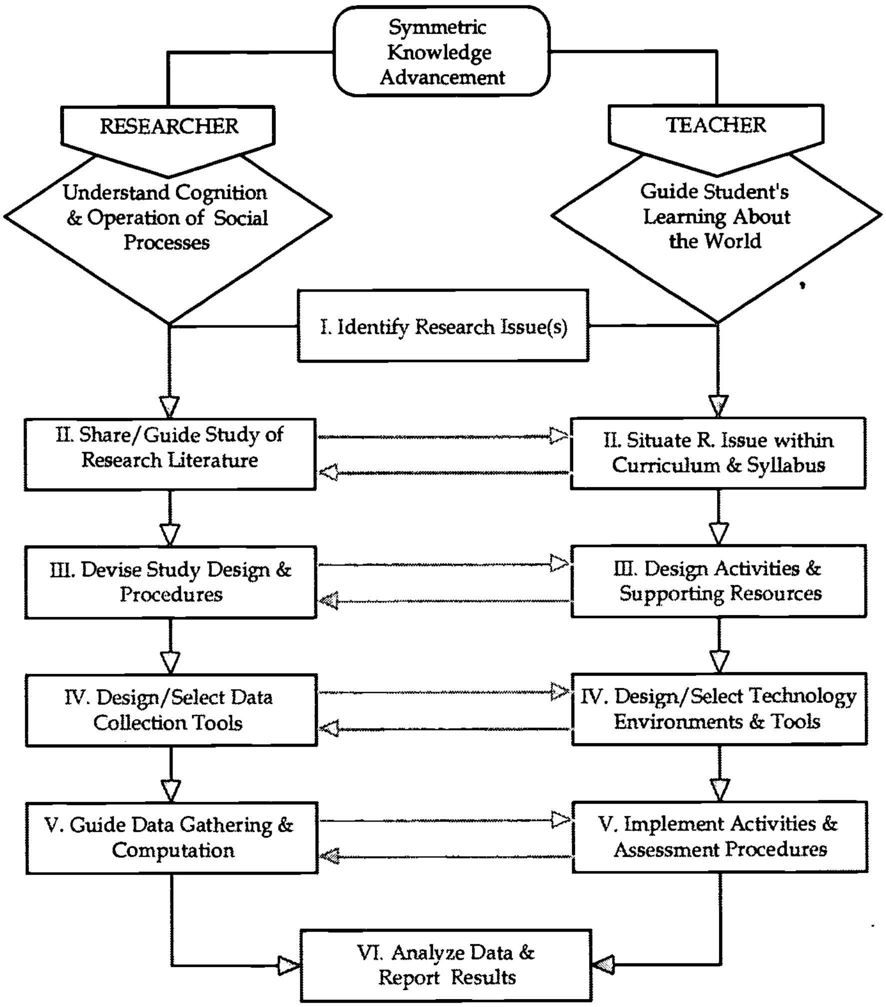

Figure 1. A six-step procedural model for educational inquiry

In steps I and VI of the model, teacher and researcher work in the same tasks. Whereas in steps II through V they work in different but sequentially related tasks, the work being, as indicated by the dimmed horizontal arrows, mutually interactive.

In step I, teacher and researcher act collaboratively to identify the research issue. Through this shared responsibility, the model aims at generating a fruitful comparison and contrast between the researcher's views on the issue and its theoretical and empirical contexts, and the teacher's views on it derived from his/her practice.

In step II, the task of the researcher concentrates on processing and studying the theoretical literature relevant to the research issue(s) addressed in the project. The task also includes sharing with the teacher the selected literature and guiding the teacher's own investigation of the practical literature pertinent to the study. Through sharing and mentoring, the model takes into account the fact that it is the impossibility of the demand, rather than the lack of interest (Wells, 1994, McGrath, 1999), what frequently prevents teachers from addressing this key component of any investigation. As Branson (1998) observes, "research duties be informed by a massive literature that cannot possibly be mastered by individual practitioners (p. 3).

On the other hand, the main task of the teacher within this step is to situate the research issue(s) within the requisite curriculum and syllabus so as to satisfy his/her administrative and moral obligations. Indeed, the teacher has to figure out how to address the research issue through activities that satisfy in an optimal way the imperatives of the curriculum (Shulman & Tamir, 1973). From a moral standpoint, because research may consume a considerable amount of in-school time and because that time is designated for instruction, the teacher has to design classroom experiences that are relevant to the main research beneficiaries: the students (Wong, 1995).

In step III of the model, the task of the researcher is to fulfill two basic research requirements, which are careful design and systematic procedures. If research findings are to transcend the local practice and contribute to the advancement of knowledge those procedures should be handled by the researcher rather than by the teacher, as is often the case in action research.

The task of the teacher within this step is to design the experimental activities and supporting resources. Because of their practice-grounded views on curricular design, teachers are very well equipped to address the formal aspects of the design activity, including specification of activity's objectives, delivery methods, and required classroom organization. More importantly, because of their first hand knowledge of their students, teachers are in a unique position to promote, if given the freedom and means to do so, activities that foster students' beliefs in the power and value of their own ideas (Wong, 1995).

Within step IV of the model, the researcher chooses, or designs and field-test, the appropriate data collection instruments, whereas the teacher designs the technology-supported environment and chooses the software tools to be used in the study interventions. To effectively address his/her task at this step, the teacher should have a degree of technological literacy equivalent to the "Appropriation" or "Invention" phases of Dwyer, Ringstaff, and Sandholz's (1990) model of teachers' adoption of technology. Indeed, according to that model, the computer expertise supposedly attained by teachers in those phases respectively enables them to experiment and to implement "fundamentally new forms of teaching and learning" (Gearhart, et al. 1990: 42).

In step V of the model, the researcher guides the teacher's gathering of data and proceeds, or delegates to qualified personnel, with their computation. Conversely, the teacher implements the research activities and, with the appropriate coaching from the researcher, addresses the assessment procedures. The researcher's coaching becomes crucial at a moment when, as Schön (1987) observes "there is a movement toward new ways of thinking about research and practice--ways that emphasize the merits of full, qualitative description of phenomena and the utility of well worked-out cases of intervention..." (p. 312). Since the procedures to assess such interventions are bound to be complex, training in their use should be provided to ensure reliability and replication.

Finally, in step VI, the researcher and the teacher team once again to analyze data from the study and to interpret the results. Collaboration at this level is particularly important if, adopting a contextualized perspective (Means et al. 1993), the study focuses on finding out specific outcomes as well as on understanding the relationships among various elements of the study and the ways that contributed to those outcomes.

Through its various steps the proposed procedural model may provide teachers with the amount of training and the degree of guidance they need to actively "feel" and appropriate the research practices, rather than just learning about them from "experts." Indeed, the model, because of the extensive exposure to training it secures throughout its steps, may have a longer lasting impact on professional skill improvement than apparently do "nutshell" professional development activities (Fullan & Stiegelbauer, 1991). Also, the model features "procedural specifications" of a developmental nature (van den Akker, & Plomp, 1993) that, by providing how-to-do-it advice, may help teachers elaborate on the what, when, how, and why of the incorporation of research into their teaching.

Application of the Model

The above model was applied to a study conducted by the presenters that assessed the effectiveness of a course for 9th bilingual graders, *Español 5/6*. The course addressed San Diego City Schools District's (SDCS) mandatory standards for Language Arts through a literature-driven (Shehanan, 1997), technology-supported curriculum, and was grounded on social learning (Bandura, 1971) social development (Vygotsky's, 1978) and collaborative learning (Pea, 1994) principles. Effectiveness of the course was comprehensively evaluated through measuring its short- and long-term impact on the language performance, technological literacy, collaboration skills, and learning perceptions, of eighty-six students in three "low," "average," and "high" achieving classes.

The study featured a causal-comparative design (Cook & Campbell, 1979) and, to triangulate results (Yin, 1994), used data from thirteen quantitative and qualitative sources. Eight of the sources included the subject's scores on the course four partial exams, the pre- and post-course Spanish Placement Test (SPT), the final electronic portfolios, and the post-course activity and were aimed at verifying language comprehensive performance and growth. The portfolios and post-course activity sources also served to verify the level and evolution of subjects' technological skill.

The ninth source, the videotape records of subjects' interactions while working in pairs or groups, was used to assess the nature, breath and depth of the collaboration processes that took place during the course and their impact on subjects' performance. Record analysis focused on the occurrence, length, and supporting tools of six types of learners' interactions: Orienting, Information Seeking, Information Sharing, Monitoring, Collaborating Writing, and Collaborative Authoring.

The remaining four sources comprised the subjects' ratings on the pre-, post-, and delayed learning surveys, and the subjects' answers to the three open questions of the delayed Perceived Learning questionnaire. These sources aimed at unveiling subjects' perceptions of the learning gains (linguistic, literary, and technological) they derived from the course and the value of the course collaborative activities.

Data were collected using the SPT, four limited-response partial exams, the Portfolio Evaluation Criteria, the Post-Course Activity Evaluation Criteria, the Learning Interactions Recording Form, and the pre-, post-, and delayed Perceived Learning questionnaires.

Course activities were organized around four units, "Poesía," "Civismo," "El Cuento," and "La Novela," which drew on a series of fictional and non-fictional reading from different Chicano and Latin American writers. Students were guided in their use of the print and www resources, and the software tools including *ClarisHomePage, ClarisWorks, Graphic Converter, HyperStudio*, and *Ofoto,* required to complete the activities. Course syllabus and reading materials were distributed via the World Wide Web.

Implementation of the course extended over a four-month period, from February 1st to May 31 of 1999. Using the web and the selected software tools, before, during, or after class time, and working mostly in pairs or groups, students completed the course activities and the end-of-course electronic portfolios. They also completed the SPT, the four partial exams, and the pre- and post-learning perception questionnaires. Six months after the experiment, and to assess the long-term effects of the course, students completed a web activity that required their use of the skills they had learned in the course and filled in the delayed Perceived Learning questionnaires.

Results, which can not be fully described here due to paper length restrictions, indicate that students in all course sections increased their linguistic, literary, cultural, and technological skills. Students also gained in learning confidence by participating in curricular experiences relevant to their socio-cultural background and mastering technology tools that would had been otherwise out of their reach. (A complete report of the study, including all descriptive statistics, will be published elsewhere).

Optimizing Variables

For the proposed model to generate that *need* for research that according to Bereiter (1999) should be "keenly felt by the practitioners as well as the researchers," (p. 24) a number of variables relevant to the researcher and the practitioner should be taken into consideration.

Regarding the researcher, a crucial variable is his of her true involvement in the research endeavor. Frequently, researchers are brought into a research project, or various ones, to ensure the project's allocation of

funds. Instead, the researcher should commit himself/herself to a research project in all its steps and in true partnership with the teacher.

A second variable relevant to the researcher is flexibility. Researchers should keep in mind that the complexity and unpredictability of classroom and school environments may affect the most sophisticated research design and that, consequently, they should learn how to readjust it if necessary. Learning first hand the constraints that teachers confront on their organizational settings and the ways they cope with them may be very instrumental in this respect.

The third researcher-related variable includes the acquisition, or cultivation, of negotiation skills. Indeed, researchers should be able, through a constructive process of listening and negotiation with teachers and school administrators, to conciliate potential conflicting views about a research project and to move teachers' interests on and solutions to local problems to a level where the solutions may have a more universal application.

On the other hand, if teachers are to participate in educational research projects in the ways suggested here, they should be given the appropriate recognition and incentives. Regarding recognition, teachers should feel that they are not viewed as subordinate research collaborators with a role often limited to the distribution to and collection from students of data gathering instruments. As pointed out elsewhere (van den Akker & Plomp, 1993), teachers should no longer be viewed by other education players "as 'gatekeepers' who should be overwhelmed or circumvented, but as partners in interactive and purposive learning processes" (p. 12).

With respect to incentives, appropriate mechanisms should be put in place to give teachers involved in research projects equitable release time so that they can devote to those projects the large amount of time and energy they require, particularly when they address issues pertaining to technology-supported instruction. However, reward mechanisms, particularly those in the form of release time or merit increase, should be designed very carefully to avoid professional rivalry that distorts and damages the collegiality that should inform the quest for effectiveness.

Finally, two incentives, of a more "ethereal" but very powerful nature, particularly for highly committed teachers, should be considered. One the assurance that teachers' research effort won't be an isolated one with little or no impact outside their classrooms. And the other, the assurance that teachers' understanding of the implications of a project is a worthwhile goal *per se*, independently of the research "success" or "failure" (Wong, 1995)

When occurring in combination, the above variables could help researchers and teachers to work toward resolving what Schön (1987) defines as *"The Institutionalized Dilemma of Rigor or Relevance"* (p. 309).

Conclusion

This article has highlighted the need for developing a research culture that, on a bi-directional and continual basis, draws from the knowledge and experience of both teachers and researcher to advance and integrate knowledge. More importantly, the article has proposed a procedure model, and summarized an illustration of its application, to prepare teachers to participate effectively in such culture. Both the research culture issue and the procedure model are topics for future discussion and testing.

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Abstract: This paper identifies and defines the evolving concept of literacy with regard to Media Literacy and Digital Literacy. The importance of Media/Digital Literacy for teachers and students is explained. An outline of a course, EDTL 639 - Media Literacy for Teachers, recently introduced into an M.Ed. in Classroom Technology program for teachers, is offered. Examples of important resources are given and course participants' feedback is covered.

Introduction

In a now widely accepted definition stemming from the Aspen Institute's National Leadership Conference on Media Literacy Education, held in 1992, media literacy has been defined as the ability of a citizen to access, analyze, evaluate and produce communication in a variety of forms (Aufderheide & Firestone, 1993). While media literacy as part of the curriculum is well established in every other major English-speaking country in the world, it has been only recently that a growing movement in the U. S. has begun to integrate media literacy into the curriculum (Tyner, 1998; McBrien, 1999). Kubey and Baker (1999) report that in the last few years progress is finally being achieved, over a decade after Ernest Boyer, then president of the Carnegie Foundation for the Advancement of Teaching, stated, "It is no longer enough simply to read and write. Students must also become literate in the understanding of visual images. Our children must learn how to spot a stereotype, isolate a social cliché, and distinguish facts from propaganda, analysis from banter, and important news from coverage...." They report that media literacy concepts are now included in the curricular frameworks of 48 of the 50 states. They further report that, of the 50 states, media literacy concepts are included in English, Language Arts and Communication strands in 46 states; in Social Studies, History and Civics strands in 30 states; in Health and Consumer Skills strands in 30 states; and in a Media strand in 7 states. They also report that most state curriculum frameworks include media literacy concepts in at least 2 of the identified 4 strands. Additionally, Hobbs (1998) states that media literacy as a subject in teacher education programs is growing, as is involvement by health groups such as the American Academy of Pediatrics. Indeed, as Tyner (1998) has pointed out, literacy in the information

age has expanded beyond traditional alphabetic literacy to include a variety of media which are, increasingly, digital (hence the term digital literacy). An ability to access, analyze, evaluate and produce communication in various forms has become essential to successfully functioning in society, both economically and as a citizen of a representative democracy.

Key Concepts

Regarding media messages, key concepts of media literacy have been identified as follows:

1. All messages are constructions.
2. Messages are representations of social reality.
3. Individuals negotiate meaning by interacting with messages.
4. Messages have economic, political, social and aesthetic purposes.
5. Each form of communication has unique characteristics.

(Hobbs, 1997)

Given these key concepts and the importance of media literacy, a graduate course, EDTL 639 - Media Literacy for Teachers was recently added to the Master of Education in Classroom Technology program at Bowling Green State University. The program follows the national guidelines in computer education developed by the International Society for Technology in Education (ISTE) and adopted by the National Council for Accreditation of Teacher Education (NCATE), (ISTE, 1992; NCATE, 1992; Thomas, 1993). The course provides a variety of experiences for students and helps to further implement Standard 2.4 of the NCATE/ISTE guidelines for the program:

"Candidates will use computers and other technologies in research, problem solving, and product development. Candidates use a variety of media, presentation, and authoring packages; plan and participate in team and collaborative projects that require critical analysis and evaluation; and present products developed." (ISTE, 1992)

Course Intent/Description

Constructed around the concepts identified above, the course involves several key components/approaches to the subject of media literacy. First, this offering combines material on media literacy concepts in relation to media such as web sites, television, video/film, still photography, advertising, and the news, with an appropriate hands-on component involving video. (In the past, some offerings of similar courses at other institutions have not included such hands-on experiences - this course is approximately 40% hands-on.) Second, the course approaches media literacy from an acquisition model (Desmond, 1997). This model goes beyond the protectionist model which tends to demonize media as something from which citizens need to be protected. Instead, the acquisition model presents media as a positive opportunity for learning activities. Such opportunities are focused on social artifacts whose meaning, use, and value can be questioned through access, analysis, evaluation and production. Third, the course investigates the value of media

literacy both as an understanding of various media constructions as art forms (television, web sites, advertising, etc.), and as an understanding of the potential effects of various media products on citizens in a representative democracy (Tyner, 1998). In addition, the course builds on concepts from a previous course in the program, EDTL 611 - The Curriculum, where curriculum and the curriculum development process are presented as representations of numerous ideologies in society. These various ideologies continually vie for a voice in curriculum and instructional practice (including the integration of technology into the schools). As students analyze, evaluate and produce various media messages, they relate that work to the climate of the schools and their roles as teachers, technology users and change agents.

Additionally, the fact that we approach Media Literacy from a positive, acquisition model (mentioned above) as opposed to the more negative protectionist model, is strongly emphasized to students. The importance of analyzing, understanding, and producing media in our culture as a way to help produce good citizens in a democratic society and as a way to understand the highly developed art of producing (constructing) modern media are reiterated to students as important course themes. Also, three interwoven strands in the course are identified to, and experienced by, participants: 1) the in-depth, understanding of relevant theory and research strand, achieved partly through readings and discussion; 2) the hands-on strand, including analog camcorders, digital camcorders or hybrid digital/Hi-8 camcorders, editing video on the computer, web searches for resources and also web site analysis from a media literacy perspective etc.; and 3) the practical strand - including three assignments whereby students integrate media literacy into some aspect of the curriculum in their current professional position. The course catalog description follows.

EDTL 639 - Media Literacy for Teachers (3) Fall, and on demand. Introduction to media literacy and its place in the curriculum. Techniques for analyzing media products (e.g., ads, television, film, news, web sites, music videos) and application of media literacy to the curriculum. Introduction to video/camcorders as classroom tools including student-created video. Prerequisite: EDTL 611 - The Curriculum, or permission of instructor.

Course Objectives/Selected Materials

A listing of specific course objectives follows.

To provide student's with:

- an understanding of the importance of digital literacy/media literacy;

- experiences and skills to analyze the following from a media literacy perspective: Television; Video/Film; Music Videos; Advertising; News;Web Sites;

- an understanding of the importance of "reading," and "writing," various media in a democratic society;

• an understanding of the importance of video and still photographic images and their potential integration across the curriculum as student-created and analyzed products;

• the skills and experience to use camcorders (analog) to create in-camera edited videos;

• the skills and experience to use digital camcorders to create videos;

• experiences using computer-based video editing software;

• the opportunity to create assignments (and analyze the products created) which integrate student-created video products into the current curriculum;

• the opportunity to examine, evaluate and recommend relevant web-based resources regarding media literacy;

• the opportunity to meaningfully integrate media literacy concepts and skills into a unit length, or longer, portion of the existing curriculum. regarding, but not limited to, one, or more of the following areas: Television, Video/Film, Music Videos, Advertising, News, Prevention Issues, and Web Sites;

• opportunities for reading/reflection and discussion of significant content in the area of media literacy theory, research and application

• an opportunity to learn about and apply The Partnership for Media Education's (PME), stated goals for media educators: 1) We teach that listening to a variety of voices deepens our understanding of complexity: 2) We teach children not to accept facile interpretations of challenging issues, but to think critically about all aspects of a message: the content, the source, the motive in creating the message, its form, and more; 3) We ask them to probe more deeply beneath the surface so that they can uncover complex truths and come to their own conclusions; and 4) We invite those with different viewpoints to join with us and participate in the dialogue.

A wealth of material is available regarding media literacy, including numerous informational, advocacy and commercial web-sites. Key organizations/projects such as: The Center for Media Literacy, The Media Education Foundation, The Just Think Foundation, The New Mexico Media Literacy Project, The Center for Media Literacy, The Media Literacy On-line Project, etc., provide gateways to relevant, helpful material and opportunities for communicating with university and K-12 instructors as well as students with an interest in media literacy. The major conference, Summit 2000, to be held in Toronto May 13 to 17, 2000 (http://www.summit2000.net) will build on last year's exceptional National Media Education Conference held in St. Paul, Minnesota as a source of information, networking and inspiration. A sample of videos currently used in various ways within the course include: *Tuning In to Media* (Center for Media Literacy), *Teach the Children* (California Newsreel), *Production Notes: Food for Thought* (Video Data Bank: The Art Institute of Chicago), and *The Ad and the Ego* (California Newsreel).

Participant Feedback/Conclusion

Student response to the idea of such a course as well as to the course experience itself, has been extremely positive. Participants understand the rationale for this offering and welcome the opportunity to explore the topics in the course, gain more skills in the use of technology, reflect on where media literacy fits into their curriculum, and then implement projects in the schools. In the near future the course will be available as an elective to students in another program within our division, a Master of Education in Curriculum and Teaching degree. While adjustments may need to be made to the hands-on portion of the course depending on students' prior experience (or lack of prior experience) with technology, the hands-on component will remain in the course. In such an instance, students will still gain all aspects of the experience, as they access, analyze, evaluate and produce media in a variety of forms. In both programs, such experiences are timely, important and highly valued by teachers and K-12 students alike.

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Empowering Minds by Taking Control:
Developing Teachers' Technological Fluency with LEGO Mindstorms

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Abstract: This paper documents "Empowering Minds," a project that has established a partnership between St. Patrick's College (Education faculty of Dublin City University), the Irish National Centre for Technology in Education (NCTE), the Media Lab at the Massachusetts Institute of Technology (MIT), and selected Irish primary schools. In this project, we are collaboratively designing and implementing a program for the use of control technology with primary school children, which it is hoped will open the gateways to new ways of learning in schools.

Background

Funding for this project is provided under the NCTE's (www.ncte.ie) Schools Integration Projects (SIP) initiative. This initiative is funding a wide diversity of Information and Communications Technology (ICT) based projects across the first and second (elementary through high school) levels of the educational system in an attempt to identify good practice which can serve as models to be replicated across the educational system.All Irish schools were invited to respond to the SIP initiative in October 1998. The four schools selected are loosely representative of the main school types prevailing in Ireland (large middle class suburban; inner city disadvantaged; medium semi-rural; two teacher rural). The participating teachers within each school volunteered their involvement in the project. The experience level with ICT among the teachers would range from complete beginner to experienced. The project builds on previous research on educational applications of control technology developed at the MIT Media Laboratory. We are using the commercial version of the MIT "programmable brick"—the LEGO Mindstorms Robotics Invention System (Martin, 1988; Martin et al, 2000 [in press]). We are also working with teachers/researchers who participated in early programmable brick research (Martin, 1996; Hayward, 1995).

Rationale

Across the globe there is an urgent need to develop and use educational frameworks for integrating ICT into the school curriculum. These frameworks needs to be informed by sound educational theories and practices, as technology of itself does not directly change teaching or learning. Therefore, we must encourage a careful and intelligent meshing of educational and technological agendas. Much prior research has focused predominantly on the child in the educational environment. We believe a change of focus is required; the key to successful implementation of technology is the teacher.

Attention, therefore, needs to be directed at the 'chief agents of change'—the teachers—and how they view not only technology, but more importantly themselves, the learner, and what is to be learned. Assumptions about the nature of the learner and the teacher in the process of learning will have implications for not only how technology will be used in education, but also for everything that happens within the classroom. The most common uses of technologies in schools today generally reflect instructionist educational philosophies, which view students as recipients of information dispensed by the teacher or by the technology. Rather than the acquisition of specific skills or knowledge, "the real potential of technology lies in its capacity to support pedagogical approaches that encourage students to become active participants in their own learning and to acquire critical thinking skills and more complex understandings" (O.T.A., 1995, p. 126).

Teachers' assumptions about the nature of learning need to be challenged. Primarily, we would hope that the project would act as a catalyst to challenge the perceptions and assumptions about learning which it is hoped will result in a major change in classroom practice at primary level. Teacher education needs the same conditions as good classroom learning. Teachers need time to experiment, reflect and discuss with others in a supportive learning environment before a shift in their thinking can occur. We believe that the "real promise of technology in education lies in its potential to facilitate (these) fundamental, qualitative changes in the nature of teaching and learning" (President's Report 1997). Technology, in the proper context and a supportive learning environment, can facilitate the teacher as a learner. Therefore the design of an effective computational learning environment should ".....emphasise the importance of constructivism and the learner's activity in building mental models of .... knowledge. The environment should ... support conversational and collaborative learning ...give sufficient feedback and be able to adapt to the needs of various learners."(Ruokamo-Sari & Pohjolainen, 1997, p.82) It was with this premise in mind that the project was organised from a constructivist perspective.

According to the constructivist's learning theories, knowledge is individually constructed in a social setting. Consequently each individual must be active in the learning situation and be responsible for their own learning. If the learners are actively involved in the learning process, the experience is 'meaningful' and motivation levels will rise accordingly (Ruopp, 1993; Thompson et al, 1992, pp.11, 68; Thornburg, 1994, pp.24-25). If teachers see themselves as learners along with their students, they will be inspired to implement change both in their classrooms and in schools in general.

Project Design

In the proposal to the Schools Integration Project, we presented the following plan as 'Phase One' of our larger goal to bring meaningful technology design projects to the Irish first level schools in a large-scale way. As of this writing, we are midway through the 1999–2000 academic year.

March 1999	An initial workshop with selected teachers, parents and children
May - June 1999	Delivery of materials to classrooms and exploratory work by teachers in their classrooms
August1999	Second workshop with teachers
September 1999 through June 2000	Full classroom project work

Table 1: Phase One of Empowering Minds Project

Materials and Concepts

For the technology basis, our project uses the LEGO Mindstorms set of robotic design materials. This set of materials includes the "RCX Microcomputer" (a hand-held computerised LEGO brick that can be built into LEGO models), electronic sensors, LEGO Technic components (motors, gears, axles, and wheels), and the standard set of LEGO building bricks. These materials allow children and teachers to have rich and in-depth explorations of key ideas in control technology, including (but not limited to!) mechanical design, power, speed, gearing, friction, sensing, feedback, software design, and project management.

A significant part of the design experience in working with the Mindstorms system is the programming of one's model. We evaluated two different software packages for this purpose: RoboLab, marketed by LEGO Dacta (the school division of the LEGO Group), and RCX Code, part of the retail package. Most of our teachers gravitated toward the RCX Code software because it is adequately powerful and substantially easier to use.

The Initial Workshop, April 1999

After the teachers were selected, the initial workshop was conducted at St. Patrick's College of Education, in Drumcondra (a suburb of Dublin). The workshop ran for five days over the Easter holidays. For the first two days, we had invited participation from two parents and four children from each of the four selected

schools. The final three days were spent working exclusively with the teachers chosen for the project. This format was an interesting innovation; an infectious enthusiasm from the children greatly contributed to the excitement of all, and built a great base for subsequent parental involvement. The days with the small group of teachers were focused and productive.In this workshop, teachers were asked to design their own projects, a novel experience for many. They all engaged wholeheartedly with the materials and were so immersed they were reluctant to leave even for lunch. There were times of frustration as they struggled to achieve their goal. Ultimately, however, they achieved success and the sense of accomplishment was palpable. These experiences opened up many conversations about how to implement this approach in the classroom and how to get the children started—whole class at once or sub-groups? From the beginning, it was apparent to all that we would be relying on the intuitions and expertise of the teachers to implement classroom models effective for their own particular situations.

Exploratory Work in Classrooms, May - June 1999

After some problems, material was procured and delivered to the schools, with approximately four weeks left in the school year. This was just enough for teachers to bring the materials to their children in a limited scale, and themselves obtain this practical experience which would serve as the basis for subsequent reflection in the summer workshop.The exploration with the materials before the second workshop proved valuable in many respects not only for the direction taken in the second workshop, but also for the teachers' implementation approach for the autumn term. The teachers made specific requests for the workshop content as they realised the need to develop their own understandings of the principles of building solid structures, how gears worked, etc. These inputs were acted upon and the second workshop was designed to accommodate the teachers' expressed needs.

As an example of 'lessons learned', one of the teachers working with the inner city children before the summer quickly realised that the majority of these children had no prior experience of building with LEGO. They had major difficulty trying to follow even the simplest of building plans, and this combined with their social background made it very difficult for them to share materials. Consequently, attempting to use the materials with the whole class simultaneously was a recipe for disaster. The teacher tackled these issues by enlisting the help of the support teacher and the infant teacher in the school. Withdrawing a small group of six children each time, she slowly worked through constructing simple models, with and without plans. In this way, she was able to give each child the attention he or she required. The teacher also worked on developing the children's ability to work together. As the children became more experienced, she began withdrawing two groups at a time and has now progressed to having the whole class working on their own models at the same time. This approach combined with the time spent organising the materials has been the key to progress. This teacher plans to have weekly whole-class building sessions and begin to withdraw the small groups again when the children are ready for programming.

The Second Workshop, August 1999

We were fortunate to be able to bring in John Bilotta, a district technology co-ordinator with over twenty years of primary classroom experience, who had participated in previous MIT research on programmable bricks. We used a substantially more structured format in this second workshop, providing teachers with focused half-day experiences rather than a multi-day open design process. These half-day focused activities proved invaluable for helping the teachers gain some important insights. For example:

<u>The Silent Game:</u> In this activity one person improvises a model, another responds by adding on to it, and a third observes. Although less than 20 minutes was spent on producing the models, many of the builders had a strong sense of it being 'theirs' and had mixed feelings about the Responders adding on to them. The Observers' presence highlights the different possible interpretations of builders' intentions. For the teachers, this crystallised the need to respect children's sense of ownership, and made them realise that it is hard to tell children's intentions from only seeing snapshots. This was brought into relief for the group by Joan's response to John's model. He hadn't intended to make a pattern, but she replicated his model, taking something that he intended as 'random' and making it a clear pattern.

<u>Slow-car Building Challenge</u> (Build the slowest car possible that still moves): This challenge drove home the theory and practice of gear reduction, and pointed out the complexity of designing successful models. One group had lots of trouble building the supporting frame around the gears and didn't finish until the next day. Another group's car fell on the floor and smashed to a thousand bits. They

commented that it was the best thing that could have happened: they needed a full redesign, but had not been prepared to take their model apart!

Building a Learning Community

Other people are the greatest source of alternative views (von Glasersfeld, 1989) that stimulates new learning. A key feature of this project is that the teachers and children are externalising their thinking and reflecting on what they are doing and how they are learning i.e. thinking about how they think. All the children are keeping a log into which they record the models they have built illustrating it with diagrams and pictures. Each teacher is keeping a journal in which they record how the project is developing in their classroom, problems they have encountered, things that have worked particularly well for them, etc. Reflecting on how they are learning and discussing it with the children in the classroom and within the group is providing the opportunity for them to realise that everyone has their own way of understanding. As they work together they are realising the importance of dialogue and the interactions among group members, as they struggle to solve their problem collaboratively. Two things are happening simultaneously: teachers are engaging in a learning environment, and are reflecting on the process of how they are learning. They are learning *with* technology, not *about* technology. Technology if harnessed in this way could provide the vehicle for lasting change and for improving learning.

The importance of a learning community where ideas are discussed and understanding enriched is critical to the design of an effective learning environment. "Teaching, more than many other occupations, is practised in isolation, an isolation that is at times crushing in its separateness." (Maeroff, 1988, p.3). But "increased communications is one of the biggest changes technology offers …to .. transcend the walls of isolation" (O.T.A., 1995, p. 2). Therefore, if this power of technology is harnessed and used in a collaborative environment, an effective learning community can be established among educators. Current problems of isolation will be reduced, the community of learners widened, and classroom walls, as they exist at present, broken down. To this end, a mailing list was set up for all participants in the project. Initially, use of this was confined to the more experienced users of the group. However, one of the teachers suggested that we mark Netd@ys (www.netdaysireland.ie) by getting the children emailing to the group a sample of some of models they had been working on. This was the springboard that was needed and it provided the context for children to begin to communicate with one another. It has generated excitement among the children who, inspired by what others had been working on, began to incorporate or adapt some of the ideas they had seen in the emails into their own models. The emails also sparked off interesting discussion as children pondered design issues e.g. how a particular gear train had been structured and what effect it had on the movement of the model. We hope to develop these links with other schools and institutions nationally and internationally. This will provide teachers and children with a relevant and meaningful context to make use of the internet and email as valid communication tools for accessing information and 'comparing notes' about their designs and the problems they are experiencing.

Removing Barriers

Other research has identified potential barriers for teachers' effective use and integration of ICT within the curriculum. We have minimised these by providing:

- adequate and appropriate hardware (e.g. computers and digital cameras)
- support structures
- appropriate professional development (cf. workshop descriptions and support structures)

Adequate and Appropriate Hardware

The majority of teachers chose to have their schools augment the grant provided, and purchase laptop computers rather than desktop machines. This has been significant in the teachers' development of computer skills and the subsequent integration of their newly acquired ICT expertise into the curriculum. All of the teachers claim that without the opportunity to bring the computer home, to "tinker around and play with", they would not have achieved such a computational fluency. Neither would they have had the confidence to use it so widely in their everyday classroom work, e.g. writing up their journals, sending

email, finding resources on the Internet, programming the models, etc. To the teachers, the value of having the computer at home to use on their own time, rather than having to stay behind after a tiring day in school cannot be overemphasised. This was especially true for the complete beginners, who could try things out at their own pace, in their own time and without the pressure of time constraints and other people's eyes.

A digital camera that recorded pictures on floppy disks (the Sony Mavica- MVC-FD73) was provided for each school to aid in the recording of the models the children created. The deciding factors on which camera to purchase were simplicity and ease-of-use. This has paid enormous dividends as all teachers and children are using the cameras confidently and effectively on a daily basis. Their use has not been restricted to the project only as the cameras are being used for a myriad of purposes—e.g. school events (sporting occasions / concerts) and projects (insects, flowers, trees).

Support structures

A variety of support structures was put in place to provide the teachers with scaffolding as they embarked on the project and their journey into "learning with the children".

Within the classroom—constructivist teaching approach: All of the teachers agree that they have never learned so much since beginning to work with the children in building their models and helping them solve the problems they encounter.

Within each school—two teachers were involved from each school: A buddy system operated as one of the teachers was more experienced with using technology. Having the supportive environment means teachers can take risks in safety as they know if something goes wrong a helping hand is always available to provide advice and support. As one of the teachers remarked "having someone in the school or at the other end of the phone takes the fear out of trying out things. I'm no longer afraid to get myself into a mess because I know if I can't sort it out one of the others will give me a hand."

Across schools: A small number of schools was selected for the initial phase of the project and good relations and a sense of rapport was built up among them over the course of the workshops. Email communication is strengthening this sense of identity and will continue to do so. The cluster of schools act as a source of ideas and inspiration for one another, as well as providing advise about issues as they arise e.g. classroom management and organisation of materials.

The project co-ordinator: The regular school visits and meetings with teachers by the project co-ordinator (Deirdre Butler) provide an opportunity for appropriate skills to be introduced as the need arises. This is the embodiment of what Vygotsky meant by the "zone of proximal development" as we were able to respond to the needs of these children and their teachers and facilitate their development of ICT skills in response to an expressed desire and need.

Resource Team: These provide expertise and advice to the group as they have had prior experience of working with the materials in a variety of settings.

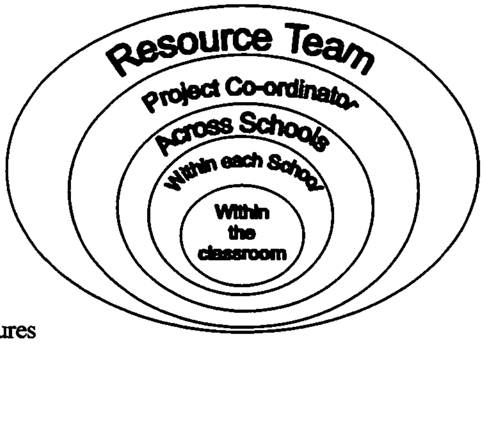

Figure 1: Support Structures

Conclusions

Inspired by both the enthusiasm of their students and the response of the community, the teachers have developed a great strength of belief in the work they are engaged in. They have been invited to give hands-on workshops, present at conferences, and host visits from other interested teachers. This has had the

effect of reaffirming for the teachers the validity of their work, has increased their confidence, and has heightened their awareness of the use of technology in education.

Evidence of improved home/school links has begun to emerge which, we hope, will lead to the development of a more relevant and meaningful approach to learning, both in school and at home. For example, parents have been visiting the schools to see the children's work, and in some cases have volunteered to help out during class and after school. The children also have renewed their interest in building with LEGO materials at home.

As the project unfolds in each individual classroom, we expect that there will be an opportunity for wide-ranging cross-curricular integration, including the development of mathematical skills, problem solving abilities, and opportunities for art, music, drama, writing, and poetry. When teachers incorporate these new technologies and a more constructivist way of learning into their classrooms, they are more able to connect their unique backgrounds with the curriculum and the interests of their students.

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PRACTICAL WAYS TO IMPROVE INSTRUCTIONAL EFFECTIVENESS USING INTERNET-BASED COURSE SUPPLEMENTS

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Abstract: This paper documents methods to increase the effectiveness of conventional lecture/discussion/demonstration classes through the addition of internet-based supplements to those face-to-face classes. Types of websites discussed include informational and interactive sites. The authors share practical experience and student comments on personal websites, listservs and email, and integrated web-based learning packages. Suggestions for instructors who want to begin including web-based components in their instruction are included.

Introduction

While striving to make their classes more understandable to their students, teachers are continually changing course content or activities, reallocating time allotted to certain activities, or increasing student participation through various means. Internet-based course supplements fall into two different categories, informational and interactive. They are used to fulfill very different needs in instruction. Informational supplements provide additional data to the students while interactive supplements help students to transform and internalize information that has already been accumulated. Interactions can be either synchronous or asynchronous. Boettcher (1999) has described four distinct levels of "Course Webness" (p. 50) to consider: web presence, web-enhanced, web-centric, and web courses. A *web presence* has all the information included in the traditional course catalog. But this level is more about marketing than pedagogy. A *web-enhanced* course is a step away from the traditional classroom model. These courses support the distribution of course materials and communication via web-based resources. *Web-centric* courses differ from web-enhanced courses not in the types of web resources used or even in the way the resources are used, but in the amount of emphasis given to the web resources. True *web courses* are designed to be 100% available 100% of the time via the internet and a web browser. Three approaches for supplementing courses are exemplified in this paper: personal websites, listserves and email, and integrated web-based learning packages. They exemplify Boettcher's web-enhanced and web-centric courses.

Approaches for Supplementing Courses

Personal Websites

Personal websites are primarily informational and can be used to post supplemental course materials such as syllabi, documents authored by the instructor or others that the instructor has copyright for, and links to other websites with information available. They provide the teacher the opportunity to present information on the instructional issues in a variety of formats. Using the relatively simple programming language, hypertext markup language (html), basic, functional web pages can be produced by relatively inexperienced programmers. Using a web-authoring program such as PageMill, FrontPage, or Composer (included with your free copy of Netscape), exciting designs including graphics can be produced quickly, with minimal effort. An added plus is that html is system independent, reducing translation problems that often surface in distance environments. We use our web pages (see http://www2.gasou.edu/eltr/tech/rcarlson/frame.html and http://www2.gasou.edu/eltr/tech/jrepman/repmanhome.html) to provide direction on the course (syllabi, daily lessons, or activities associated with specific classes), course documents to be downloaded, or links to various websites that provide amplification to the instruction. These websites also become a point of access to begin searching for other web-based documents related to the lesson - a pointer page for the lesson.

The personal web page helps to foster a sense of community. Students can look at other courses that the teacher has conducted/is conducting and gain a sense of course flow. We also publish our vitas and some writings along with some personal information so that the students can get to know us better. With the students' permission, publishing the students' pictures and email addresses on a class page can extend this sense of community.

Listservs and Email

Listservs and email comprise a type of course supplement that provides students and instructors a way to conduct course discussions. Experts can sometimes be used to anchor these discussions. Additionally, an informational function can be addressed (albeit inefficiently), when documents containing course materials are attached to electronic messages.

Hara and Kling (1999) looked at email interactions from a student perspective. They found that frustration centered around three areas: technological problems, minimal or untimely instructor feedback, and ambiguous communication. Students they observed frequently felt isolated and believed the experiences that they had were unique and not shared. This was especially true when they were frustrated with a technical problem. The students felt as if they were the only ones who experienced a problem. Feedback problems from the instructor's perspective had to do with both the nature of the communication (asynchronous) and the amount of time it took for the instructor to respond to each query. Ambiguity is frequently encountered in situations where there is not the ability to immediately question and clarify instructions or responses. This seems to be the case in this study.

We used email communication as a tool to extend our capabilities. Our students typically are full-time teachers, so they have difficulty communicating with us during the week. One of us seems always to be in class when the other tries to communicate. We impress on our students the importance of using email as an asynchronous communication tool. We insist that all of our students have functional email systems. Early in the semester, we test the systems, usually requiring some small project to be completed and handed in using email. Part of the assignment is to attach a document. This tests the system and the technical sophistication of the user and allows us to provide timely tutoring to those who need it. Later in the semester, students can take advantage of those capabilities by asking questions of the teacher or conducting asynchronous discussions with the teacher or other students. Similarly, a listserv can be used to foster class-wide discussions. We found that free web-based listservs such as OneList (http://www.onelist.com) are easy to use. Of course, almost any college/university information technology department has that service to offer to its instructors, as well. We tried to focus the listserv discussion by breaking it down into small groups and found it was not as helpful as the synchronous chat-type discussions.

Integrated Web-based Learning Packages

Finally, integrated web-based learning packages provide integrated information management for both the instructor and the student. Included in these packages are calendars, asynchronous threaded discussions, course documents, whiteboards, and synchronous discussion (chat) groups. Integrated web-based learning packages

such as LearningSpace, Web Course in a Box, or WebCT are particularly useful to augment our instruction. For a better comparison of these competing products, see Sharon Gray's article in the January 1999 *Syllabus* or access David Wooley's site at http://www.thinkofit.com/webconf.

Dabbaugh, Bannan-Ritland, and Silc (1999) evaluated the pedagogical implications of courses which used integrated web-based learning packages using Kahn's Framework for Web-Based Learning (1998), a comprehensive framework that includes eight dimensions and over sixty sub-components. They found that web courses provide ample opportunity to use appropriate pedagogical strategies – either objectivist or constructivist. Strengths of web courses included clear organization and presentation formats, well directed objectives, exceptional guidance for learners, and the use of collaborative, shared workspace. Weaknesses observed centered around interface design and lack of flexibility. They recommend that course authors focus on the use of collaboration tools such as LearningSpace.

Rittschof (1999) summarized the pros and cons of a course that used *WebCT* as the learning package. This course was a graduate-level course in educational psychology which involved higher-level thinking skills and discussions about theoretical issues. When compared to a traditional classroom setting, students reported that they shared more personal insights, voiced their true opinion more, and interacted with others more. This should encourage instructors who want to generate more discussion and include all class members. However, problems with technical aspects (the chat feature was unreliable) and the feeling of isolation (not knowing the instructor or other students) persisted throughout the course.

We chose Blackboard (www.blackboard.com) as our standard, because it offered comparable features to commercially available products, was easy to use for our students and ourselves to use, and it was free. We particularly liked the communications section, which featured email, threaded discussion, and a whiteboard/chat feature. The email provided all of the features addressed earlier. Threaded discussion provided the teachers and students an opportunity to carry on multiple asynchronous discussions throughout the week. Hot topics flourished while others died. We found that it was necessary to carefully guide the discussions so we might not unduly influence the students, while at the same time helping them to remain on track. The chat/synchronous discussion was the most challenging from a teacher's viewpoint. First, the chats could easily become schizophrenic quite rapidly because a large number of participants deteriorated into multiple conversations. This could be alleviated somewhat by breaking down the chat groups into smaller units (nominally 8 maximum). Technical problems included students with slow modems, slow computers, or inadequate keyboarding skills who subsequently experienced trouble keeping up with conversations. We never found a good way to rectify situations such as those – except for the obvious. The course documents section of the integrated packages allows the publication of course documents such as syllabi, presentations, and text and graphics documents. These were distributed in a fashion similar to those distributed via web pages, but were more convenient.

Student Comments

In order to gather student comments about the course supplements, a survey was emailed to the students of the classes who used the methodology. There were a total of 35 responses, a 67% return rate. The survey asked:

1. How did the materials posted on the web (on Blackboard or on a personal/class web page) aid your learning?
2. What communication tool worked best for you - Blackboard threaded discussion, email (listserv included), or chat? What made them helpful or not helpful for learning?
3. Did the fact that you were physically located at a different site from the instructor for at least part of the course affect the usefulness of the tools mentioned in questions 1 and 2? Why?

Materials

Almost universally, the students liked to have the class materials available on the web. Every class had a component that used PowerPoint as a presentation tool or class notes prepared on a word processor. These documents were made available through the instructor's web page or through the integrated web-based learning

package (BlackBoard). Students were able to use the documents as advance organizers, allowed them to focus on the lesson, and saved time copying notes. They also appreciated the cost savings over printed notes that instructors have previously made available at the bookstore. The following statements are typical.

"…the ppt slides were a great reinforcement to my readings."

"By looking at these slides before class, I was able to focus on the important parts of the reading assignment."

"I had them before class and was able to add *important* in formation to them instead of concentrating on writing *everything* down." (italics added)

"I spent more time listening and less time copying notes."

"…established an anticipatory set…"

"…helped to review the lesson."

Problems tended to be technical and avoidable. The following are examples.

"…problems are many. It was VERY slow."

"The only problem I had was that if they were not posted the night before class, I have a hard time getting them."

"…problems getting the notes off BlackBoard."

"…server down…"

Communication Tool

When asked to name the communication tool that worked best, students split between email and threaded discussions. But the reasons that they liked the tools were surprisingly similar. First was convenience in both time and location. Students liked being able to adapt their learning to their lifestyle.

"…time was not an issue…"

"…without driving 3 1/2 hours round trip…"

"…communicate in our own time frame…"

"…could ask my questions when they were fresh in my mind…"

"…immediate feedback…"

They also liked having a written record of the discussion.

"…good for documenting the responses…"

"You could see the development of the discussion…"

"…You could see all the posts…"

Students thought that the discussions provided new ideas.

"…thoughtful comments…"

"…can be very thought provoking…"

"…made me look at things in a different way…"

Being able to prepare a response was important, also.

"…believe it or not, I like to think before I answer!"

Problems centered around access.

"…couldn't use group chat due to access problems…"

"…couldn't schedule a time for chatting (among the group)…"

"…chats never work…"

Training on how to use the various tools was another issue.

"More instruction on how to use the various BB components would be helpful."

"…have to get into the habit of checking BB…"

"Probably 'how to use' instruction would have been helpful."

Timeliness also was frustrating.

"…not everyone responds as quickly…"

"I don't think everyone understands how it (threaded response) is supposed to work…"

"…makes everything too drawn out."

"Email is more immediate..."

Physical Location

Being physically located away from the instructor for much of the course was not a problem as long as there was some prior contact.

"…helped me with personal questions that may not apply to the whole group."
"…I felt in-touch without having to travel 4 hours every week."
"…sense of connectedness…"
"…should have met physically at least once…"
"If I had not met the people, I would have had a much harder time…"
"…have a mental picture of who I was talking to…"

But students didn't like to work with one another on projects.

"…problems with different sites on the group project…"
"…only bothered me during group projects…"

Recommendations

From our experience, we would make the following suggestions to instructors who want to begin including web-based components in their instruction.

- Start small. Begin at Boettcher's first stage and work your way up. It is a gigantic leap from a web presence to a full web course.
- Make sure that you provide for training on the applications to be used. Not everyone is as sophisticated as you. Most students overestimate their technical ability.
- Make sure that the students understand that they must have access to appropriate hardware and what that hardware is. If their access is limited (to either school or home) they are going to make their course interaction more challenging.
- Have at least one face to face session. This allows the students to build a mental image of the person to whom they are talking and makes communication easier and better. If that is not possible, post pictures, biographies, and audio files on the web so that this information can be used to acquaint the class with each other and the instructor.
- Post materials in a timely manner. They should be up on the web at least two full days before the class. This also helps to bypass unavoidable technical problems.
- Have a way to help students work through technical problems.
- Provide digests or written records of chats to those who request them.
- Discuss strategies for group work at a distance.

Following a logical progression will help you enhance your course by using tools that are available and easy to use.

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Reflective Judgment and Cognitive Interaction in an Electronically Distributed Astronomy Course For Educators

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Abstract: An Introductory Astronomy for Educators course was delivered over the Internet using mostly-asynchronous communication tools, as well as interactive Java simulation and data-sharing applets. The on-line environment was teacher-designed to provide a platform for rich interaction and critical thinking, while providing for maximum time and space flexibility for students and instructors. The purpose of this inquiry is to evaluate the efficacy of the course in meeting the goals of flexibility, science literacy through critical thinking and cognitive interaction. Data were collected in the form of student coursework, electronic records, fieldnotes, and student learning journals. Findings indicate that critical thinking and cognitive interaction were uniquely facilitated in ways that are problematic in the traditional classroom setting. Issues raised include the need for technical preparation, varying readiness for critical thinking, and the high demands placed on the instructor.

The landmark document *Benchmarks for Science Literacy* (AAAS Project 2061, 1993) set in place specific goals for science literacy. Development of critical thinking in science is suggested by *Benchmarks* as a primary component of science literacy throughout schooling. One important means of helping all students reach this goal is to provide in-service teacher training in science, featuring methods that promote critical thinking. Can the internet be used to deliver flexible, interactive in-service science education in a way that successfully models and fosters critical thinking? This study examines the delivery of a summer in-service course entitled *Astronomy for Educators* using a teacher-developed internet environment.

Structuring For Flexibility and Collaboration, and Critical Thinking

Overcoming learner isolation is a primary goal of in-service teacher education. Cognitive interaction in *Astronomy for Educators* (AFE) was facilitated using a variety of networking tools, each having different temporal and access features:

	Electronic Interaction Tools		
Function	**Study Group**	**Idea Container**	**Live Chatroom**
Time	Asynchronous	Asynchronous	Synchronous
Place	Chosen by student	Chosen by student	Chosen by student
Interactive Function	Unmoderated small-group dialogue	Unmoderated community dialogue	Unmoderated community dialogue

Table 1: Interactive Features of AFE

AFE is designed to foster a complex network of flexible, cognitive interaction. The rich interactive structure of the AFE course was interpreted using Granott's Interaction Framework (Fig. 1), a model in which cognitive interactions are classified in a two dimensional model (Granott, 1993). Using this model, the various electronic conversations that took place in AFE can be classified, forming a composite profile of the interactivity of the environment as a whole.

One dimension of the model describes the degree of collaboration in the interaction. Collaboration can involve high mutuality, with a common focus of attention (Rogoff, 1990). Such collaboration is highly interconnected and non-local in nature. Other interactions, though, involve minimal two-way exchange of ideas and common focus.

The second dimension describes the participant's relative knowledge or and expertise in the content of the interaction. A peer-peer interaction is termed *symmetric*, while an expert-novice interaction is termed *asymmetric*. These aspects of interaction can be presented visually as a 2-dimensional space, in which each dimension is considered to assume a continuum of values (Fig. 1).

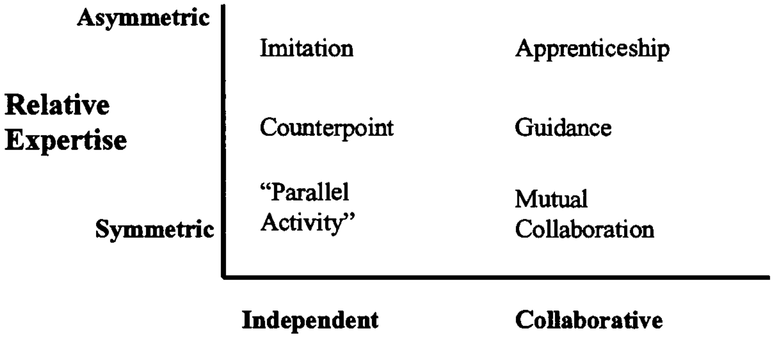

Figure 1: Interaction Framework (adapted from Granott, 1993, p.187)

Structuring For Critical Thinking: Constructing Personal Knowledge

Critically thinking students do not simply learn *about* astronomy, they practice *being astronomers*. To facilitate *being astronomers*, the course was structured as a sequence of problem-centered activities in which students construct an increasingly powerful personal cosmology based on actual observations and data. This structure is supported through the use of interactive, data-sharing modules, some delivered using JAVA programming language, in which students make astronomical observations, post and share data, and draw conclusions using the on-line environment. Such activities require critical thinking and reflection at a level comparable to scientists in the field.

The Reflective Judgment Framework (RJF) is a powerful tool for assessing the use of, critical thinking (King & Kitchener, 1994). Analysis of over 2000 intensive interviews of college students (using a wide variety of ill-defined problems) gave rise to the construction of a three-level developmental model based on the different way in knowledge and justification were viewed. *Pre-Reflective*, *Quasi-Reflective*, and *Reflective* levels of reasoning, characterized by distinct views of knowledge and justification, provide a framework by which the developmental nature of reflective thinking may be understood.

Stage	View of Knowledge	Concept of Justification
Pre-Reflective	Absolutely certain or temporarily uncertain	Authority based (known) Opinion based (unknown)
Quasi-Reflective	Always uncertain	Contextual, observer-dependent justification
Reflective	Outcome of process of evaluation.	Weight of the evidence, value of interpretations

Table 2: Overview of Reflective Judgment Framework (Adapted from King & Kitchener, 1994, p. 44-74)

Using the RJF, growth in critical thinking during AFE can be understood in terms of three broad developmental stages. Using the model, students work can be both evaluated qualitatively, and understood developmentally.

The Study

Distributed learning de-localizes school in both social and cognitive ways. Social/cognitive interaction and critical thinking are key components in a professional development science course for educators. The purpose of this study is to evaluate and analyze the implementation of on-line *Astronomy for Educators* in meeting the goals of time/space flexibility, critical thinking, and cognitive interaction. Results indicate that AFE was effective in blending maximum learner flexibility with strong intellectual development and social interaction. Caveats about AFE include technological and cognitive readiness, and the time demands of instructor involvement and interaction.

Data Sources

The electronic nature of AFE provides a unique and powerful opportunity for data recording and analysis. Data were collected electronically and automatically, giving the researcher more powerful and direct access to the content of both student work and student interaction. In this study, three separate instances of course implementation were analyzed, consisting of a total of 40 students over three different semesters. The data collected was analyzed according to grounded theory, a researcher-driven, qualitative methodology often used in teacher research (Strauss & Corbin, 1994). The data were generated from a variety of sources:

- **Synchronous Meeting Transcripts**
  Several synchronous on-line meetings were conducted. Attendance at these on-line "chat" sessions was optional. Text transcripts of these hour-long meetings were saved and analyzed. Approximately 100 pages of on-line meeting transcripts were collected.

- **Study Group Transcripts**
  Each student was assigned to a four-student electronic study group, which consisted of a message board with access restricted to group members. Approximately 200 electronic study group interactions were archived in text form for later analysis and interpretation.

- **Idea Container Transcripts**
  Each activity included an electronic message board to which all students and instructors were provided access. Approximately 500 electronic idea container postings were archived in text form for later analysis and interpretation.

- **Reflective Learning Journals**
  Thirty-five students wrote entries in an electronic learning journal in which access was limited to the individual students and instructors. Journal content of approximately 150 pages of text was parsed and passages relevant to cognitive interaction and growth in reflective judgment were extracted, forming a reduced record.

- **Reflective Essays and Other Student Work**
  A series of reflective essays, activities, and exams were administered. The first asked students to reflect on the meaning of distributed education; the second asked students to reflect on the evaluation of critical thinking after completing midterm exams. The third asked students to reflect on the impact of cognitive interaction in the course. The final essay asked students to summarize how individual cosmology changed as a result of the course. Essays and content of other student work (approximately 1000 pages of text) was parsed and passages relevant to cognitive interaction and growth in reflective judgment were extracted, forming a reduced record.

- **Structured Interviews**
  Two extensive structured interviews of approximately one hour each in length were carried out with off-campus students. The interview content was videotaped for analysis. Interview content was transcribed, and the resulting text recorded.

Profiling Electronic Interaction

Figure 3 displays the way the learning environment was used for various types of interaction in Granott's framework. The idea containers were used for the broadest range and amount of interaction.

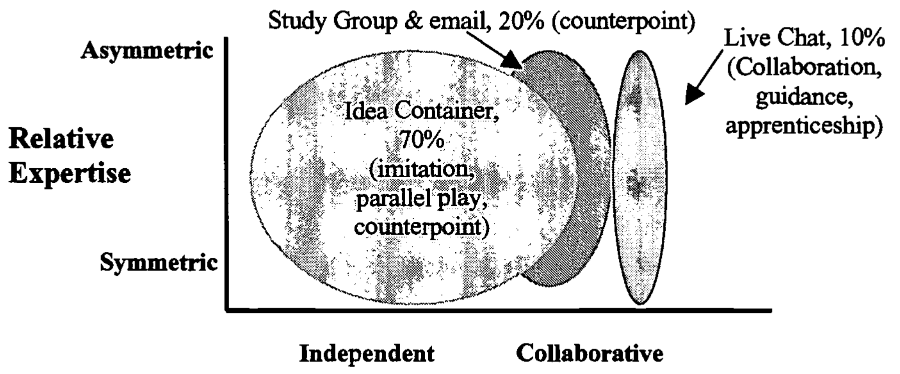

Figure 3. Distribution of Interaction Types in the Granott Framework

Imitation and "parallel play"

Imitation is an independent, roughly asymmetric interaction in which a novice learns form an expert through direct modeling, with limited two-way interaction. Idea containers were extensively used for imitation. It was reported that it was useful to "see others ideas when I was stuck" (Student Evaluation, 3/98). The perception that others' ideas were worth reading and evaluating indicates an open and critical sharing of work and ideas.

Different from imitation is the notion of "parallel play," a non-collaborative , symmetric interaction. Parallel play differs from imitation in that "partners" perceive each other as having equal expertise in the activity. The perception of equality is evident in reports that "I liked compare my ideas to others to see if I was on the right track." The idea containers facilitated the imitation—parallel play continuum in a very flexible and effective way.

Guidance and Counterpoint

More collaborative than imitation or parallel play, guidance and counterpoint were also evident in idea container interactions, as well as in study group communication and in live meetings. Counterpoint consisted of short periods of interaction interspersed through independent activity, taking the form of "question-answer" (asymmetric) or "point-counterpoint" (symmetric) dialogue. Often, counterpoints were separated by days or even weeks in time.

Collaboration and Apprenticeship

Collaboration is characterized by a highly interaction between peers of equal expertise (Granott, 1993). Collaboration is reciprocal and symmetric, with quick shifts of dominance from one to another. The participants are engaged in common activity, with common goals, sharing materials. "The participants co-construct their knowledge by continuously sharing their ways of understanding. Their knowledge structures, therefore evolve simultaneously" (Granott, 1993, p.189).

High levels of collaboration were rarely, if ever, observed in asynchronous idea container or study group interaction. Some counterpoint interactions were extended into "counter-arguments" but the central features of collaboration such as common goals and synchronous learning was not evident. To observe collaboration in the AFE we must turn to synchronous communication. The meeting room interactions demonstrated Granott's criteria for mutual collaboration (symmetric) and apprenticeship (asymmetric collaboration).

Development of Reflective Judgment

About 70% of the in-service teachers, many of whom had limited background in science, initially held a pre-reflective view of knowledge and justification in astronomy. The remaining students began with at least a quasi-reflective view, with a few demonstrating "expert", reflective understanding of the nature of astronomy knowledge.

Most students experienced some initial and understandable discomfort with applying reflective thinking skills in an astronomy course. Many students were able to integrate higher level skills as the course progressed, and reported that the interactivity of the course was an important factor in growth:

> "I really enjoy taking control of my learning, but it does take a while to get going with such a new concept...I do enjoy this type of approach, though because it gives me the chance to be responsible for gets done and to what extent. It gives me the sense of initiative needed to gain the knowledge that is required to pass this course. It also gives a self-confidence as a learner because I am also a teacher. I like the on-line chat program where we can go with questions and comments to get help or to help other students (Student Evaluation, 12/97)."

> "I learned a great deal. I enjoyed finding the planets in the evening sky. I enjoyed plotting the sunrise and sunset and moon phases. It was fun creating a sun dial and finally understanding how they work. Working through the units in determining the size and mass of things allowed me to discover things beyond this solar system...I have been out of complicated math for so long that I was frustrated a bit at times...I liked the flexibility of working when I found the time. It was a great experience completing things at any hour and submitting it. I appreciate the flexibility that you had with me, especially when my computer was not being user friendly. I appreciated the help that you gave when needed. In the beginning there was more student to student interaction...I enjoyed reading what comments people submitted. I could see myself doing even better the next on-line class I take... It was really cool being able to look up information on the internet. It was also fun going to sites set up in the various units. It is amazing how much information I could access. I felt that this class provided many opportunities to have the student interact with the subject through the idea tank (sic), physically viewing the sky, creating sundials etc. I think I have spent more time on this subject than any others - It was fun...I have come away from this class with a great deal and you have furthered my love of science. I will be able to use many of the things I learned with my family and my Second Grade Class" (Student Evaluation, 8/99)

> "I have really enjoyed taking this astronomy class. I have learned a lot. This is not just book knowledge, but I was able to see (both literally and figuratively) these facts for myself. This course did encourage me to think critically... Being able to talk to others taking the class definitely helped. There were times when I got stuck on an activity and reading what they had done put me in the right direction to solve my problem. There were also times when I was able to help others. As a teacher I really enjoyed that" (Student Evaluation, 8/99)

Discussion

Along with the enthusiasm of a predominantly successful experience with AFE comes awareness of a number of challenges for future implementation. By addressing these caveats on an on-going basis during future development I believe that AFE has the potential to facilitate powerful, robust learning for in-service teachers.

Student Technological Readiness

About half of the students began the astronomy course with skills inadequate for independent utilization of the technology. As one student put it, "I feel as like this should be a nine-credit class. I work on it constantly." It turned out that the student was engaged in two simultaneous tasks. He was not only engaged in the problem-solving tasks intended by the course designers, but was spending a great deal of time learning basic computer and internet

skills as well. The student suggested that perhaps a separate training course with instruction in the necessary technological skills would meet his needs.

Providing a course "on-ramp" which is technically negotiable for as many students as possible is one of the most challenging facets of AFE implementation. Many tasks that seem transparent to course designers such as habitually saving work to disk, using hyperlinks, efficiently arranging the computer desktop, sending email from a variety of environments, and even finding and connecting to an internet service provider can prove to be a great consumer of time and cause of frustration for students. It is recommend that future AFE course designs include optional training modules for those who are unfamiliar with the network technology.

Student Cognitve Readiness

A few students were challenged by both the independent nature of the course and the critical nature of the activities, becoming at times angry and regretful at having enrolled in the course. In two instances, students were unable to meet the demands on the on-line environment, reporting that they needed "clearly written lectures and definitions," and were unable to progress beyond the initial activities due to "a total lack of direction." One bluntly reported, "this was not the course for me." Ironically, both reported being "excellent" students otherwise, one being an earth science teacher in the middle grades. The issue of cognitive readiness for critical thinking in science seems to be problematic even for seemingly qualified students. There is no doubt a variety of reasons for this, including past experience in school, particularly in traditional science courses, which de-emphasize critical thinking in favor of "covering material.".

Increased Time Demands

I found that as my students work harder in learning Astronomy, I work harder as well. This runs contrary to common notion that on-line environments are a way to cut costs in terms of instructor time. In AFE this was hardly the case. The increased interaction and depth of learning was rewarded by longer instructor hours. Class sizes in interactive on-line course should remain comparable to those in traditional courses and be staffed equivalently.

Conclusion

The implementation of electronically distributed AFE largely met the educational goals of critical thinking and rich cognitive interaction while providing for flexibility and convenience for students. While no learning environment can be pre-programmed to be "complete" in and of itself, the mostly-asynchronous distributed learning environment as implemented by the researcher provides a complementary blend of time independence, student ownership and accessibility, and teacher facilitation. It also maintains a dynamic, flexible teacher-owned platform for further development.

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Technology Education: A Synergistic Approach

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Introduction

In the mid-60s Federal money was beginning to pour into urban school districts to improve basic instruction. Money for science materials, reading texts and audio-visual equipment slowly transformed each classroom into a state of the art learning environment. The excitement of new hardware energized the teaching staff. But slowly the equipment that we loved to have in the classroom fell out of use. It was pushed into corners, never to see the light of day again. In the rush to spend the funds, a vital step was missed. We were never really trained to integrate the new technology into our instructional process.

Since those early attempts to integrate technology into the curriculum, technology itself has taken a quantum leap into the future. In some districts, unfortunately, technology itself has become the end. During many visits to local school districts, we have observed a pattern re-emerging. New computers and software were in the classrooms but were being used at best to be a reward for students who completed an assignment early. School media specialists reported that assignments given to students for research over the Internet consisted mostly of the student downloading information and submitting it to their teacher. I t seems that the objective for this use of the Internet *was to use the Internet!*

The February 1999 issue of Educational Leadership was devoted to integrating technology into the classroom. One of the articles outlines a successful program's philosophy by stating: *"Technology became the new tool. The staff determined early in the process that technology would not be the driving force, instead it would be to provide curricular support. They adopted the philosophy: We use technology to learn, not to just use technology."*
With this framework, we began to examine how the successful integration of technology into the instructional process could be institutionalized. The Pennsylvania State Department of Education helped in this quest.

State Program—Link to Learn

The State of Pennsylvania has established a $166 million Link-to-Learn initiative to serve as a catalyst for the effective use of information technology to enhance education, promote community partnerships, and support economic growth in a knowledge-based society. Institutions of higher education are encouraged to be innovative in developing delivery systems that will make systemic changes both in pre-service programs as well as in-service staff development processes. Providing hardware, software and training is a fundamental part of this program.

Grant Description

Chestnut Hill College proposed to increase the proficiency of its pre-service teachers to use technology to improve teaching and learning. As a result of this initiative, by June 2000, participating pre-service teachers will possess the following minimum technology competencies:

Ability to use word processing

Ability to use database software
Ability to use spreadsheet software
Ability to use timeliner, concept mapping, graphing, prewriting software
Ability to evaluate game and simulation software across the curriculum
Ability to evaluate and use Internet and Web resources
Ability to design activities in which students use Internet and Web resources
Ability to create support materials for the use of technology in classrooms by children
Ability to integrate use of technology into the curriculum, choosing age-appropriate software and creating activities that connect software used to topics being taught
Ability to organize the classroom's physical layout and activities to maximize the use of one computer in a classroom

These competencies will support effective teaching of the emergent Pennsylvania academic standards in English language arts, mathematics, science and social studies for grade levels K-8.

Additionally, these competencies will support language arts, mathematics, science and social studies curricula for cooperating teachers in grades K-8.

These competencies were developed through examination of the standards for technology usage by classroom teachers articulated by ISTE (the International Society for Technology in Education) and NCATE (the National Council for the Accreditation of Teacher Education) and through content and technology standards articulated by discipline specific organizations (e.g., National Council of Teachers of English/International Reading Association; National Council of Teachers of Mathematics; National Social Studies Association; National Science Teachers Association).

To enable our pre-service teachers to acquire these competencies, Chestnut Hill College proposed:

(1) to require a beginning course in Educational Technology of all pre-service students
(2) to educate the methodology/practicum faculty on the integration of technology into their courses
(3) to place pre-service teachers with in-service teachers who have been or are being educated about the use of technology in education (This is directly in keeping with the *Pennsylvania General Standards for Institutional Preparation of Professional Educators [proposed],* Section I-H which addresses both the quality and importance of field experiences.)
(4) to educate in-service teachers about the integration of technology into their curricula so that these in-service teachers and their classrooms may serve as practicum sites for our pre-service teachers
(5) in conjunction with the Graduate Program in Applied Technology, to establish and maintain a Technology-in-Teaching Resource Center for in-service teachers so that our pre-service students will always be assured of appropriate placements. (This is directly in keeping with Section I-I of the proposed *General Standards* which speaks to collaborations with higher education to "design, deliver, and renew effective programs for the preparation of school personnel...")

In sum, in order for our students to learn to use technology in their classrooms, they must not only learn the technology and design lessons and units incorporating technology, *but must also see the use of technology modeled in their practicum sites.* Since the lack of appropriate sites remains a serious obstacle to full preparation of our pre-service teachers, by partnering with K-8 sites and educating their teachers, we create opportunities for our pre-service teachers to practice what they have learned.

During the funding period, this project is directly serving approximately 117 pre-service teachers and approximately 10 higher education faculty.

Chestnut Hill College should be able to sustain this initiative after Commonwealth funding by 1) creating a cadre of higher education faculty to serve as the basis for the Technology-in-Teaching Resource Center and 2) by establishing a pool of cooperating in-service teachers who can a) model the use of technology in the teaching of content areas and therefore benefit future cohorts of our pre-service teachers; and b) serve as mentors to other teachers in their school and in the neighborhood.

Actually, Chestnut Hill College partnered with two Philadelphia public schools, two Catholic schools and two private academies to develop a relationship between pre-service and in-service teachers. These schools provide a diversity of populations and promote a variety of teaching and learning styles. Like Chestnut Hill College, all partner schools are located in the northwestern section of Philadelphia and constitute Chestnut Hill College's "service area". During the funding period, this project will directly serve approximately 60 in-service teaches and approximately 1550 students in grades K-8. Once educated, however, these in-service teachers will continue to impact pre-service teacher populations from Chestnut Hill College as well as other teacher preparation institutions for many years to come.

Findings

In order to effect institutional change we found that teacher preparation institutions, local school districts and teachers as a sub-culture must all interface with a singleness of purpose. This of course is easier said than done

The Teacher Preparation Institution

The Department of Education at Chestnut Hill College was more than ready for systemic change. It had recently revamped both of the graduate and undergraduate programs. New course requirements such as "Technology in the Classroom" and " Introduction to Special Education" were introduced while some of the traditional "methods" courses became electives. A two-semester generic methodology course was created. However for technology education to become a part of all of these courses, the department members themselves must be trained. Each of the department members as well as three faculty members from departments that were integral to the teacher training process took part in a course that was designed for them.

It was intended that each faculty member would incorporate these methodologies into their pedagogy thereby serving as a model for the pre-service teachers. This was not an easy process. Some of the faculty members embraced the changes while others were more reluctant. In the end faculty members cooperated in their own manner yet became significantly more skilled than before the course.

The role of the teacher preparation institution in effecting true change has been ignored or underestimated in the past. Local school districts must depend on colleges to provide an infusion of new ideas and procedures as well as the enthusiasm that new teaching staff member bring to the table. If the college faculty themselves are not committed to changing their practices, how can we expect the pre-service teachers to incorporate them into their methodology? At Chestnut Hill the Education Department and the Technology Department have formed an alliance that has been mutually beneficial. Other departments who also educate the pre-service teacher have seen the potential for significantly improving their courses by incorporating technology into their curricula.

We would like to digress for a moment to expand upon our use of the word "technology". Technology as we use it is more than hardware; it is the Internet, software but also a state of mind. A desire to rethink old procedures and be open to new approaches to teaching which involves the manipulation and digesting of a torrent of new information which cascades over us each day.

The School:

One of the most difficult aspects of this project was to effect systemic change in the planning and implementation of the instructional program. We found that each school had its own unique decision making process in terms of curricular/technological change. As part of the project each school appointed a Link to Learn coordinator to work directly with the College. These individuals served as on-site "experts" to help cut through the school's bureaucracy and provide a valuable source of information to the college on both suggestions for training for their in-service teachers and also the performance of the pre-service teachers.

However a fundamental question arose, "How does change take place?" Can an outside agency, a college or State Department of Education, encourage an individual school to incorporate technology into its delivery system? As usual we found that the answer does not fit nicely into a pre-determined mold. The outside group can provide motivation, training, and expertise and of course, funds to begin the process. Yet without the

commitment of the principal, who sets the tone for the school, and a core group of respected dedicated teachers who believe in the program change will only occur sporadically and without survivability after the project expires. This finding is not new. A school has its own culture that resists change of any kind. Therefore, we have found that it is equally important to know "who" should be involved as well as the "how" it will or should occur. There must be a schoolwide philosophy which outlines how technology will be integrated into the curriculum for success to be achieved.

The Teachers:

One of the requirements to receive funds for equipment for individual teachers was for those teachers to participate in a graduate course of their choice, which has a technology focus. We found that after they overcame their initial reluctance, they truly found the course to be extremely helpful and motivating. For many of the teachers this was the first course they had taken in many years. We also found that some used this course as a first step to an advanced degree.

The interaction between the pre-service teacher and the in-service teacher in the classroom help to institutionalize the technology changes into the classroom milieu. This forced interaction helped both individuals. The in-service teacher now had to change their methodology to serve as a model for the students and the pre-service teacher saw an actual lesson being taught that incorporated the theory they had been taught.

Implications for the Future of Technology-Education Integration:

The goal of this project was to create placement opportunities for our practicum and student teachers in which they would see technology used, as well as classroom instruction at the college that included technology (in courses other than the single hand-on course). This is essentially a process of changing behaviors, both of cooperating teachers and also of college faculty. We know that meaningful change happens slowly, and only when teachers own the process. This seems to be true in our case, for both groups of teachers.

Cooperating teachers in the six schools

The state made all the funds available to us almost immediately and expected that we would spend all the money and that we would do so quickly. This raised the issue of who made decisions. We chose to offer options to each of the schools and to each of the individual participants, options in courses as well as hardware and software purchases. The process took longer than the state officials seem to have expected. But this process seemed worthwhile to us. It seemed critically important to honor the individual needs of each school, and to move in rhythm with each school to make appropriate and productive decisions.

For instance, we did not create a "one size fits all" technology course for the cooperating teachers. Instead we called a meeting and explained the content of the courses we offered in the Applied Technology program, inviting each participant to choose a course that addressed his or her needs. This meant that some teachers took courses in the summer, while some took courses the following fall. If we think of this program as having duration of fifteen months, this is problematic, because placement sites would not be immediately available for the fall for all of our students. If, however, we choose to envision this program as the beginning of an evolving relationship with these schools, the deliberate pace with which we began allowed for some critical understandings to be established.

The first understanding is that each of these schools has a culture and a history, and that they must make decisions with which they can live. In addition to giving them course options, it seemed important to us to pass the decision-making power on hardware and software to each of the schools. We did the ordering of hardware, but only after the technology coordinator at each school indicated to us what would be required. It took longer to establish a useful base of equipment, but the purchases were all necessary and desirable. In fact our funding came through in February and March, and schools did not have their equipment until September.

Software purchasing followed a similar pattern. We refused to prescribe software for the schools, inviting teachers instead to wait until they each had taken a course, and knew what was available to support their curricula. Again, we used each school's technology coordinator to oversee this process, to guarantee that teachers did not make redundant purchases. Most software was purchased in the fall. We had offered in April to do presentations for each faculty, demonstrating software and

talking about methods of evaluation. Only one of the schools was ready to take us up on that offer immediately. Other schools needed more time to have the equipment and begin the year, and then requested presentations.

The next understanding is that teachers need time to think about their curricular goals, and consider whether and how technology can be used to achieve those goals. The offer to do presentations for schools will be extended again as we begin our spring semester at the college, acknowledging that teachers may not all be ready to hear information at the moment we choose to provide it. We could ignore this reality, and have our presentations fall on deaf ears, or wait until they ask for a presentation, in the hope that this request indicates a willingness to listen.

College faculty

Educating the college faculty has been equally tricky. The grant provided funds to pay ten professors to enroll in Applied Technology courses. Five professors took courses (again of their own choosing) during the summer. This group included adjunct faculty members and professors from other disciplines in the college. Time constraints, professional obligations and just plain resistance have kept five of the full-time education faculty from taking a course and their endorsements of technology in their courses vary from professor to professor. We remind ourselves again that change takes time, and that meaningful change must be owned by the teacher. This lesson is true even when that teacher is a college professor.

We evaluate this program in terms of our long-term goals: providing students with placements in which they see technology used; and integrating technology into our college education courses. Our placements differ among themselves, of course, because the schools in which our students work have differing cultures, and because each teacher is an individual. But we feel secure that the opportunities are more readily available to demonstrate roles for technology in elementary classrooms as a result of this project. Our college courses will also vary in the extent to which technology is integrated in them. This is to be expected.

Moreover, our evaluation of the project is only a snapshot of the first days of the journey, as we begin to create what we think of as a professional development community. This community includes our college, with its teacher education program and applied technology program, and six distinctly individual elementary schools, all working to communicate about best practices and creative approaches to teaching and learning.

USING the INTERNET as a TEACHING TOOL to FIND STATISTICS for USE in GRADUATE EDUCATION

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Abstract: At the University of Louisville, many graduate students in Education take "Introduction to Research Methods and Statistics," to meet their program requirements. As a teaching tool, the Internet is being used as a source for finding statistical data sets. The data sets are then utilized to complete various class exercises. While, the assignment sounds simple, it is not as simple as it sounds. Students in graduate school come from different backgrounds in terms of disciplines, level of knowledge, computing or Internet networking skills. Regardless of a student's knowledge base, graduate students are expected to have a certain level of proficiency. This paper will be helpful to both the educator and students. It will discuss strategies on navigating the Internet to find needed information, how to capture statistics efficiently and critically evaluate an Internet site and the information.

Background

The University of Louisville (U of L) Libraries has a well-developed Information Literacy Program (ILP). "Finding, evaluating, and using information from a variety of resources is the essence of Information Literacy." (IPL Index Page, 1999) The ILP provides several services to the U of L community of faculty, staff and students. A few of these services are:

(1) *Jumpstart Classes* are designed to meet the needs of students and the university community in general with finding computer and library resources;
(2) *Short Courses* are designed to meet the needs of faculty and staff related to computer and library resources;
(3) *Research 1-On-1* is designed for individuals who need help with their research meet with a librarian to discuss the best resources for their project; and
(4) *Librarian Visit* is designed for a librarian to meet with a class and provide effective methods of research.

Another aspect of ILP is the Library's Liaison Program. The Library Liaison Program at the University Libraries provides U of L faculty with a personal contact in the libraries. This contact, or liaison, can help answer questions about the libraries and inform teaching faculty about new services and products. The Library Liaison Program was established as an on-going partnership with teaching faculty. From this partnership, the libraries hopes to:

- build collections that reflect curriculum and research priorities;
- supply user-centered services;
- integrate information literacy into the curriculum;
- create resource-based teaching and learning programs; and
- encourage lifelong learning.

How does all of this relate to "USING the INTERNET as a TEACHING TOOL to FIND STATISTICS for USE in GRADUATE EDUCATION?" Librarians assist, instruct and inform faculty and students on how to access and use paper and electronic resources available both, in-house (locally) and via the Internet (remotely). In this instance, a Library Liaison to one of the departments in U of L's School of Education was asked to provide instruction to students in a graduate level statistics class. The professor wanted the students to be able to find data sets on the Internet that could be downloaded into a spreadsheet or Statistical Package for the Social Sciences (SPSS). Clemmitt (1996) said, "good internet sites also give students a tremendous amount of control over data access." So once students find good sites, they should be able to find data that meets their needs and be able to manipulate the data for various class exercises and projects. The class session was scheduled and the class visited the library to meet with

the librarian, in the Collaborative Learning Center (CLC). CLC is a classroom in Ekstrom Library designed with 25 student computer workstations, Internet access, and a high quality projection and audio system.

Many people have access to the Internet and are amazed at the abundance of information available on the World Wide Web (WWW). In a graduate classroom setting, students come from different backgrounds and are at various stages of their educational program. Someone may have recently received a baccalaureate degree, while someone else is returning for some sort of certification, and yet another, is pursuing an advanced degree, after being out of the field of education or school for several years. Some people may use the Internet regularly, while others may not even own a computer. Regardless of their level of education or familiarity with the Internet, students need to be able to find statistics and manipulate the data for various reasons. Students and educators need to know how to find data sets. While there is no easy or correct way to search for information on the Internet, there are searching techniques that will aid the user in searching the Internet.

The Search

Many libraries have subject guides, which provide students with places to start searching for their information needs. Basically, a subject guide is a list of books, periodicals, and electronic resources including databases and electronic journals that a librarian has reviewed to aid researchers in search of information on a particular subject. On the U of L's Research Center Web page (Fig.1), anyone can use their mouse and click on the subject of their choice. While this list is not inclusive of everything available in the library or on the Internet, it provides a broad range of subjects to explore. A subject guide can be in either paper or electronic format. An example of an electronic subject guide on the Internet is available at U of L's Research Center Web page see, (Figure 1), (The Research Center, 1999).

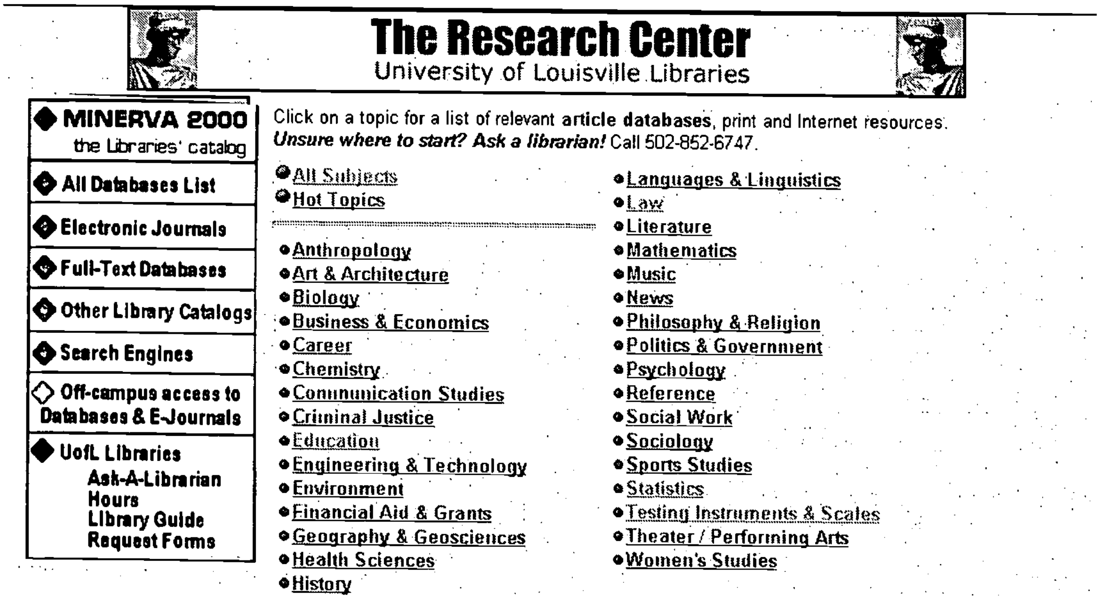
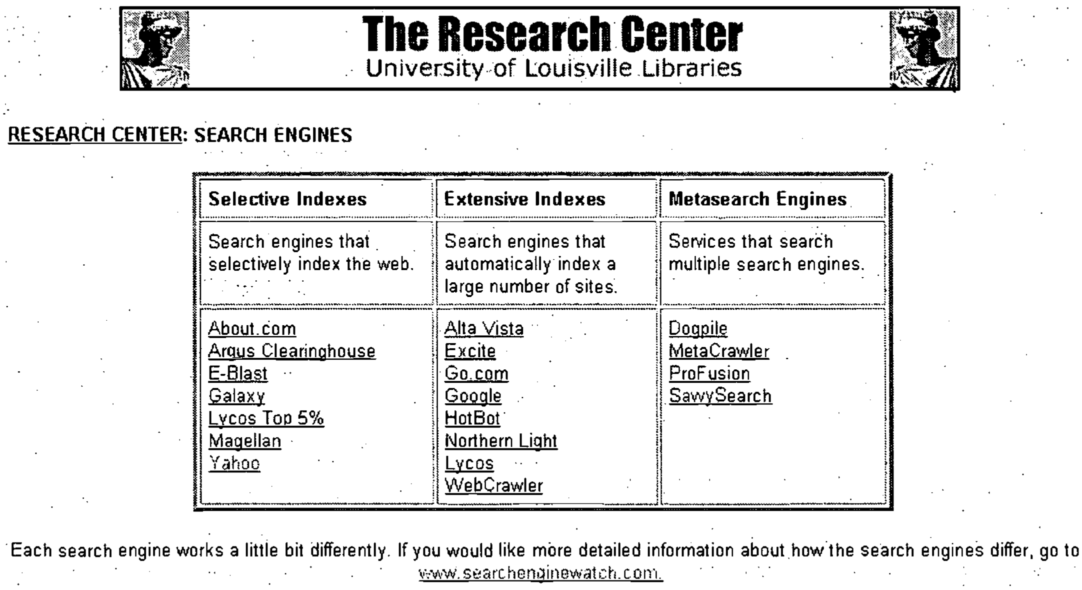


Figure 1. The Research Center is a virtual gateway to resources at the University of Louisville Libraries.

By clicking on a particular subject, from Research Center Web page, the library has provided the patron with basic information on that subject to begin a quest for information. When searching the Internet, it is strongly suggested that the user have a strategy. For a productive search, it is highly advised that students brainstorm a list of words that best describe the subject/topic for the information being sought (Crehan & Teitelman, 1998). These words should define or identify the unit of analysis and they will be used as *keywords*. It is the keyword that is instrumental in navigating the Internet. Once the keyword(s) have been identified, the search can begin.

Another method used to search the Internet is *natural language* or *free-text* searching. This method allows the user to type into the text box provided by the search engine, specifically in sentence form the subject being

searched. It should be noted that there are many types of search engines and they vary greatly. It may also be necessary to go to the help section and modify the keyword or the natural language search. All search engines are not the same, but they have similarities, see (Figure 2), (Internet Search Engines, 1999). According to an online dictionary, a search engine is a computers program that, when executed, it retrieves a list of documents based upon the search strategy provided by the user (Webopedia, 1999). For more information regarding searching and search engines visit the web page *www.searchenginewatch.com* (Search Engine Watch, 1999).



The Research Center
University of Louisville Libraries

RESEARCH CENTER: SEARCH ENGINES

Selective Indexes	Extensive Indexes	Metasearch Engines
Search engines that selectively index the web.	Search engines that automatically index a large number of sites.	Services that search multiple search engines.
About.com Argus Clearinghouse E-Blast Galaxy Lycos Top 5% Magellan Yahoo	Alta Vista Excite Go.com Google HotBot Northern Light Lycos WebCrawler	Dogpile MetaCrawler ProFusion SavvySearch

Each search engine works a little bit differently. If you would like more detailed information about how the search engines differ, go to www.searchenginewatch.com.

Figure 2. Web page listing various types of search engines and how they search the Internet.

Finding Statistics on the Internet

Locating statistics on the Internet to download is not a difficult task, but it can be time consuming. It would be helpful for the student to know the unit of analysis and how to evaluate information, before beginning the search. One can be overwhelmed searching the various Web sites given all the available data and the time it takes to determine if what is found is what is actually needed. A list of educational and governmental Web sites has been compiled to serve as starting points to browse and retrieve data sets. These Web sites were chosen based upon the criterion, which will be mentioned later regarding evaluating information on the Internet. Three examples of searches using government web sites for educational data sets are listed:

NCES http://nces.ed.gov/ > NCES Electronic Catalog > 2) Integrated Postsecondary Education Data System > 3) Data file > Search > NCES Search Products Information http://nces.ed.gov/pubsearch/search.asp > Fall Enrollment Data File, 1997 (http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000161) > Download the 1997 Fall Enrollment data as a zip file > Save .dat files as .txt files > Open saved file in Excel

U.S. Census Bureau http://www.census.gov/ > Product Catalog http://www.census.gov/mp/www/censtore.html > Subjects Index *"E"* http://www.census.gov/acsd/www/sub_e.htm > Educational Attainment > http://www.census.gov/population/www/socdemo/educ-attn.html > CPS March 1997 - Preliminary Data (EDUCATIONAL ATTAINMENT OF PEOPLE 25 YEARS OLD AND OLDER, BY SEX: MARCH 1997) (http://www.bls.census.gov/cps/pub/1997/educ_att.htm) > save as .txt file > Open saved file in Excel

NCES - http://nces.ed.gov/ > Electronic Catalog > Data Access Tools > National Public School and School District Locator > Data > pick and click on a ZIP file (it may be necessary to use a Helper Application to unzip the file before attempting to save it as text) > open and save as a .txt file > Open saved file in Excel

Printing and Saving Data

A procedure for printing a report or saving the report as a file depends on the browser or Web site. One may have the option of printing only specified pages of a report, or mailing a document as e-mail to oneself or someone else. Saving a file can be done through the *save*, *save as*, or *load to disk* commands when available. Many reports are in a fixed-width font, based on the 80-column format to provide maximum printer compatibility. These reports can be quite long, so it is advised that you check the length of a report before printing it.

Converting Data to Spreadsheet Format

These instructions are for Netscape 4.07 and Excel 97 SR-2. Procedures may differ with other software applications.

1) Once the full report is on-screen, choose *file*, *save as* and save the data with a .txt extension* (e.g. filename.txt)
*Depending on the software or instructions from the data set site, the extension could be different (e.g., .csv, .prn).
2) *Open* the saved file in any text editor (such as Notepad or Simple Text).
3) In Excel, *open* a file.
4) *Open* the saved data file.
5) A dialogue box will open up offering methods of converting the text file to a spreadsheet.
6) Choose the *Fixed Width/Delimited text* radio button (it depends on the Web site).
7) Click *next* and you will have an opportunity to change the width and placement of the fields. Often Excel will interpret the field widths correctly. If not, you can add a column break by clicking, remove one by double clicking or move one by clicking and dragging.
8) Click *next* again to have a chance to change a field's data type. Leaving the type as *general* usually works fine.
9) Click *finish* and you will have the data in a spreadsheet.

Evaluating Information on the Internet

When looking for statistics on the Internet, one must be careful and evaluate the source of information. As we prepare to use the Internet as a source for finding statistics, we must remember what features makes the Internet, a World Wide Web (WWW) of information. It is a place where the quality of information varies tremendously. The Internet is a place where the lines that define entertainment, advertising, self-promotion and expression are blurred, and this must be kept in mind, when looking for information on the Internet, and this information must be evaluated critically. Five criteria (accuracy, authority, objectivity, currency, and coverage) are listed below that will be helpful in evaluating information found on the Internet see (Table 1), (Web Research Evaluation Checklist, 1999).

Web Research Evaluation Checklist

Accuracy	Questions To Ask	Be Aware That...
	• Are the sources for any factual information clearly listed so they can be verified in another source? • Is the information free of grammatical, spelling, and other typographical errors? • Is it clear who has the ultimate responsibility or the accuracy of the content of the material?	• Almost anyone can publish on the Web. • Most Web information is not verified by editors and/or fact checkers. • Errors not only indicate a lack of quality control, but also can actually produce inaccuracies in information. • Web standards to ensure accuracy are not fully developed
Authority	Questions To Ask	Be Aware That...
	• What is the nature and purpose of the page? • Is it clear who is sponsoring the page? • Is there a link to a page describing the purpose of the sponsoring organization? • Is there a way of verifying the legitimacy of the page's sponsor? That is, is there a phone number or postal address to contact for more information? An email address is not enough! • Is it clear who wrote the material and are the author's qualifications for writing on this topic	• Often difficult to determine authorship of Web sources. • If author's name is listed, his/her qualifications frequently absent. • Publisher responsibility not often indicated.

	clearly stated? • If the material is protected by copyright, is the name of the copyright holder given?	
Objectivity	Questions To Ask	Be Aware That...
	• Is the information provided as a public service? • What biases might the author(s) have? • Is the information free of advertising? • If there is any advertising on the page, is it clearly differentiated from the informational content?	• Goals/aims of persons or groups presenting material often not clearly stated. • Web often functions as a "virtual soapbox".
Currency	Questions To Ask	Be Aware That...

	• Are there dates on the page to indicate when the page was written, first placed on the web, and last revised?
	• Are there any other indications that the material is kept current?
	• If material is presented in graphs and/or charts, is it clearly stated when the data was gathered?
	• If the information is published in different editions, is it clearly labeled what edition the page is from?
		• Dates not always included on Web pages.
		• If included, a date may have various meanings:
		  ◦ Date information first written
		  ◦ Date information placed on Web
		  ◦ Date information last revised

Coverage	Questions To Ask	Be Aware That...
	• Is there an indication that the page has been completed and is not under construction? • If there is a print equivalent to the Web page, is there a clear indication of whether the entire work is available on the Web or only parts of it? • If the material is from a work which is out of copyright (as is often the case with a dictionary of thesaurus) has there been an effort to update the material to make it current?	• Web coverage may differ from print coverage. • Often hard to determine extent of Web coverage.

Table 1. A Checklist showing five criteria that can be used to evaluate information found on the Internet.

Education and government web sites

The Internet is an excellent source for information. The Web sites listed below do not begin to represent the many statistical web sites that are available on the Internet, but they are a place to start.

Statistical Resources on the Web -- Education http://www.lib.umich.edu/libhome/Documents.center/steduc.html
National Center for Education Statistics (NCES) http://nces.ed.gov/
U.S. Census Bureau http://www.census.gov/
School District Data Book (Oregon/U.S. Census) http://govinfo.kerr.orst.edu/sddb-stateis.html
Journal of Statistics Education http://www.amstat.org/publications/jse/archive.htm
Kentucky State Data Center (KSDC) http://cbpa.louisville.edu/ksdc/
State Data Centers http://dir.yahoo.com/Society_and_Culture/Issues_and_Causes/Population/Data_Centers/
Data Ferret (Federal Electronic Research Review and Extraction Tool) http://ferret.bls.census.gov/cgi-bin/ferret
Inter-university Consortium for Political and Social Research (ICPSR) http://www.icpsr.umich.edu/
The Henry A. Murray Research Center at Radclifffe College http://www.radcliffe.edu/murray/data/index.htm
Social Science Data on the Net (University of California at San Diego) http://odwin.ucsd.edu/idata/
Missouri State Census Data Center Library of Data Holdings http://www.oseda.missouri.edu/infolib/uexplore.html

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A Hero's Journey: Introducing Modular In-service Diploma Courses in IT at Trinity College Dublin

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Abstract: This paper is a reflective narrative exploring the introduction of a modular in-service programme, using the device of the Hero's Journey (features of which are described). The programme is a response to an Irish government initiative which aims to integrate IT into the education system. Pedagogical and curriculum issues, rather than skills or technical matters, are central to the programme; it thus relies heavily on the inputs of experienced classroom teachers. Modules are taught at many centres both on- and off-campus. These features provide organisational challenges. The Hero's Journey proved to be an effective frame for analysing the experience, with both strengths and difficulties being identified and with the spiral nature of the process facilitating replanning. Reculturation, in Fullan's use of the term, has been identified as the essence of the programme.

Introduction

In common with many countries, Ireland is seeking to prepare its education system to meet the challenge of technological development. The major response is entitled "Schools IT 2000" (Department of Education and Science 1997, FitzGibbon & Oldham 1998). It has as major foci to explore creative ways in which IT can be successfully integrated into the Irish education system and provide IT professional skill development for at least 20,000 teachers (Department of Education and Science 1997). Since it involves the whole country and seeks to include all teachers and schools, it is an example of a large-scale educational reform. The nature of such reform measures is, as Fullan points out, largely unappreciated; in his opinion what is involved is *reculturation* rather than *restructuring* of the institution. The former is a much more difficult task (Fullan 1999).

As part of Schools IT 2000, a National Centre for Technology in Education (NCTE) was set up, one of its tasks being to provide in-service courses in IT for teachers. These courses do not lead to certification, but they have created a demand for certified courses. The Education Department at Trinity College (University of Dublin) was already providing in-service courses in other disciplines, using a flexible modular approach in collaboration

with regional Education Centres. The same approach was used in designing and running a programme of such courses in IT.

The introduction and implementation of the university programme is explored in this paper. The experience is analysed using the metaphor of a "hero's journey," as suggested by Brown and Moffett for exploring school transformation: "To walk the path of the hero's journey is to leave the state of unconscious innocence and move towards conscious acceptance that we are living in times of chaos, discord and disequilibrium" (Brown & Moffett 1999 p. 58). Importantly, however, such a journey is one of "hope" (Brown & Moffett 1999 p. 1). This metaphor is used as a frame for reflection on the experience of the programme for two reasons; first, it was perceived to offer insights on the successes and failures which occurred; and secondly, it provides a spiral approach, permitting the replanning and subsequent evaluation to become a seamless activity. The spiral nature of growth, both personal and institutional, is highlighted in the seven stages which are specified for the hero's journey (Brown & Moffett 1999 p. 14):

1. Breakdown and the Call: Innocence Lost
2. Chaos and Complexity: This Way Come
3. The Heroic Quest: The Search for the Grail
4. Gurus and Alliances: Companions Along the Way
5. Trials, Tests, and Initiations: Staying the Course
6. Insight and Transformation: Arriving where we Started and Knowing the Place for the First Time
7. A New Call: The Journey Begins Again

1. Breakdown and the Call: Innocence Lost

Breakdown is understood as the loss of unconscious innocence — hence, the recognition of a problem. In the case of the document *Schools IT 2000*, several sections focus on the need for various kinds of teacher development (Department of Education and Science 1997). As Brown and Moffett point out, "all great mythic quests and journeys represent movements away from the stability, comfort, and safety of the known in response to external opportunities or threats" (Brown & Moffett 1999 p. 41). IT represents both opportunity and threat for teachers, and this phase in the journey might be considered as arising from the sense that breakdown has occurred or is about to occur. The path for the hero is away from unconscious innocence towards enlightened engagement: that is, taking a path of direct experience in which change is confronted directly. The Call, for the government department, is the recognition that the education system needed to integrate technology into the curriculum, and the realisation that this has considerable resource implications: hardware, software and (crucially) teacher preparation were all necessary. Courses are now being offered by many institutions, including Trinity College, specifically the Division of In-Service Education within the Education Department. This is the unit the work of which is critiqued in the paper.

The loss of innocence for the Division was the recognition that it was not meeting the needs of teachers in the "Information Age"; certified courses which would build on the government-sponsored courses were required. The Call was to provide appropriate courses. In particular, there was a need to fill a perceived gap in the market. Other universities were offering courses focused on skills (proficiency in the use of applications packages) or technical expertise (in computer science and machine maintenance). The Trinity College modules were intended to complement, rather than compete with, these courses; in particular, they were to be aimed at teachers with an interest in curriculum and the teaching/learning environment, and with a curiosity as to whether these might be enhanced by use of IT. Thus, the content was to reflect curricular and pedagogical issues, with the aim of increasing capability: capacity building rather than product transfer (Fullan 1999).

To set the context for exploration of the "hero's journey," some organisational features of the programme should be noted. The main outlines for the modules were created by a small steering group with members drawn from three sources: the University Education Department, one of the regional Education Centres which collaborates extensively with the Department, and the ranks of IT educational consultants (teachers with extensive and recent classroom experience in the area but currently working in advisory or support roles). The first three authors of this paper are members of the group. Seven modules were outlined originally: Software and Resource Evaluation, Selection and Use; Communicating with IT; Curriculum Design and Delivery; Presentation using IT; Authoring for Multmedia and the Internet; Planning for IT; and Management Uses of IT (http://www.tcd.ie/Education/In_Service/index.html). It was intended that each module would be developed further by its own team, typically involving members of the steering group and practising teachers with particular expertise in the area concerned. The modules were to be taught at a variety of sites around the country —

reflecting the Division's commitment to an "outreach" model that has not been common in Ireland — and by locally-based teachers as well as Division personnel and those involved in module design. Teaching and learning approaches would be innovative, to allow for creativity as mentioned earlier. Innovation would also be reflected in the style of assessment, which would not be restricted to the production of papers in standard academic format (the norm for assessment for graduate diplomas in the University), but rather would reflect the use of IT and the participative and collaborative approaches that the modules were designed to foster. The remaining sections of this paper examine how these intentions were implemented.

2. Chaos and Complexity

The use of the two terms "chaos" and "complexity" in describing the second stage of the hero's journey is interesting, especially in the light of Fullan's assertion that they are the same thing. He prefers to use the latter term, considering that "the new science of complexity essentially claims that the link between cause and effect is difficult to trace, that change (planned and otherwise) unfolds in non-linear ways, that paradoxes and contradictions abound and that creative solutions arise out of interaction under conditions of uncertainty, diversity and instability" (Fullan 1999 p. 4). The Division's experience echoes this understanding. With hindsight, it can be seen that the inherent complexity of the task guaranteed a measure of chaos. Brown and Moffett quote Bennett who describes the chaos present in schools as "the multitude of variables that can affect quality implementation of a sound educational innovation, chaos is doing too much too fast so that nothing is done well or connected to anything else. Chaos is the lack of a sustained focus" (Bennett, in Brown & Moffett 1999 p. 70). A pertinent question raised is: "How is it possible to improve the quality of teaching and learning ... [with] unrealistic time estimates?" (Brown & Moffett 1999 p. 73) (see Hargreaves 1995).

The In-Service Division had over ten years' experience of organising inservice programmes for teachers. Despite this experience, it was not able to anticipate fully the demands associated with the effective delivery of professional development in the area of curricular integration of IT. These included the need for the Division to engage in: curriculum design, software identification, software licensing and procurement, hardware specification, networking specification, identification of local venues and technical support, tutor identification and induction, identification and access to learning resources for participants (such as software and web-based resources), and identification and dissemination of assessment procedures.

Moreover, time estimates did indeed prove unrealistic. The seven modules listed above were outlined in winter 1997-98, and teaching commenced in Summer 1998. At Education Centres around the country, there was an immediate demand, not only for individual modules, but also for sets of four different ones, so that teachers could complete a diploma inside one year. This, in turn, meant that a larger team of lecturers ("tutors") than envisaged had to be set up. In the first year of implementation, twenty nine modules were offered at seven sites, both on and off the university campus. This caused difficulties. For example, production of documentation was rushed; tutors were appointed in haste, without time for proper induction; designated computer teaching spaces were not available as promised; internet connections were not in place. These can be viewed as examples of external chaos. Examples of internal chaos would include, for the tutors, conflicting emotions and loss of focus when encountering organisational and technical difficulties; for the students, confusion with regard to the nature of IT in education (perhaps perceived as an efficient mode of teaching but encountered as a series of technical problems) and the role of the tutors (expected to be "experts" but not necessarily more expert than some of the participants, especially at dealing with the technical problems).

In this phase it is also necessary to confront the "shadow" elements within an organisation. These are defined as "unacknowledged and covert patterns of behavior that are in competition with the formal, overt components of a business or educational organisation" (Brown & Moffett 1999 p. 60). This includes the extent that the stated purposes or actual reality are at odds with the declared values, and the acknowledgement of limitations such as lack of knowledge and possibly lack of will. An example of the former would be the

contradiction between a declared aim of the Division, "to enable teachers to reach their potential" (as stated in the Students' handbook), and the reality of insufficient attention being given to providing support for completion of the assignments. This was not sufficiently addressed by the Division initially. Perhaps this exemplifies the need for teacher educators to change their habits of practice towards a new model of professional development as outlined by Stein et al.; for example, a shift is recommended from "short duration with bounded personal commitments" to "longer duration with more open-ended personal commitments" (Stein et al. 1999 p. 244).

Because of the nature of the programme, assessment was always going to be a challenge. As indicated above, the course designers wanted to use a variety of modes, reflecting the innovative philosophy of some modules. Given the wide range of topics, tutors and conditions of teaching, it was difficult to ensure equality of standards; in particular, tutors without experience of third-level teaching were "thrown in at the deep end." (In fact, it can be said that a side journey emerged; this was the development of the tutors, especially in relation to assessment.) Moreover, the fact that modules were being run at the same time as the national — non-certified — courses for Schools IT 2000 led to some confusion. Because of their experience of non-certified courses, a number of students queried the need to produce assignments, suggesting that attendance would be sufficient to obtain credit.

3. The Heroic Quest: The Search for the Grail

The vision quest, in the words of Brown and Moffett, is "embodied in our search for ways to translate all that we now know about quality curriculum, instruction and assessment into the daily lives of schools" (Brown & Moffett 1999 p. 82). The underlying aim of the Trinity College Education Department in seeking to introduce IT is that of many educators: to address the needs of increasingly diverse student populations and the complexities associated with the increased demands made on education by society. Finding the way in which this can be achieved can be equated to finding the Grail (see Fullan 1993).

The vision was initially outlined by the small steering group, so — contrary to the suggestion of Brown and Moffett — it was not developed collaboratively with the whole group of tutors. However, as "vision building is an open-ended, dynamic process" (Brown & Moffett 1999 p. 84), tutors were able to input their on-going experience as part of subsequent group meetings, and thus claim ownership of the vision for themselves. This, together with the fast-changing nature of the discipline, has meant that course content has evolved continuously in the period. A contributory factor has been the continuing improvement in computer literacy of students entering the modules. An important aspect of the vision driving the quest was that it should address curricular and pedagogical, rather than technical, interests, as described above; while this remains dominant, it is now possible for some more technical modules (for example, on advanced web authoring) to be introduced, without contravening the spirit of the programme.

Altogether, therefore, it was possible for the process to be viewed as "hopeful," another attribute of the Grail quest. Five recurrent patterns for this phase were revealed (Brown & Moffett 1999, Senge 1990):

a) personal vision building as a sacred commitment — once sure of our vision, we need to stand up for it;
b) shared inquiry as a cornerstone of the successful vision quest — no one can achieve the vision alone, and as it is a process, needs to be subject to constant inquiry;
c) self-mastery as the ultimate jewel in the lotus — all need to be dedicated to self-mastery without which it is not possible to move from unconscious innocence to confront the realities of chaos and complexity;
d) the capacity for collaboration as a prerequisite to achieving the vision — team skills are essential, and also to be able to stand aside from the team if necessary;
e) vision and the "razor's edge of paradox" — to walk on the razor's edge is to be balanced between following the vision and encountering opposition and obstacles.

These patterns were present in the tutors' group, and were perceived to be developing to varying extents within the different class groups of students.

4. Gurus and Alliances: Companions Along the Way

An important part of the heroic journey is the acceptance that personal limitations require reaching out to companions, including wisdom figures, who embody expert knowledge and insight. The Trinity College in-service operation relies heavily on the participation of such colleagues from outside the university. For the IT courses, it was hoped that experienced classroom teachers would do most of the lecturing. Selection of tutors

presented some difficulty; the lack of relevant qualifications meant that many excellent practitioners of IT in the classroom were not formally qualified to teach in the programme (a Master's or higher degree being required). Initiation of the tutors' group, which maintained regular contact using email as well as having formal and informal meetings, was crucial. Members became "gurus" for each other at particular times. Collaboration was the norm, and tutors on a module in one centre shared their experience, presentations, notes, worksheets and other materials with a newer team in another centre. Companions along the way also included books — notably (Grabe & Grabe 1998) — articles, websites and other non-personal sources of information. Also, a model of collaboration as being the norm for educators was being presented to the students.

The students — the teachers attending the courses — are also companions who travel with us. It is envisaged that tutors and students together will be agents of change in the school system.

5. Trials, Tests and Limitations: Staying the Course

This stage recognises the difficulties involved. Those encountered at the beginning were outlined in section 2. Some touchstones suggested by Brown & Moffett are very useful in this context: problems are natural and inevitable, and learning occurs at the edge of chaos (Brown & Moffett 1999 p. 126 ff.).

To stay the course, a systems view must be adopted. One of the difficulties in offering free-standing modules, rather than intact programmes which are the Irish norm, is the higher rate of drop-out that tends to occur. Initial evidence suggests that students are staying with the programme, although a worrying factor was the lower than hoped-for number of assignments submitted (201 out of 527 registrations). In all, there were 29 modules, and sixteen diplomas were awarded in October 1999. More will presumably follow, as students have three years in which to complete assignments. Five students who had previously taken other modules qualified to enter the (follow-up) Master's programme (eight modules completed, with a suitably high average grade).

One aspect raised by Brown and Moffett is that of burnout — following John of the Cross, they term it "the dark night of the soul" (Brown & Moffett 1999 p. 125 ff.) — regarding *initiative overload* and *program proliferation*, resulting in cognitive disconnects and despair. "Giving up'" did occur. Some tutors have chosen not to present during the first term of 1999/2000 academic year. Despair however, was not a contributory factor in their decision; rather, it was the reality of undertaking a full-time teaching job and a part-time tutoring one as well. The challenge to bring about change and transformation in the education system remains with them. In the drive to meet the needs of the students, insufficient care may have been taken of the tutors, for example with regard to the provision of 'amulets' (which could be as simple as encouraging them to say 'no' to requests for more teaching!) to assist them in their roles. New structures are being explored.

6. Insight and Transformation: Arriving Where We Started and Knowing the Place for the First Time

The hero's outcome is the arrival transformed at the point of origin, but knowing and contributing to the place "in a new, more fully conscious way." We hope that, as for a hero, our experiences have equipped us, and our students, with "insight, wisdom, efficacy and commitment" (Brown & Moffett 1999 p. 146). It remains to investigate the extent to which this is the case.

Students were invited to submit an evaluation form, which explored their perceptions of the lecturer, the venue and the suitability of the content, at the end of a module. Of the evaluations received, comments were very positive regarding the teaching, content and timing of the modules; the negative comments related to the technical difficulties which plagued the first modules in particular. Unfortunately, however, the responses were too bland to support further analysis. In many ways, the assignments presented for assessment were more revealing regarding the quality of understanding and level of the attainment of the students. Overall, the quality

of assignments increased as lecturers learnt to modify the task set in the light of their experiences. Several of the assignments reached a high enough standard to support a proposal that they should be made available to other teachers on a website. Students' appreciation of the difficulties of maintaining heavily-used equipment to a high standard of functionality, especially in regard to web connections, grew during the period. Indeed, to the question "what other content should be taught?", a common answer was the skills to maintain a networked system in a school. This lies somewhat outside the scope initially envisaged for the modules, but it is being addressed in a parallel Master's degree programme introduced in Autumn 1999 as a joint initiative between the Education and Computer Science Departments (http://www.cs.tcd.ie/courses/mscitedu), and co-ordinated by the fourth author of this paper.

Further work is planned on assessment and on the development of new modules to reflect the ever-changing field, possibly incorporating the use of web-based discussions and video-conferencing to integrate more local expertise with that in the university and to support students when doing their assignments. It is hoped that the most interesting projects will be made available to other teachers through either the College's web page or the NCTE site, Scoilnet ("scoil" being the Irish for "school"). One possible indicator of success to date is that modules very similar in scope and content to the Trinity ones are now being developed by NCTE.

One conclusion that can be reached is that the programme, and of course those of other institutions, has resulted in the establishment of nuclei of educationalists, critical and analytical of the role and potential of IT in education in the curriculum, around many of the Education Centres around the country. This is in accordance with the purpose of the hero's journey. The legacy of the transformed heroic educator includes being able to approach change fearlessly, to take responsibility for our actions, to know the darker side, to be reinvigorated regarding their role in education and their teaching, to know that we need others and to share with others, and to be aware of the need for resiliency: that is, to take care of ourselves.

7. A New Call

A temptation in undertaking a journey may be to cling to ways that are traditional and comforting and in some respects that happened in the planning and initial presentations of the modules. However the desire to facilitate the type of professional development experience which genuinely impacts on classroom practice has led to a realization that what is necessary is not simply an upskilling exercise but a re-envisioning of teaching and learning and a consequent reculturation of students, tutors and university (Fullan 1999). Students have had to be prompted to go beyond the understandable desire for quick-fix solution and concrete applications for the classroom, and to reflect on the underlying models of learning. Tutors, as a necessary pre-requisite to dealing with the complexity of the teaching task, have had to develop collaborative skills such as peer-learning and team-teaching. The university has had to review its models of assessment to take account of the new media and different modes of presentation.

As the first cohort of IT students proceeds to study for Master's degrees and new groups come forward to take up the modules (established and new), the cycle starts afresh and there is a new Call. We hope that we are approaching the next cycle with more appreciation of the tasks involved, but with the same sense of excitement and hope that promoted the original enterprise.

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Classroom-based Technology Training for Inservice Teachers

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Abstract: An alternative technology training model for non-computer using inservice teachers provided teachers with classroom-based technology training. The training model included access to computers in the classroom as well as a technology mentor/support person for half a day each week. The teachers made significant progress in acquiring the technology skills to use computers and Internet resources for instruction in class. While highly successful for the teachers involved, the amount of resources required for this training model make it an unlikely training model for replication.

Background

Schools are acquiring computers and wiring for Internet access across the country. Along with the challenge of acquiring the equipment to make computers accessible as learning tools in the classroom, is the challenge of training veteran inservice teachers to integrate the new tools into their instruction. A common approach to providing inservice teachers with training is the "one-day workshop." Students are dismissed from classes and the teachers attend a workshop to learn computer skills. The content provided to teachers in these training workshops varies greatly, however, one consistent observation is that most of the workshop time is spent on learning the operating procedures for the computer without much time to focus on how to integrate the tools and resources into the curriculum. Additionally, learning procedures requires practice and rehearsal. The "one-day workshop" format does not provide the conditions necessary for this type of learning. Without opportunities for practice (or required practice), the teacher is not likely to remember the workshop content. Teachers are often frustrated by the low retention rate for the new skills from workshops in this format. Variables such as access to a computer following the training and the relevance of the training content to the teacher's curriculum are important factors in determining the retention rate of the workshop.

In an attempt to provide teachers with a more effective training format, a training model that focused on providing training weekly in the classroom setting was developed. The training model addressed many of the concerns or frustrations that teachers reported experiencing while trying to integrate technology into their instruction. To address the access issues, the model provided five student workstations, a software budget to purchase curriculum appropriate resources, Internet access, a color printer, a digital camera, a laptop computer for the teacher, a LCD projector, and a technology mentor/support person for half a day each week in their classroom for each teacher participating in the project. The goal of the project was to provide training, model the integration of technology tools into instructional strategies in the classroom and then have the project teachers share successful technology lessons with other teachers at their grade level or content area in the participating schools. The project targeted veteran, non-computer using teachers at four different elementary grade levels and four different core-curriculum areas. The project was funded by a grant from a state agency and was designed to run for two academic years.

Research Procedures

This case study research describes the experiences of eight inservice teachers who participated in a classroom-based, inservice, technology training model that was implemented for two years in four school districts in a mid-western state. Data was collected through a series of surveys and interviews during the two-year period of

the project. The surveys used a three point Likert scale with one being low and three being high to determine the value, comfort level or confidence level for the teacher responses. The project teachers responded to interview questions via e-mail throughout the two years of the project. All of the training provided focused on instructional uses for the technology tools as opposed to classroom management or personal skills such as grade book programs or e-mail. The technology mentor also provided troubleshooting and technical help for the classroom teacher. The technology mentor was also interviewed at the conclusion of each year of the project. The project teachers could also have one half day of release time a month to plan and work with the mentor outside of the classroom setting if desired. The teachers learned about the computers and Internet resources by using them for instruction rather than in workshop settings. The series of surveys were given to both the project teachers and the non-project teachers in the participating schools. The results were compared between the two groups of teachers to determine the effectiveness of the training model.

Findings

The project teachers reported increases in their personal technology skills such as confidence in using and understanding technology vocabulary. By the end of the two-year project, teachers increased their understanding of technology vocabulary from a mean of 1.5 to 2.1 on a three-point Likert scale. Their comfort level using technology vocabulary also increased from a mean score of 1.1 to 2 on the same scale. The project teachers increased their confidence level when using technology outside of the classroom from a mean score of 1.7 to 2.6 on the same scale. Likewise, the teachers reported a higher confidence level at a mean of 2.4 up from 1.3 when using technology in the classroom for student instruction. The number of classroom lessons using technology they taught also increased from a mean of 1.8 at the beginning of the project to 4.6 after the first year and declined to 2.8 the final year of the project. The project teachers also increased their confidence in troubleshooting skills and reported helping other teachers in their schools with technology questions or problems. When asked how many technology lessons they had the opportunity to observe being taught, the project teachers reported an increase from .4 to a high of 6.4 after the first year of the project.

The teachers reported an increase in the number of computer applications they used from 12 total applications at the beginning of the project to 39 total applications at the end of the project. Participants also revealed the importance of providing modeling and classroom management strategies for using the five student workstations. Teachers increased the different types of instructional strategies they used with the technology resources in the classroom. The eight project teachers reported using a total of 8 instructional strategies for using computers for instruction at the beginning of the project with an increase to 30 total strategies by the end of the project. The teachers were asked to rate the value of eight different strategies for learning technology skills. The teachers consistently rated "someone to show me how" as the most valuable form of technology training experience. Finally, the project teachers reported an increase from a mean of 1.8 to 2.5 for their comfort level with the classroom-based technology training. The rating for the value of having the mentor in the classroom while they learned how to teach a technology lesson increased from 2.1 to a high of 2.75 after year one. The mean scores for the project teachers increased in every category over the two-year project. The non-project teachers who were surveyed did not show any consistent growth except in the use of the Internet for information searches and many times the mean scores remained at the same level for all three rounds of the survey.

Conclusions

All of the project teachers made more progress in integrating technology tools and resources into their instruction than did the non-project teachers. However, given the fact that the project targeted non-computer using teachers, they should have reported gains of some degree regardless of the effectiveness of the model. Since the non-project teachers would have included teachers who were already using technology, the results of those surveys would not have shown as much growth during the two years of the project. Since the training was based on using the computers for instruction, the teachers learned technology skills required for integrating the tools into instruction. Lessons focused on instructional activities to meet curriculum objectives in addition to more typical student productivity projects.

The teachers were more inclined to plan and teach lessons that used the technology resources available in their classroom rather than using computer labs available in the school. The majority of project teachers had little

difficulty in producing weekly classroom lessons or activities for their students. Usually there is a period of personal productivity as the teacher practices the skills until they have a comfort level that allows them to use the computers for instruction. Most of the teachers seemed to successfully move past this stage, but two of the eight project teachers were often hesitant and did not initiate their own classroom lessons using technology. They relied more heavily on the technology mentor to generate and teach the lessons each week. Comments from the teacher interviews reinforced the importance of being able to watch technology lessons modeled in the classroom.

The difficulties the training model encountered were the amount of time required for the teachers to learn basic machine skills and the amount of technical support required. The rate at which the teachers progressed in their technology integration was varied among the participants and appeared to be related to the personality of the individual teacher. Most viewed the opportunity in a positive way and made significant progress. Teachers who had limited time to invest due to coaching responsibilities or who were closer to retirement did not make as much progress during the project as the other teachers. The teacher's perceptions of the training model varied from being viewed as an opportunity to an additional obligation once a week.

There were problems maintaining the computers in some of the classrooms. Five of the classrooms were Windows platform machines and three were Macintosh machines. The Macintosh machines were literally maintenance free and reliable during the project period. The teachers in these classrooms were able to plan lessons without the worry of technical glitches that might interrupt or ruin the lesson. However, the brand of Windows machines purchased for the classrooms were unstable and frequently required troubleshooting, technical support, and repair above the level of the teachers. All teachers were concerned about maintaining their classroom technology activities without continued technical support after the project ended. The lack of adequate technical support in instructional settings is critical to empowering teachers to integrate technology resources into their teaching.

Summary

While all teachers made significant progress in integrating technology tools into their instruction, the classroom-based training model is extremely resource intensive. It requires providing a "model" technology classroom with equipment as well as support personnel for the teachers. The resources required to replicate the model probably make it impractical to be implemented in most school districts. Continued evaluation of the role of the project teachers in their school should be followed to see if they continue to share their teaching strategies and skills to help other teachers in their schools move toward integrating technology tools into their instruction. If this activity takes place in the schools, then the dissemination value in sharing successful instructional strategies for using technology tools in the classroom might make it worth the investment in resources.

Transforming Teaching Practice with Technology: Incorporating ISTE Standards and Performance Assessment in a Constructivist Approach to Graduate Teacher Education

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Abstract: This paper analyses the importance of integrating appropriate technologies into graduate teacher education programs in an attempt to encourage the transformation of teaching practice into a form appropriate for the new millennium. It describes a site-based, graduate teacher education program based on a constructivist learning model. The importance of including in the program recognized technology standards; situated software training; technology based information management, problem solving and communication processes; and the integration of technology into the curriculum is stressed. The paper discusses technology training that assists graduate students to develop abilities to effectively conduct research using electronic information retrieval systems; to utilize technology to analyze, interpret and represent research data; to appropriately incorporate technology into classroom practice; and to utilize presentation software to communicate effectively with students, colleagues, parents and the public. Various types of performance assessments are discussed that require the demonstration of the inservice teacher's technology competencies.

Introduction

The use of computers and the Internet became a central feature of life in the final decade of the twentieth century. Schools saw a dramatic growth in the use of this technology from computerized grading systems to instructional games and simulations. Effective use of technology by teachers enhanced the teaching and learning process (Jonassen 1996; Kauchak & Eggen 1998). Educational technologies became an essential part of the instructional process (Teachers and Technology 1995) and helped teachers and students to restructure learning to a more meaningful, more individualized experience (Knapp & Glenn 1996). Many knowledge instruction classrooms have given way to knowledge construction classrooms in which technology plays a major role in assisting the teacher to engage and motivate the learner (Fisher, Dwyer & Yocam 1996; Kauchak & Eggen 1998).

Technology skills and knowledge empower not only teachers but also students in their educational endeavors. Technology has allowed a much more flexible, creative learning environment where students are able to pursue their individual interests through the exploration of real-life problems and issues (Knapp & Glenn 1996). Further, students' acquisition of technology skills and knowledge in the school setting provides a basis for their later success in the technology age of the 21st century.

Undergraduate students are now graduating from teacher education programs that integrate technology into the program curriculum. However, many inservice teachers completed their initial degree at a time when little or no technology was incorporated into the program. Of these teachers, many have had minimal inservice activities or taken few if any courses related to technology in education. It is therefore important for graduate teacher education programs to address the development and enhancement of teacher technology competencies.

Background

The need to increase inservice teachers' technology competencies was one issue considered five years ago when a site-based version of The Master of Education (M.Ed.) in Curriculum and Instruction was developed at Wichita State University. Created for classroom teachers and other educators with responsibilities for improving curriculum and instruction, this program was designed to develop dynamic, reflective practitioners capable of monitoring and improving their own practice through the application of educational theory and research. A crucial component of this new site-based program was the role played by information technology in the process of graduate student learning.

Now in the fifth year of operation, the site-based M.Ed. program has been made available to 15 different cohorts at 10 off-campus sites with 280 graduates as of the end of the Spring semester, 1999. Another 240 students are currently in the program with 119 scheduled to graduate by the end of Summer 2000. Master of Education students enroll in a two year core of 24 semester credit hours with a cohort of between 30 and 40 students.

Each site-based program is taught by three facilitators, one from the university, one from the host site and a third person from the field who complements the expertise of the other two facilitators. Throughout the program, a heavy emphasis is placed on reflection on practice and action research. Students work on a variety of classroom, school and district level projects to improve curriculum and instruction. Projects may be conducted by an individual, by small groups from the cohort, or by a collaborative group comprised of at least one M.Ed. Curriculum and Instruction student along with parents and colleagues such as teachers, principals, curriculum advisors, and school curriculum and instruction teams. Project topics, identified by the student, focus on appropriate ways to address needs, concerns and questions about one's own personal classroom practice, school organizational patterns and school-community issues.

This paper discusses one of these site-based M.Ed. programs situated at a sixth grade center. The school's library and adjacent 30 terminal computer lab is used for weekly class sessions and computer lab activities. The remainder of the paper, then, describes the approach taken at this site to integrate technology into the program.

Incorporating ISTE standards

There are six program goals with 29 program outcomes for the Master of Education in Curriculum and Instruction. The program goals state that graduates of the program should be able:

#1 to identify, analyze, and explain (a) successful curricular models and instructional strategies and explore the basis for their success, and (b) curricular and instructional problems impeding the improvement of learning and teaching in classrooms and schools, and propose sound solutions.

#2 to monitor, evaluate, and suggest means to improve instructional practice, including the evaluation of educational outcomes and programs.

#3 to assume responsibilities for the development, implementation, evaluation, and revision of curricula or programs of study in particular disciplines and/or for particular populations.

#4 to locate, evaluate, interpret, and apply appropriate research and scholarship to the study and solution of practical educational problems in curriculum and instruction.

#5 to plan and conduct action research, using sound theory and appropriate research designs, to investigate educational questions related to the improvement of curriculum and instruction.

#6 to demonstrate professional leadership skills and continued professional growth in curriculum and instruction.

To achieve the program goals, students are required to gain an understanding of technology concepts, operations, and applications; and the possibilities for the use of technology in the classroom. Additionally, students must develop and use a variety of technology skills to conduct research and give professional presentations to various audiences. The program uses the International Society for Technology in Education (ISTE) foundation standards to guide the development of the students' technology understandings and competencies. These standards include eighteen different technology standards classified into the three categories of a) basic computer/technology operations and concepts; b) personal and professional use of technology and c) application of technology in instruction.

Technology training in the program

Technology training begins in the first semester of the program with lab activities led by the instructional coordinator from the host district. During regular class time, students select labs that they feel are relevant for them, to learn to use e-mail, the Internet, Microsoft Word, Excel, Access, Powerpoint, and HyperStudio. These lab training opportunities continue throughout the two year core program in addition to individual tutoring sessions as needed.

Students also go on campus to be trained in conducting electronic searches. This training is led by library personnel at the Wichita State University main library. The following week after this training, another class period is spent in the library where students research a self-selected topic for a literature review project. It is expected that they will put into practice the skills gained in the previous week to use available electronic search resources. Students are further expected to complete electronic searches for other projects during the remainder of their M.Ed. program.

Technology and student research

After learning their way around an automated library system and gaining the skills of electronically accessing information, students research curriculum and instruction topics and issues relevant to their classroom practice. The use of software such as Microsoft Word, Excel, and Access, is also integrated into the students' action research projects. These software programs help students to analyze, organize and report the data they have collected. With them, students make tables and graphs that are used for poster presentations, in research papers, or in multimedia presentations that are developed to share research findings.

Technology and student communication processes

In between class meetings, students communicate via e-mail with course facilitators concerning course and program requirements; and with other students about projects being completed collaboratively. The usage of e-mail communication has increased dramatically over the last four years. In one of the first 1995 cohort groups , all of the students received e-mail addresses from WSU and were encouraged to use e-mail to communicate with the facilitators and each other. At that point roughly 20% of the students made use of it for program communication.

However, in the most recent cohort all but four of the forty students already had e-mail addresses before entering the program. E-mail is used on a regular basis to communicate general course and program information to all students. Additionally, almost half of the students already have utilized e-mail to communicate with one or more of the facilitators.

Integration of technology into curriculum and instruction

Technology is viewed by teachers as a viable method to enhance the learning and teaching in their classrooms (Kauchak & Eggen 1998). Teachers' action research projects focus largely on ways to better the education process for the students in their classrooms. Improving curriculum and instruction in any subject level at any grade level, often includes the integration of technology into existing curriculum (Knapp & Glenn 1996). Students conducted action research on technology topics such as using computer generated graphic organizers for reviewing and testing; creating a Web site for the school district and community; effectively using that one computer in the classroom; and using the Internet to benefit students' learning.

One teacher commented in her end-of-semester reflection paper that she had most enjoyed her action research that explored how technology impacts the mathematics classroom. She commented, " I integrated technology, to a certain extent, into my math classroom before I began my study. But I had never replaced an entire unit with an Internet project. What amazed me the most was how well students carried the concepts over into the next unit."

Another context in which technology can play an important role is when teachers have occasion to serve on school Quality Performance Assessment (QPA) or accreditation committees for their school. Students

in the M.Ed. program have utilized their acquired technology skills to construct PowerPoint or HyperStudio presentations for the final review process. They also create charts and diagrams to use as displays, as well as school brochures to distribute to the community, parents and the accreditation review panel.

Performance assessment of teacher technology competencies

Students are required to complete 3 projects in each of the four core semesters of the program. The presentation of all of these projects requires the use of various technologies, thus creating the context of performance assessment for every project.

Projects are reported in four different ways. Following the more traditional manner of presenting research, one project per semester is written as a paper. This requires the use of computer software such as Microsoft Word and Endnote to write and format the paper; and Excel and Access to organize data into graphs and tables for insertion into the paper.

A second way in which projects may be reported is through a poster presentation. Students again may use software to make graphs, tables, titles and labels for their poster. Some students use a digital camera to record events relevant to the project, and then print the photos to display on their poster. A requirement for the poster presentation is that a handout of some type with a summary of the information be available with the poster. This handout often takes the form of a brochure created with software such as Publisher98.

Students can also present their projects orally. Often, students use technology to create visual aides similar to what might be used in a poster presentation. Additionally, video clips, filmed and edited by the student, may be used to enhance an oral presentation.

Finally, at least one multi-media presentation of a project is required during the four semesters of the program core. This requirement is usually completed during the third or fourth semester when students have acquired advanced technology skills.

A grading rubric has been developed by the site facilitators for technology presentations. The rubric shown in Figure 1 delineates for students the competencies required to gain a satisfactory rating for the presentation. A student's ability to successfully complete a technology presentation is based to a large degree on the student's attainment of the competencies set out in the ISTE teacher technology standards.

Conventional Standards for Technology Presentations	Rating scale (Circle one)
- True multi-media, two or more types of media in the presentation - Used the Internet as a resource and credited the information used appropriately. - Presentation complements but does not distract from the main idea or theme. (e.g. sound, graphics, video, etc.) - Presentation layout is visible to all audience members - Organizational skills are apparent in the planning for the final presentation (e.g. storyboards, etc.)	4 - Creates a product that exceeds conventional standards. 3 - Creates a product that clearly meets conventional standards. 2 - Creates a product that does not meet one or two of the conventional standards. 1 - Creates a product that does not address a majority of the conventional standards.

Figure 1 A rubric designed by program facilitators to assess student technology presentations.

Student insights into technology training and application

Evidence of the successful integration of technology into program structure has been evident from student reflections written at the end of each semester. Many of the students describe the initial self-doubts they had concerning their ability to become technology-literate. However, technology training sessions, individualized tutoring, and the completion of projects requiring the application of technology skills empowered the graduate

students with technology. Comments like the following testify to the fact that the program component of ongoing technology training and application greatly enhanced the students' competencies and positive attitudes concerning the use of technology for their professional development as well as in their classrooms.

"I enjoyed the library research this semester immensely. I have implemented several ideas in my daily classroom schedule that were discovered in the articles...My students gained quite a bit from my library research - whether they wanted to or not...The time spent learning about the various computer programs was extremely beneficial...I feel much better about the technology presentation we will be doing next semester." Renee

"Another exciting project I worked on this semester was a PowerPoint presentation. After taking all the computer classes last semester I was able to easily present my project findings to the class." Felicia

"Over the past two years, I have gained many important technology skills that have proved useful to me in this program and in my classroom too." Thomas

"With the presentation of my research using PowerPoint..., I provided professional leadership and continued my personal professional growth." Barbara

"Learning to use the computer system at WSU, ERIC and LUIS were important first steps in completing our first literature review... At first using WSU's library seemed like torture!! But now I feel much more confident about being able to walk in and access the information I need to research a topic." Evelyn

Summary

This paper discussed how one Master of Education program successfully incorporated learning experiences to advance inservice teachers' acquisition of technology knowledge and skills identified in the ISTE foundation standards. It explained how lab activities and university training sessions are used for group as well as individual technology knowledge and skills tutoring. It also discussed the various types of performance assessment, required as part of the coursework that provides a venue for the students to demonstrate these competencies.

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Computer Technology in Foreign Language Teacher Training

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ABSTRACT: The rapid changes in language learning involving technology of the last decade are having a great impact upon efforts at supporting up-to-date teacher training for language instruction. Due to tremendous advances in Multimedia-Based Content (MBC) and Technology-Enhanced Language Learning (TELL), especially those involving the World Wide Web (WWW), learners of foreign and second languages are pursuing self-paced, interactive study in the context of formal instruction. This paper presents background information, outlines important developments, and discusses problematic issues in language learning technology as they have an impact on teacher training.

INTRODUCTION

Owing to the extremely rapid, widespread deployment of computer technology in such a relatively short time, there have been few publications to date which discuss the changes necessary in teacher training programs due to this remarkable transformation. The references presented in this paper do show that the current research on technology in language pedagogy is enlivened by the creativity of individual practitioners, who then reflect upon their use of MBC and TELL. This paper builds on the two most recent and valuable contributions by Kassen & Higgins (1997) and Scott (1998). The ideas offered here are the synthesis of practice and reflection, which itself is a key component to training teachers to effectively use technology. Reflection on practices improves them (Kassen & Higgins, 1997). Kramsch & Andersen (1999) put the challenge of MBC in perspective by emphazing that MBC requires even more mediation and interpretation by the instructor to facilitate student understanding. The very important process of mediation means that the role of the teacher in instruction is not endangered by the rapid deployment of MBC, but rather, that the need for the teacher to effectively mediate learning materials is even greater with MBC.

Language learners of today – both in the environment of traditional instruction and by independent efforts – are increasingly computer literate. Two labels accurately fit this audience: they are visually literate and entertainment-oriented. This generation is capable of working well with MBC and in a TELL environment, but also demands much of the materials, in terms of graphic user interface (GUI), help functions and navigational ease, and of the instructor mediating them (Gölz, 1999). Although CALL materials have existed since the 1960's (Levy, 1997), the tremendous leap to multimedia and internet-based resources is having a greater impact. An expanding amount of interactive materials on the WWW, MBC on CD-ROM or DVD, and exciting TELL options, are transforming the ability to learn a foreign or second language effectively (Bush, 1997). Because today's language learners are so technologically sophisticated, they respond to materials and methods that give sensory stimulation and genuine feedback.

Growing from a basis in CALL, recent MBC and TELL materials, including resources in the WWW, will continue to transform the role of teacher and empower interactive, learner-centered language learning. While the practical advantages of MBC and TELL lie both in the presentation of culturally rich materials and in interactive feedback, the next generation of teachers needs to find adequate means of acquiring technological knowledge and skills, within specific language training programs leading to teacher certification or graduate language programs, in order to work most effectively with students. This discussion assumes that the current task-based instructional paradigm, which seeks meaningful contexts for speech acts, to be a viable theoretical basis for language learning (Savignon, 1983; Hadley, 1993).

One ever-present question is the appropriate starting point for this discussion: are the new technological options really necessary for students to learn in the most pedagogically effective manner? In

one well documented case, students using a multimedia computer-assisted language learning system (MCALL) at the Universiti Malaysia Sarawak, with absolutely no instructor help, earned significantly higher TOEFL scores, at a reduced cost to the institution, than students who were in conventional, instructor-led classes (Soo & Ngeow, 1998). Although the results of teacher-mediated MBC are still dramatically challenged by some scholars (Roche, 1999), the effectiveness and enjoyment of MBC involving an instructor in the language learning process is claimed by both students and teachers in many surveys and studies (Bush, 1997). The best argument for implementing MBC and TELL lies in its unique strengths.

THE STRENGTHS AND CHALLENGES OF MBC AND TELL

The strengths of MBC are that sound, still image, video and hypertext are superior to a course based on a textbook, because the learner has the visual and aural input of real speech in a context (Pennington, 1996; Levy, 1997). The use of interactive exercises in a TELL setting, which give better, immediate feedback based on the learner's answers, is also superior to the completion of material which must be evaluated later. Self-paced learning with MBC and TELL, within the successful task-based instructional paradigm involving interaction with an instructor and other students, has become an effective course format. Examples of beginner-level MBC materials include video clips of dialogs and interviews, which a learner can use repeatedly, and often have many "help" features that explain the language the learner sees, hears and reads. Such features can be specific lexical items, such as providing an accurate translation for the given context, grammatical explanations, such as noting the use of the subjunctive form of a verb, or contextual notes, such as explaining that the use of a given slang term is perhaps only appropriate with friends or family. This pattern of repetition, combined with meaningful help on demand, is extremely effective in improving listening ability (Joiner, 1997). Examples of effective cultural resources include hypertexts illustrating the unique traditions and values in a given culture, as well as biographical and historical materials. The material which governments, organizations and businesses place in the WWW can also be adapted for language learning (Green, 1997; Glatz, 1998, Walz, 1998).

Multimedia materials are especially helpful with intermediate level learners, because progress at the level beyond beginner seems slow and student frustration is often high. Hypertext for intermediate level learners is a dramatic advancement, because it allows learners to hear passages, to see the related images and to use the extensive help features. The result of hypertext usage is rapid acquisition of vocabulary (Chun & Plass, 1996) and an improved ability to read (Martinez-Lage, 1997). Reading is an important vocabulary builder (Roche, 1999) and greatly accelerates the ability to comprehend speech, a factor in communicative competence. The entertaining aspect of multimedia is also motivating for learners. Both group – shared learning – and independent individual learning are options with hypertexts.

MBC learning experiences are culturally rich, visually oriented and less frustrating than the traditional, textbook-based instruction. The positive results of MBC materials include an increased ease of oral comprehension and reading ability, an emphasis on speaking in context, as modeled for example in video clips, and grammatical information integrated into the useful passages presented as hypertext. The use of MBC also lends itself to cooperative learning. Concentrated work on specific vocabulary, with which students have difficulty, is possible. The greatest benefit is in the use of better, immediate feedback in TELL, which helps to maintain continued interest in learning. Learners who use MBC and TELL materials are truly a new generation.The new MBC and TELL instructional options challenge students and instructors with many exciting, difficult and unresolved issues involved in converting traditional pedagogical methodology to effective practices mediated by computer technology. These issues relate to two areas of language instruction: (1) presenting of course content to the learner, (2) enhancing each individual's learning processes with feedback. New teachers must become aware of the MBC and TELL materials available for their given language of instruction and **fluent in their practical use.**

EVALUATING MBC AND TELL MATERIALS

The challenges of implementing MBC and TELL materials must be preceded by active involvement in exploring and evaluating MBC and TELL materials, both in regard to technical and to

pedagogical concerns (Kassen & Higgins, 1997; Scott, 1998). Such questions as to whether the given materials are able to account for diverse learning styles, or offer an array of "help" options, or have a range of level-appropriate scenes or exercises, must be given equal weight with questions as to whether the graphic user interface (GUI) is logical and inviting or whether the video clips can be effectively interrupted and repeated (Plass, 1998). In the process of learning to evaluate MBC and TELL materials, students training to be instructors attain the necessary level of technical comfort with computer operation. Knowing whether a program or a computer is not functioning correctly can be very important, especially if the number of computers or the time for student use is limited.

A teacher training model suggested by Kassen & Higgins (1997), which they label the Language Learning Technology (LLT) module, stresses that learning to teach with MBC and TELL materials involves five distinct phases: preparation, familiarization, exploration, integration and synthesis. Underlying each phase is the important opportunity for reflection on theory and practice, yielding both knowledge and skill. The end result is technological options integrated into the learning experience for students, from which the instructor can better evaluate other MBC and TELL materials for possible selection. Scott (1998) emphasizes that graduate teaching assistants (TAs) would do well to relate the technological capability of MBC or TELL materials to underlying pedagogical theories. Scott correctly views three basic learning modes, the sequential, the relational, and the creative, for each of which different materials are designed. It is also recommended that teachers in training develop research skills for studying how students react to MBC and TELL and their performance with various learning environments. Such inquiry is still quite unevolved, but will influence the development of future MBC and TELL materials (Chapelle, 1998). Scott's analysis compliments the ideas of Klassen & Higgins, also finding that the need for reflection in adopting technology to be crucial. The following points are meant to focus on those pedagogical concerns which future teachers confront in both evaluating and implementing MBC and TELL materials, followed by the more difficult area of creating such materials. Each area not only involves a keen concern with the *how* of technological options. It should be emphasized that teachers must also reflect on the *what* and *why* of the materials in a learning environment (Tedick & Walker, 1995).

MEDIATING THE SOCIAL CONTEXT OF MBC

The need for students being trained to teach a foreign or second language to understand the problematic creation and implementation of multimedia is extremely important (Kramsch & Andersen, 1999). Because MBC is itself a mediated social context for language learning, altered and interpreted by the attempt to depict language usage, the crucial role of the teacher to explain and amplify the full cultural background of the material is not diminished, but increased. Although MBC is a much more improved starting point for productive classroom interaction than textbooks, it offers much more detailed material to the student and can therefore be overwhelming. The student enters into an exploratory mode of learning which must be mediated by the instructor for full understanding. Practical examples of successfully mediating the social context of MBC include: (1) interpreting the appearance and actions of people, (2) interpreting the patterns of interaction between people, (3) interpreting locations and living spaces, and (4) interpreting important objects. Meditation of these four aspects contributes to the acquisition of information in order to compare and contrast both the cultural and socio-economic background of the MBC with that of the individual learners. What may be depicted as common or ordinary, special or unusual, must be explored for its contextual background ***and*** language usage. Understanding the language used by the people in the given MBC, while the primary goal of the learner, is but one part of the material. The language is made living, but subject to even greater scrutiny. The competent teacher learns how to use the entire offering for positive learning by exploring with students all the nonverbal material that MBC provides. In focusing then on language usage, which is best understood in terms of this larger contextual background (Frommer, 1998), the teacher has mediated this material and related it to the specific language used.

THE ROLE OF INDIVIDUAL LEARNING STYLES AND COOPERATIVE LEARNING

The nature of an individual student's reaction to any learning environment reflects their unique and often complex motivation and personality, and the fit between classroom dynamics and the individual

student's learning style can influence language acquisition (Meunier, 1998). While learning style preferences vary and reflect personality differences, MBC and TELL materials are actually a means to bridge the learning style preferences of various learners in a class. An instructor using MBC and TELL materials can balance activities that involve linear and concrete thought processes with those that are more interpretative and open-ended.

Although the use of TELL materials is at times more problematic, as the nature of the given interactive exercise and feedback may not fit well with an individual's learning style, the key to effective use of MBC and TELL materials is to assume that any given computer activity is only one of many learning tools in working toward a specific goal. Some learners will indeed find TELL in general more effective for them than others, just as some learners will respond more positively to a certain type of TELL activity than another (Levy, 1997). Practical examples of successfully accommodating individual learning styles include: (1) stressing target vocabulary items by means of activities involving all four skills, (2) supplementing difficult grammatical points with additional oral practice, and (3) introducing tasks which involve negotiating meaning, bridge information gaps, and have many possible means of completion or allow creative answers. The challenge of MBC and TELL materials for the instructor is not so different from that of traditional methodology: to be able to monitor student progress toward language acquisition and provide additional material or activities when necessary.

The practical implementation of MBC and TELL provides rich opportunities for cooperative learning, whereby students work as partners or in small groups on tasks involving not only listening and reading, but also speaking and writing (Beauvois, 1998). The product of such work can then be taken up in classroom activities. Approaching MBC as a learning environment for students in isolation, alone at a workstation, fails to play to its strength as an engaging and entertaining medium, which allows productive partner and group activities that help all participants. Partners and groups, separated geographically, could in fact meet solely in the context of the same cyberspace learning environment (Hoven, 1999).

Beyond the real world limitation of perhaps not having enough workstations for each learner, which could then be made into an advantage, the use of cooperative learning strategies reinforces the mediated nature of MBC, owing to the interpretative nature of video clips and images. Practical examples of successful cooperative learning strategies include the following: (1) adopting techniques from the use of video in the classroom, such as previewing activities and description activities of images or video clips without sound, (2) basing role-play activities in small groups on the given situations introduced in MBC, and (3) adapting dialogs and interviews presented in MBC for team writing assignments. Many assignments for individual completion can be the basis of cooperative learning activities. The dynamic contexts of MBC naturally provide excellent material for subsequent class discussions.

CREATING MBC AND TELL MATERIALS

Few instructors or creators of multimedia have the personal experience of extensive language learning in such interactive, visual environments which are now available. Many teachers have also never been trained to evaluate and implement MBC and TELL materials. There is still, in general, a lack of institutional support for such training. The perception that authoring software is very difficult also remains a stumbling block. Multimedia is often not integrated into the curriculum and outcomes, but fulfills a supplemental role. Although rapid changes in hardware and software do occur, the stability of the WWW is a bright spot for development efforts. Digitizing existing materials (pictures, slides, music, texts, etc.) for use as language learning resources on the WWW, especially on cultural topics, has been a realistic goal for many instructors and programs, although substantial efforts do require the use of an advanced relational database (Pusack & Otto, 1997). The effort at creating cultural resources on-line, and directing learners to authentic materials on the WWW, is already highly developed (Green, 1998; Glatz, 1998; Walz, 1998). The creation of more comprehensive multimedia materials, with advanced interactive exercises giving useful feedback, is an on-going challenge. The need for future teachers to learn to be fluent in the creation of MBC and TELL materials can be best addressed in a course format which combines students with a technical background with language students. A good introduction to the process of design grows from evaluating MBC and TELL materials and should continue by offering practical experience in placing materials on the WWW. The ingredients for success would be an emphasis on incorporating various learning styles into the group projects and designing projects of an appropriate scope.

SUMMARY

The need for more MBC directed at target audiences based on age, level of instruction, and incorporating diverse learning styles, is crucial. The need exists for detailed analysis of learning patterns in order to improve materials (Chapelle, 1997). Because the need for language learning is strong in the highly mobile, communication-oriented world of the Information Age, and the important advancements in multimedia resources and technology suitable for language learning are greatly helping to meet the challenging requirements of language learners, the teachers of the future must master the technological palette available. While the need for students being trained to teach a foreign or second language to understand the problematic creation and implementation of MBC and TELL is extremely important, technology will not endanger the role of teacher. Empowering interactive, learner-centered language learning brings even greater challenges, but also greater rewards. New teachers, fluent in the materials available for their given language of instruction and in their practical use, will not simply passively implement commercially packaged content and interactive exercises. Well-trained teachers, who understand the theory and practice of mediating the social context of multimedia, the role of individual learning styles and cooperative learning, and the basics of creating their own content and interactive exercises, will be able to meet the challenges of technologically sophisticated learners. While the practical advantages of MBC and TELL lie both in the presentation of culturally rich materials and in interactive feedback, the next generation of teachers must critically adapt these technological options to the needs of their specific language program.

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Implementing The Virtual Campus Learning Community for Teacher Education at George Fox University

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Abstract: The George Fox University Virtual Campus Learning Community (VCLC) is an internet environment designed on-site by professors to serve adult distance education students in professional programs. The VCLC is a grass-roots alternative to traditionally designed on-line course delivery systems. Internet course delivery systems are often conceived and implemented institutionally, driven by administrative goals of greater control, uniformity, and cost efficiency. VCLC is instead conceived and implemented "in house", directly accountable to the needs of teachers, students, and other stakeholders. This paper will describe the rationale for undertaking grass-roots on-line course development, followed by a description of the VCLC's technological and pedagogical framework. VCLC is more cost effective, and and is better suited to needs of our professors and students than commercially available systems. The paper concludes with a narrative history describing the VCLC implementation to date, including "lessons learned" and recommendations for those considering grass-roots on-line course development.

The Education Department at George Fox University delivered web-based instruction for two years using "George Fox Online University," a web course system designed by an external vendor and implemented by institutional initiative. The on-line system was plagued by high cost, required high-end user hardware and software, and designed and implemented with administrative needs in mind. Most crucially, however, the on-line system created dependency on a rigid, centralized technology structure, frustrating and disempowering faculty members and students. These factors combined to create an intractable situation for professors in our department committed to meeting the needs of professionals studying at a distance.

VCLC is an alternative model developed by George Fox University Education Department professors on-site. VCLC is relatively low-cost, uses "mid-range," widely accessible software and hardware and is structured specifically to meet the needs of adult professional programs. It also enables professors to independently and creatively implement web-based tools which facilitate and support teaching and learning, communication, service activities and scholarship.

VCLC implementation began in Spring 1999 and has progressed gradually to include 6 professors teaching 12 web-based courses with approximately 120 students. The cost of development (about $5,000) has been absorbed by regular department budgets and a small community development grant. Training of professors has consisted of mentoring relationships with peers, combined with a once-weekly short meeting to share concerns, questions, and experiences. VCLC is continuously being evaluated and modified by the stakeholders whom it is designed to serve. While VCLC implementation has not been free of difficulties, the heightened ownership inherent in our "grass-roots" approach to development has effectively empowered our department to use the internet for quality teaching and learning.

Exploring a Blind Alley: Lessons Learned

In 1996 George Fox University undertook serious study of the potential benefits of using the internet to deliver distance education. The initiative, "George Fox Online University," (GFOU) was conceived by top administrators as a efficient way to generate tremendous financial revenue for the university. Despite a faculty study group recommendation, based on the experiences of other institutions, that on-line course delivery does not provide significant financial gain, university administration pushed the plan forward. Rather than using on-site technical personnel to develop an on-line system, programming and hardware support was outsourced to an external vendor, isolating professors and students from the process of system design. By 1997 $250,000 had been invested in the On-Line University, with a commitment to about $400,000 more over the next several years.

In mid-1999, GFOU was discontinued after a substantial investment. A case study (Ankeny, et al, 1999) describing the rise and fall of GFOU lists several factors contributing to its failure:

- The financial estimates were based on marketing the system to undergraduate students (the largest population), not graduate and adult students as suggested by professors. Enrollment figures indicated that cost-effectiveness was only realized where the system was used to deliver graduate courses.
- Administrators mistakenly believed the GFOU would be a more efficient method of delivering instruction. In fact, it was less efficient for faculty, in that they needed to devote more time to online teaching than in face-to-face classes due to the interactive nature of the medium.
- The impact of disempowering faculty and students by outsourcing the technical design and implementation on the GFOU was underestimated drastically. The result was a system whose design and functionality failed to match the needs of students and faculty, and was intractable to change. As described in the case study (Ankeny, et al, 1999),

  > "[the system designer] seemed to be enamored with technology and didn't clearly understand how faculty taught. He thought the conversion of normal courses to online courses simply involved turning materials over to technicians who would then scan them into a digital format." (Ankeny, et al, 1999).

- The culture of dependency created by the top-down nature of the GFOU made it impossible for professors to actively participate the creative use of technology:

  > "Now that [faculty member's] pages were built, he ran into his first major institutional roadblock: getting access to a web server. This was where the collision of ideologies about institutional approaches first came clear to [faculty member]. He was told that only administrators had accounts on the (singular) web server. Further, he was told that since these pages were accessible to the world, every page had to be reviewed for content and appearance by one particular administrator in the institution... Her office was clearly a bottleneck in the institution" (Ankeny, et al, 1999).

After, the GFOU was discontinued, it became the responsibility of individual departments and units on campus to implement on-line course delivery as desired/needed. For the Department of Teacher Education, implementation was not a question; it was absolutely necessary in order to meet the needs of many students enrolled in programs at a distance. Can a department with limited technical means develop its own on-line course delivery system? What follows is an account of the process of our department went through to develop its own "skunkworks" for delivering distance education on-line.

Grass-roots Design and Implementation: Building a Skunkworks

After the demise of GFOU, the George Fox University Department of Teacher Education was left to its own devices to continue serving students at a distance. The department was afforded a unique opportunity to design and implement a system based on educational objectives and needs as seen by faculty, students, and administrators working together as a team. The model for planning and development has proceeded organically, a product of the input of shared voices and concerns. On-going development of the Virtual Learning Community (VLC) has led not

only to empowerment of department professors, but a shared sense of mission for all stakeholders. This process was referred to by a colleague as the building of a "skunkworks," a reference to its "learn-as-we-go," unofficial formula for action.

Laying The Foundation

A key consideration in the design and implementation of the distance education delivery system is an assessment of the needs and characteristics of faculty and students. It is important to determine the educational objectives of the teacher and learners and the teacher's basic assumptions about the learning process prior to the development of the delivery system. As Chang (1998) pointed out, technology must be consistent with the existing values of faculty members. Faculty members must see that there is real educational value in the use of technology, not that a technological system exists for the sake of technology alone. This section presents the rationale for accepting faculty input as a key step in the distance education implementation process. In addition, student-centered learning will be examined, as well as features desired by faculty in the distance delivery system.

Meeting Faculty Needs

While much has been made over the last several years about the need for distance education development to be a team effort, the faculty member is key to the success of the distance education program. In fact, as noted by Parisot (1997):

> Faculty are crucial to implementation of any new technological change. However, little has been done to understand the changing role of faculty in adapting to technology and the changes in the psychological and physical environment promised by distance learning. Therefore, a more thorough understanding of the faculty experience in the distance learning environment is important to the formulation of institutional policies designed to guide the diffusion of distance learning into the teaching process (p. 1).

Policies related to the marketing and delivery of distance education programs must take into consideration the needs and characteristics of the potential teachers. Institutional desire to implement distance education often centers on concerns of finance and competitive advantage (see Levin, 1998; and Lawton and Bonhomme, 1998). A typical approach for an institution in implementing a technological innovation is to purchase a "system" and make it available for those that want to try it out. Faculty members may or may not be involved with identifying features and functions of a system that they would like to have to enhance the teaching/learning process. "Unfortunately, many academic institutions are swayed by the bells and whistles embedded in a fancy software package and do not consider what the learner can receive and handle as part of the learning process" (Palloff and Pratt, 1999, p. 63).

When faculty members have had the opportunity to describe important considerations in the functioning of distance learning delivery systems, the technological details are not cited as the primary concern. Needs and objectives of the participants are often the decisive factors for faculty members. Factors considered key for faculty members preparing to teach at a distance include: a) an ability to adapt teaching styles and methods (Lawton and Bonhomme, 1998: Chang, 1997), b) a working knowledge of the technology used to deliver the distance education program (Miller and Carr, 1997; Parisot 1997), and c) skill at facilitating learning (Knowles, 1993).

Faculty members need to be prepared and supported in the distance learning experience. What works in a classroom environment does not necessarily work in an electronic teaching environment. Having an appropriate virtual environment to work in is a key part of that preparation and support. There are a number of considerations in building an online teaching space. Faculty members seek technology that supports teaching and learning. Palloff and Pratt (1999) described elements of effective courseware for distance learning. An effective delivery system is functional, simple to operate for teacher and student, and user friendly. These characteristics speak to a transparency for the courseware that allows for the participants to create content, interact, move in and out of the learning space and troubleshoot problems unhindered by the technical system.

In addition to functional courseware, faculty seek opportunities and support in professional development related to distance education and resources appropriate for supporting their efforts at teaching in the distance environment. Support for teaching not only includes technical support, but support related to accomplishing their educational objectives in a new environment.

The Need for Student-Centered Teaching and Learning

Distance education researchers (e.g. Lawton and Bonhomme, 1998; Chang, 1998; and Harasim, et al., 1995) have pointed out that a traditional pedagogical model of teaching and learning is not well supported in a web-based learning environment. Internet-based distance learning seems to be supportive of a particular framework for education, one that features a student-centered approach. This section examines foundations for student-centered teaching and learning in the virtual environment.

Smallen, (quoted in Van Dusen, 1997) described the ideal learning environment. This environment contains subject engagement and interaction. Interaction is defined as, "consistent opportunities for students to interact with other students and the instructor, to test their own ideas and to learn from the ideas of others" (p. 15). While Van Dusen stated that learner-content interaction can be enhanced in internet based teaching, due to the variety of ways content can be conveyed, learner-learner and learner-teacher interactions are problematic. However, other distance educators (e.g. Machanic, 1998; Riegle, 1996) pointed to the possibilities of building *strong interaction* with students in internet-based courses.

Strong interaction leads to new possibilities for learning. Parisot (1997) pointed to a unique aspect of distance education. Distance education tends to democratize the educational experience. The web-based distance education program seems to operate best when the teacher assumes the role of a facilitator of the learning experience, as opposed to being an authority who transmits knowledge to the student. This creates a number of questions for the teacher and the delivery system. Are faculty members ready to give up a traditional transmission and control mode of instruction? Are faculty ready to abandon the traditional pedagogical model and adopt a different mindset, that of the facilitator? If, as Knowles (1993) suggested, the students' ability to take responsibility for their own learning is an important variable for success, than the teacher's ability to release that responsibility to students is also very important.

From Pedagogy to Andragogy

Although a number of models of teaching and learning could be considered in preparing distance education programs, adult education theory is especially important to consider. Knowles (1993) is noted as the developer of the *andragogical model* of adult learning. The assumptions of this model are that the learner is increasingly self-directed, the learner's experience is a resource for learning of self and others, readiness to learn comes from life tasks and problems, problem-centered approaches have the most meaning, and motivation for learning is internal. Knowles stated that the most important variable to be considered in working in the andragogical model of education is the level of the learner's skill in taking responsibility for his or her own learning.

Building on the assumptions of andragogy are process elements that describe the procedures involved with delivering educational experiences. Table 1 describes the process elements of a course and a description of that element in the usual pedagogical contrasted with the assumptions in the andragogical model.

Process Element	**Pedagogy**	**Andragogy**
Climate	Top-down	Collaborative, trusting, supportive
Planning	Teacher driven	Mutual planning by teacher and students
Needs Assessment	Teacher prescribed	Mutual assessment
Setting of Objectives	Fixed	Negotiated
Learning Plans	Uniform	Contracts, projects
Learning activities	Objective	Inquiry projects, independent study
Evaluation	Normative	Criterion referenced, expert and peer validation

Table 1: Description of elements in the andragogical model.

Considerations of these process elements should help in making decisions regarding the delivery system for distance education. If the assumptions of the andragogical model are accepted, then faculty members would seek a delivery system that would foster an environment of trust and mutual support. The system would allow for flexibility and joint control on the part of the faculty members and students. The system would allow for easy access and ongoing interaction.

When viewing internet-based distance education as an opportunity for developing a student centered approach, faculty members' assumptions about the learner and the teaching learning process lead to particular types of activities and an ongoing interaction among the participants. The delivery system must allow for the functions and processes desired by faculty and students.

Raising The Walls

The VLC's goal is to empower, giving maximum freedom for both students and professors to create their own teaching and learning environments on-line. To accomplish this, the department faculty as a whole worked to develop a flexible course template, in which the needs of technological beginners would be met, along with allowing expert users to use the space in creative ways.

The VLC Shell

At the core of VLC are CGI scripts that professors use to create a hollow course "shell," or template. The VLC "shell" can be recreated independently by faculty members, who are then able to configure their own virtual classroom using the shell's functions. In some respects creating a VLC course resembles an old-fashioned barn-raising. The community provides the energy and work to erect a functional, but empty, course-space. It is up to the professor and his/her students to create within this hollow shell a functioning learning community based on the needs, talents, and desires of the group.

VLC Functions

The VLC supports features that map strongly to many of the assumptions and elements of the andragogic model, as well as meeting many of the previously cited faculty needs (Table 2).

VLC Function	Element(s) or Assumption(s) Supported
Asynchronous Access	• Subject engagement on the student's own terms
Idea Container: Professor-configured Message Boards	• Development of supportive collaboration and interaction • Adaptive to unique teaching styles and methods • Course Interactivity • Peer validation
Webliography: Dynamic, annotated link library that students and professors can build independently	• Student initiated learning • Democratization of the learning environment • Peer validation
Learning Journal: Private discussion space accessible only to professor and individual student	• Supportive communication and availability • Mutual assessment • Negotiated setting of objectives

Table 2: Mapping VLC Functions to Andragogy

Living in the VLC

In Fall 1999, four members of our department including one off-campus adjunct faculty member taught courses involving nearly 100 students using the VLC framework. A short weekly meeting was held to provide an opportunity to share concerns about current courses and to suggest changes for "VLC 2.0," the next iteration of the system. The total cost so far, absorbed by standing department budgets, has been less than $5,000. One faculty member summarized the difference between VLC and its predecessor GFOU:

"The Online University System had functions I found to be attractive, but it was a closed system. What I mean by closed is that I could not alter the appearance or functions of the system. I had to alter my goals or activities to fit the existing structure. The system was also closed in the sense that any suggestions I had for altering the system had to have the approval of administrators and technical consultants who advised me on the unavailability of programmers or the high cost of altering the system to address my concerns. The system was difficult to navigate in and didn't coordinate well with other software that I wanted to use. What I have found with the current VLC is that I have immediate access to the technical consultant, one of my faculty colleagues, who can either change the system to suit my needs, or instructs me in how I can make changes myself. The system allows for easy creation of content files and interactive space. We regularly meet to address concerns and make changes. I feel like I am a co-owner of this space, whereas with the previous system I felt like I was a sharecropper who was subject to the owner's mercy for addressing my concerns." (Professor Interview, 11/99)

Ironically, the VLC system is very comparable technologically to GFOU, utilizing many of the same programming tools and functions. The key distinction between VLC and GFOU is instead one of politics and flexibility. VLC professors enjoy being *sharers* and *leaders* in the development process, able to take creative initiative in developing and teaching their on-line courses, as well as contributing to the ongoing development of the larger system. Politics, unexpectedly, may be the crucial design factor in developing and implementing internet course delivery technology.

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Active Learning Environments Prepare Teachers for Technology

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Abstract: The Technology Assistance Program (TAP) of the Southwest Educational Development Laboratory (SEDL) is currently involved with the *Applying Technology to Restructuring and Learning* project that involves 150 teachers in six site schools located in SEDL's five state region. The primary purpose of this study is to document how teachers and their teaching practices change as they integrate technology into their classroom. Another important part of this project is the design, development, and implementation of staff development sessions that model constructivist learning environments supported by technology. This paper will describe the development issues that faced the TAP Team when designing these professional development sessions, some of instructional strategies used in the sessions, various classroom management models, and the effectiveness of the professional development for helping teachers successfully integrate technology into their classrooms.

Introduction

Utilizing technology in teaching and enabling students to implement technology in their learning are two of the greatest challenges in today's classroom. Consequently, professional development for in-service teachers is one of our nation's top priorities — especially professional development that emphasizes the effective integration of technology into the curriculum. Current research shows that technology curriculum-integration rather than technology skills training should be the primary focus of technology-centered staff development. Instruction should focus on and illustrate how technology can support educational objectives via instructional environments such as collaborative problem solving and cooperative learning activities. And most importantly, activities should be designed that engage teachers both intellectually and professionally. (Brand 1998).

A recent national survey of teacher's use of digital content (Education Week, 1999) shows that "curriculum-integration" training seems to have a greater impact on teachers than "basic technology skills" training. Results of this study show that twenty five percent of teachers who had only basic technology skills training within the past year say they rely on digital content to a "moderate" or "very great" extent for instruction, the same percentage as among teachers who had no training at all. However, for those teachers who had only curriculum-integration training, the number of teachers who use technology for instruction increases to thirty seven percent. Fifty one percent of teachers who had eleven hours or more of basic technology skills training within the past year say they feel "much better" prepared to use technology than they did twelve months ago. However, sixty five percent of teachers who received eleven hours or more of curriculum-integration training say they feel "much better" prepared to use technology than they did twelve months ago. In practice, however, the average teacher receives less curriculum-integration training than basic technology skills training. Overall, some forty two percent of teachers had six or more hours of basic technology skills training within the past year, compared with just twenty nine percent of teachers with six or more hours of curriculum-integration training.

An analysis of most technology training curriculums for classroom teachers reveals that technology skills training is frequently the primary focus of these sessions; that is, training for basic word processing, draw/paint, database, spreadsheet, classroom management tools, multimedia and presentation applications, digital cameras and scanners, and telecommunications components. Effective curriculum-integration activities are often minimal. And when they are included, the most common strategy is to have participating teachers create a lesson plan that includes the use of technology. The weaknesses of this approach are that the teacher often does not implement the activity, it creates a false notion that a single technology activity is "integration," and the selected technology becomes the purpose of the classroom activity. In general, teachers are left on their own to figure out effective technology implementation strategies (Sun et al. in press).

Establishing a Theoretical Framework

Constructivist learning principles were the anchor for the *Applying Technology to Learning and Restructuring* project. However, during the initial planning stages it became apparent that team members held differing views of constructivist learning theory, how it played out in a classroom, and how technology supports the construction of knowledge. While "constructivism is not a theory about teaching but is a theory about knowledge and learning" (Brooks and Brooks, 1993, p.vii) it was important for the TAP team to develop a framework of understanding and explore the implications of these issues for teaching.

Over the course of several weeks, the TAP team reviewed the literature (Brown, Collins & Duguid, 1989; Duffy & Jonassen, 1992; Brooks & Brooks, 1993; Duffy & Cunningham, 1996; Jonassen, 1996; Maddux et al, 1997) and arrived at a common understanding which resulted in the following six principles of constructivism. These principles become the foundation for the *Applying Technology to Learning and Restructuring* project. (1) Learners bring unique prior knowledge, experience, and beliefs to a learning situation. (2) Knowledge is constructed uniquely and individually, in multiple ways, through a variety of authentic tools, resources, experiences, and contexts.(3) Learning is both an active and reflective process. (4) Learning is a developmental process of accommodation, assimilation, or rejection to construct new conceptual structures, meaningful representations, or new mental models. (5) Social interaction introduces multiple perspectives through reflection, collaboration, negotiation, and shared meaning. (6) Learning is internally controlled and mediated by the learner. By developing and sharing this common belief of how learning occurs, the TAP team was able to create more meaningful learning environments throughout the professional development series.

Design and Development Strategies

A common problem that faces staff developers in public schools is "efficiency." That is, how to teach large numbers of teachers in the shortest amount of time. A review of delivery strategies for technology strands reveals that a three-hour or six-hour workshop is a popular and commonly used approach. In most cases a particular workshop will have a single technology focus, be led by a facilitator skilled with that technology, and be conducted in a computer laboratory setting. Just as with any teaching method, a workshop is helpful for some but not for others. Frequently workshops become professional development "events" and do not have the follow-through necessary to create impact over time. Sometimes they tend to be too long, create information overload and fail to engage the attention of participants (Sun et al. in press)

Because TAP's goal was to model authentic learning environments in its staff development sessions, it chose to create activities that used limited numbers of computers rather than having a computer available for every person. The logic was that if teachers had to teach with a limited number of computers, it would be more meaningful for them to participate in sessions with limited computers. The object was to help them learn how to manage limited resources instead of becoming an "expert" in any single computer application. If the TAP team had chosen to conduct all of its professional development sessions in a computer laboratory setting, it would contradict the teams' belief that learning is enhanced in authentic situations, promoted through collaboration, and is learner-centered rather than instructor-centered.

This strategy was successfully used in the early sessions that promoted team activities at computer learning stations. However, when the TAP team was faced with the need for participants to learn a specific technology in more detail, it was tempted to use a traditional instructor-led lab setting approach. However, since some of the labs available for use either in the teachers' school or school district were either too small or were not adequately equipped, the team couldn't take the "easy way out." The TAP team was faced with designing a different way of delivering training with a technology focus. To do this, the team found that it didn't need to abandon its original goal of modeling authentic learning environments with limited numbers of computers. The following section describes three models that don't require a lab setting to teach technology rich activities and can be replicated by teachers in their classrooms.

Constructivist Learning Environments Supported by Technology: Classroom Models

The design and development of sessions for the *Applying Technology for Learning and Restructuring* project evolved over a period of several months and strove to accommodate a variety of computer skill levels,

different learning styles, curriculum interests, and varying available hardware and software at the six site schools. Constructivist learning environments supported by technology promoted collaborative learning activities in a variety of group configurations. The models below describe some of those group configurations. The TAP team found that the type of grouping didn't necessarily assure success in completing a project, solving a problem, or learning new skills. Having an engaging activity with an overarching structure and clear expectations, along with defined roles and responsibilities, proved to be key to the success for collaborative projects.

The *Active Learning Stations* model was designed with a thematic focus — "Your Community." The teacher/facilitator presents the activity and then functions as a "consultant" for the remainder of the activity. With the goal of the project explained, teams of four to five rotate through three different "learning stations" to gather data and information. One station uses a digital camera to gather images, another station uses a simple electronic spreadsheet to analyze data, and a third station uses printed materials about the community. Each of the stations has roles for each of the team members as well as instructions for completing the tasks at that station. While the "learning station" approach is commonly used in K-6 classrooms, it is not as commonly used in the middle and high schools. However, once they had seen how it worked and actively participated in it, several middle school teachers in our project were able to use it successfully in their classrooms. The teachers who used this model report that it required advance planning and organization. They also caution "first timers" to focus on a manageable or simple project. A team of five middle school teachers used this model for a collaborative project but found that they planned too many activities. However, they also found that student interest and energy were high and they will definitely use this approach again — but next time on a smaller project.

The *Navigator Model* is another team approach designed by the TAP team. This model is more technology intensive than the *Active Learning Environments* model. This model was designed so that participants can learn to use a software application while learning a new educational concept. (One of side benefits of this model is that it helps to alleviate the problem of technology-competent teachers who "hog the keyboard" in team sessions.) Several teams of four are given a different part of a concept to explore within their team. To do this, they are asked to create a "concept map" using *Inspiration* software. While the team carries out its initial discussion, one person from each team attends "Navigator" training. Navigators are those teachers with medium to high computer skills and are selected in advance for that role. The facilitator spends approximately fifteen to twenty minutes with the Navigators teaching them the basics of *Inspiration*. Once they are trained, the Navigators return to their team. They then instruct the rest of the team on how to use the software. The Navigator has to abide by one specific rule … they can only give instruction and cannot touch the keyboard. The rest of the team rotates using the keyboard so that everyone has a chance to use the software. Several teachers have found that the "Navigator" model helped them learn to resist putting their hands on the keyboard while they are helping students do work on the computer. They also found it very beneficial for managing those students who want to do all of the computer work for their classmates. By appointing these students as "Navigators," the students are more conscious of their behavior with the "no hands rule."

The *Expert Model* is very similar to the *Navigator Model*. However, in this model there may be several "Experts." When using the computer, the Expert can be doing the work on the keyboard. The role may rotate to other members of the team. This model is useful for carrying out more complex projects that require different skill sets and levels of expertise. The Expert is not necessarily the team leader or facilitator. When TAP carried out this staff development session, it pre-assigned teams and distributed the technology skilled teachers across all of the teams with the designation that they would be the technology expert for that team. Teachers report that in their classrooms, student technology "experts" seem to occur naturally. Those with the interest and skill come forward. However, they report the tendency of some of the less skilled students becoming dependent on these more skilled students.

Summary

While many of the 150 teachers in the six project site schools for the *Applying Technology to Restructuring and Learning* project initially expected technology-skills training, they instead received a much richer technology curriculum-integration learning experience through active learning environments. Computer skills were learned in context through meaningful authentic learning experiences and greater control was placed in the hand of the learner. Each of the staff development sessions in the series is characterized by the following: (1) supported by constructivist learning theory and takes into account teachers' understanding and beliefs about how students learn, (2) utilizes inquiry, problem-based teaching and learning, (3) uses commonly available

software found in classroom settings, (4) includes two or more instructional strategies for managing a constructivist learning environment supported by limited amounts of technology; and (5) through reflection activities at the end of each module, asks teachers to judge how the different instructional strategies could be applied to their own classroom setting. Overall, each module exemplifies instructional strategies that reflect a constructivist learning environment; includes a link to computers through hands-on experiences, links to curriculum competencies, collaboration among participants; and small group and/or whole group reflections.

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Modeling Technology Use in Special Education Teacher Training

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Abstract: This paper summarizes a discussion of techniques for teacher educators to use for modeling technology use in credential program courses. While university faculty typically have access to sophisticated platforms and programs, few K-12 teachers have or will have such access. If, instead of exclusively using university systems, faculty use or model a variety of K-12 software programs, teachers may more readily see the usefulness of technology in their own classrooms. Such modeling often takes less instructional time, shows applications in action, and facilitates discussion of other uses of technology in all content areas and grade levels.

It seems obvious that the breadth and depth of available technology is rapidly increasing. At the same time, a teacher shortage and related political climate are encouraging university faculty to condense preparation programs and turn out trained teachers as fast as possible. Whether a credentialling program requires specific technology classes to cover technology standards or the program follows an infusion model in which students demonstrate competency of specified standards, class time is tight: It is steadily becoming more difficult to adequately cover concepts, applications, and evaluation of technology in special education teacher credentialling programs. Recent studies seem to document that technology applications are neglected in teacher training programs (Basinger, 1999; International Society for Technology in Education, 1999).

One simple and modest alternative may be for the instructor to increase the modeling of effective techniques in the delivery of the college course itself. Such a design would use principles of modeling as the instructor conducts the course using techniques and materials themselves readily available to most K-12 teachers. The instructor may also perhaps briefly discuss the technique or software program and other potential uses or generalizations. While many college faculty are trying to increase their use of technology both instructionally and to support their own work efforts, we often do so with recent software and high-powered institutional platforms not readily available in nor suited for public school classrooms and teachers. For example, while most faculty have access to very sophisticated test generator programs, local school districts generally do not. If course examinations are constructed using the university's package, the students may not easily see or really believe how test generator software can be of use to them. On the other hand, if a software program such as *Teacher's Helper Plus* is used to make the test, the instructor can also take just a few moments to share with the students how easily the test was made, state that the software is less than $50 for either Mac or IBM platforms, and discuss how K-12 teachers might use such a program for tests, quizzes, study guides, or worksheets.

Some other opportunities to model K-12 software in teacher training may be in the areas of instruction or course management. The present discussion includes only a few possibilities in each area. These general examples could be used in courses ranging from an introductory course on inclusive education to methods of instruction for students with learning disabilities to advanced behavior management and so on.

Instruction

In the broad instruction area, regardless of what the specific course content is, technology for use by K-12 teachers can be modeled in assessment, assignments, instructional techniques, and materials preparation. The test generator example discussed above is just one such example in assessment. Another assessment example relates to portfolio assessment which can be very useful in special education and is also increasingly common for credential candidates as part of their own professional development. Electronic portfolios such as *Grady Profile* or *Portfolio Assessment Kit Supreme II* are available for K-12 students and could be used by teacher candidates to prepare their own professional portfolios.

Other course requirements and assignments can be written to require students to use or include technology content in their responses. For example, virtually any class could include an assignment to find and review an Internet site related to the course topic. K-12 teachers could use a similar assignment by giving a menu of sites for their own students to review. A slightly more sophisticated assignments might be:

> Specify a question or topic related to this course's objectives. Investigate Internet sites on that topic and prepare an annotated list of three which are new to you and which specifically answer your question. Include an introductory paragraph on why you selected these 3 sites and how, as a whole, they answer your question and will support your future professional development.

Other assignments may require a student to use *PowerPoint* in making an oral presentation or to submit assignments electronically to the instructor and classmates. Common K-12 software such as puzzle generators (for example, *Crossword Companion*) or cloze generators (for example, *Word Link*) can be used to make a study guide for a chapter or other course handout. Again, a moment can be used to describe how the worksheet was made or for class brainstorming on how a similar technique could be used in their K-12 classes.

Credential candidates may be required to develop websites, often using something like *Dreamweaver* (Macromedia) or even HTML. It may be more effective to create sites using *Site Central* or *HyperStudio* which are more likely to be found in K-12 programs. An even simpler and more accessible option for K-12 teachers is to use TrackStar or another education website template site.

While faculty commonly use *PowerPoint* to prepare overheads, we can also model materials preparation with common word processors or graphics programs. It takes only a moment while presenting the content of the course to mention that "This overhead was made with X program and could also be done with something such as Y program. You could make similar worksheets for use in your classrooms."

Course management

Technology can be used and modeled by faculty as they manage their university courses including tracking student grades, maintaining frequent communication with students, and developing syllabi and grading rubrics. Many if not most universities automatically provide faculty with sophisticated grade book programs. Alternatively, faculty can use a program such as *Easy Grade Pro* to keep student grades in a class on assessment. At midterm time or a little later, faculty may use the programs parent report options and easily prepare a family report for each student just as K-12 teachers can use that option to send home frequent progress letters.

Using email to distribute study questions before a lecture may increase a student's motivation to use email. Email or a course listserv can also be used to distribute announcements such as job openings, campus events, newspaper articles or television programs on disability issues for which classtime might have other wise been used.

Faculty frequently make assignment rubrics using word processors or spreadsheets. While such utilities are available to K-12 teachers, so are programs such as *Teacher Timesavers* which has added features of specific school examples in the documentation and subprograms such as flashcard generators. An instructor can also demonstrate how he/she used a spreadsheet program to make the course schedule and show how a K-12 teacher can use a spreadsheet to make rubrics and schedules.

A great source for technology support to faculty is *The Electronic Scholar* (Edyburn, 1999). While research productivity is Edyburn's focus, many of the tools he describes are potentially useful in K-12 classrooms. For example, faculty (or K-12 teachers) could use ED Tech Tools to make interactive quizzes for their students whether the course content is advanced management theory or Harry Potter.

Other techniques

There are also some other simple and relatively passive techniques which special education faculty may use to increase the visibility of technology in teacher credential programs. Textbook selection is perhaps the most significant consideration. In addition to selecting a text by how well the content meets course objectives, texts may also be considered by how technology is represented in that content and how much technological support is available. For example, virtually all programs have some sort of generic introduction to disabilities course. Watson (1999) described 10 such texts but concluded that only 6 of 10 included any mention of technology. On the other hand, Lewis and Doorlag's (1999) text includes extensive discussion of

technology, assistive technology, and educational software. Over 35 software programs are listed in the index and Internet sites are plentiful throughout the text. Another aspect to textbook selection is to use supplemental texts such as "Technology for inclusion: Meeting the special needs of all students" (Male, 1997) in introductory courses or beginning methods classes.

The number of texts with publisher-run websites is increasing. These websites typically include links to other Internet resources, text based quizzes, and chapter study guides. Using Internet references in course required readings or reference lists also models the use of a variety of media in instruction. The number of sites with full text information is increasing.

Requiring electronic collaboration in fieldwork and other classes also models a technique teachers can use throughout their career. Requirements may also include subscribing to a professional listserv, newsgroup, or chat room (Birnbaum, 1999).

It is also important to continually keep "low tech" possibilities in mind. Fax, phones, voicemail, and snail mail are all increasingly easily accessible technologies with applications for K-12 teachers (Carlson, 1999).

Conclusion

There are many technological resources and techniques which work effectively for college teacher trainers while realistically modeling and discussing what a local classroom teacher can also do. As faculty, we can consciously use the techniques we teach in the delivery of our own course content. Taking time to specifically mention the techniques and materials we use may motivate our students to use more such materials and techniques with their own students.

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An Effective Model for Professional Development in Using Technology to Learn

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Abstract The Virtual Learning Technology Community (VLTC) is a collaborative technology professional development model that supports k-12 students, k-12 teachers, university faculty, university preservice teachers, and instructional technology staff developers at local service agencies. The ***mission*** of the VLTC is to establish and support a community of regional institutions actively engaged in using existing and emerging technologies to support learning by all members. The ***vision*** of the VLTC is to provide assistance to additional PK-12 schools seeking support for improving the use of technology to help students develop competence in [a] finding and evaluating information and ideas, [b] using available learning tools, and [c] communicating effectively. The VLTC has impacted 400 teachers in 27 schools, 6,000 students, and 20 preservice interns. The long-term impact of the model is enhanced by dissemination activities, archiving and sharing successful strategies and institutionalizing essential support structures.

Introduction

Over the next ten years, more than two million new teachers will need to be hired and trained to use technology. Yet, most institutions of higher education do not adequately prepare teachers to use technology. Teacher education institutions, state education agencies, and school districts are further challenged to meet the technology staff development needs of experienced teachers. Thus, new models of support in which educators at all levels (university teacher educators, k-12 teachers, preservice teachers and k-12 students) learn together must be developed to make use of scattered expertise and limited resources.

The Virtual Learning Technology Community (VLTC) is a three-year project, which began in November of 1997 funded by the University of Wisconsin System. The VLTC model creates a virtual community where teacher educators, k-12 teachers, preservice teachers and k-12 students communicate, share, and learn together through a variety of activities, thus improving technological literacy and skills of all participants. The community develops new and spin-off projects that expand the impact on learners (e.g., k-12 teachers, k-12 students, university students and university faculty instructors for student teachers and graduate students in the k-12 schools). The VLTC supports communication, collaborative learning and sharing, and efforts to generate new resources. To date, the VLTC has reached over 260 teachers and approximately six thousand students across 30 schools.

Description of VLTC Goals and Activities

Phase I VLTC activities focused on establishing the model, working on communication strategies and identifying teacher needs. Personnel were identified, roles and responsibilities were defined, and assessment strategies and tools were developed. The VLTC web site was established as a resource base and communications tool (http://www.uwec.edu/Academic/CI/vltc/vltc.htm). The coordinator identified schools where staff development could be conducted, recruited teachers to participate and lead activities, and identified classrooms where teachers were already beginning to integrate technology into instruction. Concurrently, teacher educators began recruiting interns and developed technology support packages (laptop, software and communications tools, video conferencing tools, and scanners) to ensure access to some advanced tools.

Phase II emphasized building links between the VLTC and Regional institutions. Interns were placed at three different schools sites to (a) supply some technical expertise, (b) work with teachers to explore new tools (e.g., video conferencing) and develop new strategies for using technology, and (c) provide release time for the teachers to attend and lead staff development. VLTC teachers began attending and teaching workshops, revising curriculum, and identifying advanced staff development needs. UWEC and UW Stout responded with a series of graduate offerings including ITV Instructor Training, Computers in Education: On-line Communications and Information Retrieval, Information Literacy, Instructional Design and Development, Technology in Science and Mathematics instruction, Creating Multimedia Productions, Distance Learning Networks, and Web Design. Initial efforts reached 52 teachers and approximately 1,000 students in fourteen small districts.

Phase III (Strengthening links among Regional PK-12 Schools) activities emphasized strengthening the social context to support high-risk activities associated with changing long-held teaching and learning paradigms. Through a variety of face-to-face and electronic mechanisms, VLTC participants shared their developing knowledge of current regional projects, established new ways to communicate, and publicized ongoing efforts. Participants were encouraged to think about technology as a tool for learning subject matter rather than just learning about technology. Projects ranged from introducing desk top video conferencing into classrooms and using asynchronous learning environments such as NiceNet and Lotus Notes Learningspace to building class web pages to using video editing tools and graphics design tools.

Three current projects focus specifically on context building. Each project took a different approach to bring together educators from different places and levels to focus on common goals. The *Technology Mentors* program uses a multiplier model to support k-12 staff, university and high school students, and preservice teachers as they work to redefine curriculum, instruction, and assessment in technology-rich classrooms. During the first year of the program, nine master mentors participated in technology staff development and leadership activities to prepare them to work with other building teachers. Each teacher worked with two additional teachers to build a network of 27 teachers prepared to support others and to serve as hosts for preservice teachers. The design for the second year required that each master mentor and building mentor work with two additional teachers (thus supporting 54 additional teachers). The success of year one activities was so high that 42 new teachers applied for the Mentors program. By the end of the project, the original target of 81 teachers will be surpassed. Over 160 teachers will receive advanced staff development aimed at increasing their ability to integrate technology into instruction. Fifty-one teachers will participate as staff development leaders by conducting training, presenting model integration strategies for peers, and coaching teachers in classroom settings.

You're I.T. (Integrating Technology into the Curriculum) blended 70 VLTC and Technology Mentors staff and teachers in a two-day symposium and staff development series in March 1999. The symposium began with a dinner and debate examining the pros and cons of bringing technology into classrooms. Participants were divided into teams one month before the symposium and assigned the task of finding evidence from the literature to support their argument. Listservs were set up to facilitate team planning and sharing of information. The debate was moderated by an area School Board President. The following day, a series of breakout sessions provided opportunities for the Technology Mentor teachers and VLTC teachers to share strategies with an audience of invited teachers, university educators, preservice teachers, and k-12 students. Sessions were structured to emphasize integration strategies and discussions of successes and failures rather than just showcasing technology. The symposium closed with an evaluation session and discussion of networking strategies to ensure that participants were able to connect with presenters and each other. *You're I.T II* will extend the success of the first symposium by including additional participants, increasing staff development responsibilities of mentor teachers, and showcasing projects completed by student teachers and interns.

FastforWord (involving 6 K-12 students, 30 undergraduate students (preservice teachers), 1 graduate student, 1 university faculty member and 1 K-12 teacher) assesses the validity of a CD-ROM and Internet based program that claims to improve the language skills of children with specific language impairments, and specifically, dyslexia. The focus of FastforWord is evaluation of commercially developed support technology. Participants will conduct research to determine if the program improves the temporal

sequencing deficits that cause specific language impairments and dyslexia. FastforWord provides an opportunity for teachers and students to take a more critical stance toward the integration of technology into learning by testing developers' claims against independent evaluations. Consequently, teachers and students will develop a clearer view of the time, processes, and resources needed to assess the impact of technological tools on student development.

Phase IV (Supporting New Projects Impacting Students In VLTC Schools) activities emphasize (a) extending participants opportunities to work together, (b) institutionalizing new groups, courses, and connections, and (c) disseminating the VLTC model. VLTC will continue phase III activities, particularly the FastforWord, You're I.T. and Technology mentors activities. In addition, several new projects such as small grants for teachers, and advanced graduate studies drawing on Phase III activities, have been introduced.

Phase IV also includes evaluating the impact of VLTC. Tracking the influence of VLTC activities on teacher knowledge, classroom practices, and student learning is complicated by the very nature of the project. As the variety of activity increases, tracking impacts on practices becomes more complex and difficult to document. Table 1 at the end of this document illustrates the links among project goals, activities, outcomes, and assessment strategies. Current activities include collecting post data using survey instruments, assembling portfolios of teacher and student work, and conducting exit interviews with students and teachers. Each data set documents ways the project influences practices and helps identify new questions deemed important by the participants. A sample of teacher projects, complete analyses of survey and workshop interview data, shared presentations at conferences and descriptive data illustrating patterns of participation will be archived through the VLTC web page.

Using Outcomes to Support the Transition to a Self-Sustaining Model

When the VLTC project began, we envisioned a set of small districts developing links with each other, and with regional agencies and Universities. The partners would work together to increase the amount and quality of student learning through a variety of uses of technology. During the course of three years, the community has grown from an initial set of six schools to include more than 30 small schools and one large urban/suburban district. By the end of the 1999-2000 school year, 300 K-12 teachers and their students will have been impacted in some way by the community activities. Twenty teaching interns will have completed semester-long experiences focused on different ways to enrich student learning through technology. VLTC established a regional technology staff development symposium drawing 75 - 100 participants, supported teacher development in the use of distance learning technologies, and draws participants from preservice teachers, university teacher educators, K-12 teachers, and K-12 students. We face significant challenges, though, in moving from an externally supported to a self-sustaining community. Several important transition issues are highlighted below.

Maintaining a teacher-driven model. While the initial impetus for VLTC came from a small collaborative group, the identification of teacher development goals rests mainly in the hands of the participants. By respecting participants' changing perspectives and helping them develop better ways to learn from each other, the community is internally driven. One indicator of the success of the internally driven approach is the sheer increase in participants in VLTC activities at a time when teachers are inundated with technology-oriented staff development opportunities through graduate courses, service area workshops, and other local, regional, and state-supported opportunities. The need remains for participant-driven development that offers something different from the "shopping mall" available to educators. We are challenged by demands on participants' time, changing expectations about costs/benefits of participation, and just getting lost in the total volume of opportunities.

Institutionalizing community activities. A second important element is securing and maintaining institutional support for community activities. Two new courses initially funded by VLTC now exist as regularly offered on University summer and academic year schedules. Two distance education initiatives are now attracting internal funding; interest and hardware/software resources generated through the VLTC experience provide a sufficient base for continued pilot project development.

Large scales summer staff development opportunities have sufficient history and visibility to attract some institutional support, but are more difficult to sustain. Competition for larger amounts of institutional resources may limit the long-term feasibility of such initiatives, especially as educators are faced with more and more choices for investing their time.

Five schools now contribute $4,000 per intern to bring advanced preservice teachers into their districts to complete student teaching and work with classroom teachers to integrate technology into teaching. The interns complete a technology integration project in the host school. They provide release time for supervising teachers to attend staff development, work with other teachers, and engage in resource development. Hardware/software support for the interns and their supervision will continue through University funding. However, as more projects offer internships and compete for quality preservice teachers, we face limitations in the number of qualified preservice teachers available to fill the slots offered by schools. Without continued successful placements, K-12 districts will shift resources to other projects.

Our experience clearly highlights the need for a coordinator who is a recognized, active member of the school communities where staff development is occurring. The coordinator is in a unique position to identify linkages and common needs across buildings and districts, and make the "people connections" necessary to create and sustain the conversations needed to bring groups together. The current coordinator position will be continued with support from a regional agency.

Summary

The VLTC has achieved the goal of creating a community that is driven by internally-defined goals, includes a variety of learning opportunities and communication possibilities, and brings together educators at all levels. The project web site provides an archive and "one-to many" communications tool. Sharing mechanisms such as You're I.T. highlight the gains in technology skills and instructional integration made by community members and help sustain connections among participants.

Sustaining the community concept requires that the participants have gained sufficient value during the project that they begin assuming responsibility for the costs and organizing activities required to bring people together. As the VLTC funding cycle ends, we are working to develop strategies for sustaining the community concept. Our success in shifting some grant-supported activities to institutionally supported events is encouraging. However, we will need to develop more strategies to sustain links among VLTC teachers, foster new staff development projects, and help teachers make increased use of distance learning technologies.

Table 1
Links among VLTC Goals, Outcomes, and Assessment Activities

Goal	Key Activities	Outcomes	Assessments
Phase I: Establish the Community	1. Coordinator hired 2. Monthly meetings at different sites 3. First K-12 sites and activities identified	- Coordinator will be sustained at CESA 11 at reduced level after project ends - K-12 districts commit teachers and $$ to intern projects	Technology Needs and Practices: Large scale pre-post survey to track changes in teachers knowledge, use, and confidence with technology
Phase II: Establish links with Regional Institutions	1. Interns placed at three K-12 Districts 2. Staff Development activities offered through CESA 11 3. Partnership with U.W. Stout's Nakatani Center 4. UWEC Graduate Courses offered	- Increased staff development at Intern schools - Twelve workshops for 52 teachers in 4 districts impacting 1000 students - Three new courses offered for the first time supported by Universities	Intern Interviews Post workshop surveys, exit interviews with evaluator
Phase III: Strengthen links among Regional K-12 Schools	1. Technology Mentors VLTC partnership links teachers in two regions 2. You're I.T. brings K-16 educators together in common forum/workshop 3. Expanded staff development activities through CESA 11 4. Distance Ed. Activities extended to CESA 10 Districts 5. Video-conferencing across districts 6. Collaborative Presentations to a variety of audiences 7. Continued intern placements	- CESA 11 teachers worked directly with Eau Claire School Teachers and staff development team - You're I.T blends 70 educators and students across all levels - workshops for 260 teachers and 6000 students in 20 districts - Nice-net and Net meeting projects in elementary and middle schools - Distance education facilities used for content and practice with D.E strategies - Three national, seven State/Regional and three local conference presentations	Exit surveys, group interviews, number and type of presentations at workshops Exit surveys, interviews with teachers and students
Phase IV: Support new and ongoing classroom projects; disseminate model; shift support to regional institutions	1. Small grants for K-16 teams 2. Advanced graduate study by a cohort of teachers 3. Continued Staff development through CESA 11 4. Rotated Intern placements to support new projects 5. You're I.T. The Next Steps 6. Continued Presentations	- Opportunities for 6 – 10 small group projects linking University and K-12 educators - Workshops will be maintained at current levels with increased school/CESA funding - Teachers will present curriculum projects and strategies	Project summaries and artifacts, Examples of revised curriculum Post workshop surveys Number and type of presentations Technology Needs and Practices Post Survey

Where Do I Go When I Don't Know What to Do: Using the Internet to Create a Virtual Learning Community

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Abstract: This paper presents a case study describing the efforts of teachers to improve communication among their colleagues at their respective schools, an elementary school and a college of education. Frustrated by the lack of time to collaborate with fellow teachers the creators used the Internet to improve communication and to work toward developing a community of learners among teachers. Still in their infancies the two sites are constantly changing as their use suggests improvements, but the goal of the endeavors has been reached: the creation of learning communities among teachers, replete with a true sense of communication and collaboration.

Introduction

A great deal of research is currently available describing on-line communities of learners created via the Internet. Many of these "virtual communities" are created to connect students to teachers, students to students, and teachers to teachers. Kowch & Schweir (1997) defined learning communities as "collections of autonomous, independent individuals who are bound together by natural will and a set of shared ideas and ideals, and who are engaged by influencing each other within a learning process." A whole new dimension has been added to the creation of learning communities with the use of technology. Virtual or online learning communities are materializing on the World Wide Web. A virtual learning community works in the same way as the nonvirtual community to extend the participant's professional community, but it can extend the reach of the community far beyond the walls of a classroom (Dyrli, 1998). A review of the literature reveals evidence of learning communities being established at all levels, elementary school through higher education (Jorn, Duin, & Wahlstrom, 1996; Kowch & Schwier, 1997; Tinto, 1997).

As new learning communities are established, learning goals need to be determined, and specific tasks to be completed must be created. To do this successfully Jorn, Duin, and Wahlstrom (1996) suggest that the perspective participants must be the focal point of

consideration. It is their belief that a learning community will be effective only if the participants want to interact and communicate.

Background

The lack of time to collaborate with her fellow teachers while attending to the many daily responsibilities assigned to elementary classroom teachers frustrated a fourth/fifth grade social studies teacher. As the social studies chairperson she spent a great deal of time locating resources for other teachers and wishing for more hours in the day to be able to really help her colleagues. This frustration inspired her to use her personal Web site as a means of connecting the teachers at her school to social studies resources.

The idea for this Web site was inspired when the teacher was invited to co teach a graduate level general methods course. In preparing for the course, she was referred to a Web site created for faculty. In an effort to enhance consistency in course material, delivery of content, and communication among the large number of faculty who teach the two general methods courses in the undergraduate and graduate programs at a state university a virtual learning community among faculty had been created.

The courses were developed to address the needs of beginning teacher education majors and graduate students seeking initial certification. As the courses are requirements for certification, there are many sections offered each semester to accommodate the large student population. As such, there are numerous instructors, including adjunct faculty, who teach the courses. The Web site is designed to create a learning community among the disparate faculty.

When an individual, like the social studies teacher, accepts the responsibility of teaching one of the general methods classes he/she is directed to the Web site instead of a generic course syllabus. The new faculty hire may still be in different state, but thanks to the virtual learning community created by the Web site, he/she is instantly connected to all faculty who teach the course and many resources available to help plan and teach an exciting semester of work.

Elementary School Web Site

Creating a Web site for the faculty at the elementary school was easily initiated by expanding an existing Web site. The social studies teacher used a personal site she created for sharing school information with students and parents. Her learning goal was accomplished by adding a link for communicating with other teachers at the school. Here other teachers can find links to the Sunshine State Standards (required on all lesson plans), the National Geography Standards, sample lesson and unit plans, and Internet resources. She has organized these resources into two categories, teacher resources and resources for use with students. As she locates interactive things for student use like crossword puzzles, seasonal stories and jokes, or music to coordinate with themed work, she connects the locations to her site.

Thinking ahead for summer work on the Web site, the elementary teacher plans to survey her colleagues to receive their ideas and suggestions. She wants to be certain that the Web site continues to be designed with the perspective participants as the focal point of consideration. One suggestion thus far has been to write and include lesson plan ideas for all

grades at the pre K – grade 5 school. In the future she hopes to connect her faculty site to the Florida Council of Independent Schools Web site so that all member schools will have easy access to the information. She is also exploring software that will allow her to establish chat rooms to facilitate online communication in two directions for the teachers.

University Web Site

The university site is made up of several different components. Essential course elements comprise the first component. Information contained in this component is linked with other sites where instructors can access specific authors and information associated with a particular topic. There are links to Internet sites for faculty use and a separate listing for links for student use. Some of the sites are local, like the link to the university library's site, Beyond Yahoo! Finding Everything on the Web. This site explains how to conduct successful interest searches. Other sites are more global in nature. ERIC Clearing House on Assessment and Evaluation is found under the heading of assessment sites. Links to other sites are grouped by the course content, like a methods and approaches site, a multiple intelligence theory site, and a teaching tips site. Each is easily available for faculty perusal.

Within Instructional Strategies, the second component of this Web site, can be found the methodologies recommended for curricular inclusion. These strategies will be linked with corresponding researchers and authors. Plans are also being made to secure videotaped examples of different methodologies and to incorporate them within this Web site. Thus, a variety of strategies can be observed while online. It is hoped that viewing an actual strategy being implemented, with literature discussing the strategy will enhance faculty understanding and eventually facilitate student use of each strategy.

Because of the large number of students who are enrolled in the college of education, consistency among all sections of this course, in content and delivery, poses a major challenge. Some semester there may be as many as sixteen sections of the course offered. As a response to requests by new instructors for access to course materials created by veteran colleagues, the Web site will also include faculty-developed materials and activities. A generic syllabus as well as black-line masters of transparencies and assessment instruments is available. Instructors using one of the recommended textbooks will be able to access chapter outlines of that text. The availability of microteach documents, such as lesson plan formats and evaluation forms, will greatly facilitate the incorporation and execution of microteaches, a time-consuming but integral component of this course. A supply of highly successful, instructor-generated activities will also be made accessible by means of this Web site. As the list of videos for this course can become quite cumbersome, a video bibliography will be included. Each video will be linked to sites dealing with the main topic of the video, thus enhancing the depth in which material can be delivered.

Finally, in the Resources/Assignments/Activities component of the Faculty Web Site, a Professional Portfolio link has been developed. Because the portfolio is an entrance requirement for student teaching, it is imperative that education majors receive accurate, consistent, and timely information regarding the portfolio format and content as well as portfolio submission and evaluation from their professors. A link delivering current portfolio workshop and training session content has been developed and is accessible via the Professional Teaching Practices Faculty Web Site. As this course is the forum within which the introduction to the professional portfolio is to be effected, it is vital that faculty teaching

the course have access to the most current and accurate information regarding this college of education requirement.

The Professional Teaching Practices Faculty Web Site is viewed as a vehicle to facilitate curricular design, enhance consistency of content and its delivery, and expedite communication among faculty members. The Web site will also consist of a component that will allow faculty to communicate with one another, both online as well as via a listserv. Direct email links are listed on the first page of the Web site, which connect to regular faculty members who teach the course. The adjunct faculty members who are not assigned office space on campus, and who often work full-time away from the university campus, especially appreciate these links. The adjunct faculty have easy access to request shared materials, or simply ask a question.

Conclusions

The full potential of these two Web sites as a means of communication and in the dissemination of information has yet to be determined. Currently in their infancy states, the sites are being continuously updated and expanded as teachers/instructors contribute new materials, resources, and knowledge of possible links. It is anticipated that once the Web sites are fully developed and faculty are informed of their existence and trained in their usage, the objectives for these sites will be realized. We hope to enhance consistency in course material, incorporate resources and activities within the course curriculum and improve communication among faculty. Regardless of the numerous modifications made to the Web sites as they undergo construction, our ultimate goal remains unaltered: to create a learning community, replete with a true sense of communication and collaboration among its members.

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Metaphoric scaffolding: Using digital video techniques to overcome teacher apprehension about new approaches to learning

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Abstract: This paper is a work-in-progress report on an approach to help teachers break the traditional barriers to learning that occur under transformative learning conditions. Teachers typically want to be taught innovative new techniques using the learning approaches that they have successfully used in the past. Introducing unfamiliar new learning approaches coupled with often-intimidating new technologies seems to be at odds with the objective of helping teachers apply constructivist methods including modeling the desired learning outcomes through their own examples. The authors explore the use of a metaphoric scaffolding technique that disguises much of the learning environment in order to give teachers a more familiar and comfortable realm in which to achieve learning success. As success is achieved, the teachers are led back through the metaphor to understand how they have used the new technology to produce tools that will be of direct benefit to them in the classroom.

Introduction

A recent study by the American Association of School Administrators (AASA), titled "*Preparing Schools and School Administrators for the 21st Century*", identifies guidelines that schools must recognize in order to prepare students to succeed in the new millennium, beginning with the premise that the definitions of "school," "teacher" and "learner" are reshaped by the digital world. In this paper, we are primarily concerned with both the definition of teacher and the role of teacher-as-learner:

"In the past, many have considered the teacher's primary role to be a dispenser of information. Great teachers have always far exceeded that expectation. In the 21st century, students have increasing access through the Internet and other sources to as much or more information than their teachers. That means teachers will take on a mantle of even greater professionalism, serving as orchestrators of learning and helping students turn information into knowledge and knowledge into wisdom" (Withrow, F. et al, 1999, p. 66-72).

According to the study, the 21st century will require knowledge generation, not just information delivery, and schools will need to create "a culture of inquiry." "We talk about lifelong learning for everyone in society," says futurist/forecaster Marvin Cetron, a member of the AASA study. "We need to be sure we offer lifelong learning for our teachers, as well. Our teachers need to be the catalysts in setting a culture of academic excellence," he adds{Uchida, Cetron, et al., 1996}.

In order to prepare teachers for this environment, the first and most difficult hurdle to get over is the idea of accepting change. Accepting change is an individual process in which the "acceptance time frame" is going to vary with the staff. Understanding that a total buy-in is rarely achievable at the beginning of a change effort will also keep the teacher from labeling a behavior, response or attitude as "resistance to change."

In this paper, we relate our efforts at using the metaphor of movie production as the scaffolding 'prop' to expedite the learning process of teachers in a graduate level multimedia design course. We began

by examining teacher's apprehension about learning how to integrate technology into instruction. We observed that teachers who were predisposed to learning experiences that offered immediate "use it tomorrow" applications, were equally committed to (but often anxious about) learning experiences that required greater risk-taking.

While most teachers are eager to learn how to apply technology to help students learn more effectively, others have continued discomfort with technology and believe that computers are not necessary to do their job (Stone, 1998)..."Computers apparently have not really changed the way we teach." Even the most receptive teachers often want to be taught the latest technology integration techniques the same way that they have always been taught. The teacher's prior experience of being a student, and the cultural expectations of the teacher's role greatly influence the acceptance of new instructional strategies (Stigler & Hiebert, 1998). Strategies that vary significantly from familiar, traditional methods may produce stress that ultimately becomes a barrier to the learning experience. The use of metaphor served as a substantial bridge to link teachers' comfort level with predictable learning experiences to the "professional stretching" level of transformative learning experiences.

The learning paradigm from the past has usually consisted of traditional instructional delivery techniques: set and listen lectures, show and tell workshops, and a variety of other teach-by-telling methods. These traditional approaches greatly influenced the design and use of early computer technology applications such as the tutorial structure of computer-assisted drill-and-practice programs and brought a degree of rigidity to technology integration. Today's new paradigm for professional development is based on the goal of preparing teachers to transform their thinking, teaching and learning. At the same time teachers must be able to "coherently combine curricula, tools, and standards...the process must be ongoing, acknowledging the gradual nature of change and respecting teachers' needs to maintain control of their evolving professional goals and commitments" (Grant 1999). The "gradual nature of change" presents the greatest challenge to innovation and the notion of gradual is inconsistent with the need to expedite the infusion of technology into instruction. The situation is exacerbated by the need to produce more and better teachers. "Over the next decade we will recruit and hire more hire more than two million teachers for American's schools. More than half the teachers who will be teaching 10 years from now will be hired during the next decade (National Commission on Teaching and America's Future, 1996).

At least 20% of the teachers in the pilot course are highly uncomfortable using approaches other than those that they identify with successful outcomes in their own past learning experiences.

Metaphor strategy

The development of a metaphor strategy evolved from answering the question: What type of learning experience will allow teachers to embrace change and break away from their traditional reactions to transformative learning experiences? The answer lies in admitting that in order to embrace something new it is often necessary to either remove or realign something already in place. Ineffective or inappropriate teaching practices needed to be gently replaced with a "user friendly" learner-driven model of instruction that could be easily replicated in any teaching-learning environment. The use of a metaphor allows combining the novel with the familiar and serves to lower anxiety while raising interest.

An effective strategy at the beginning of any change effort is to acknowledge four basic assumptions : 1) previously used traditional methods are not wrong but are not matched to the instructional goals of the program; 2) teaching is a strategic act of engagement that requires both teacher and student to understand the learning dynamics; 3) changing how a teacher teaches takes more than conveying information or presenting activities; and 4) learning to change a teaching style is as difficult as learning to change a learning style (Bellanca 1998).

Until teachers are comfortable using and accessing information with technology, there will be no significant change in instructional practices in the classroom. When questions and concerns are addressed in a compassionate, professional manner, there is a high likelihood that the new technology will be adopted successfully. A preservice teacher shared this insightful remark: "The way you are taught in college is the way you will be apt to teach when you begin your career in teaching. I'll be more comfortable to use this type of instruction in my classroom now that I have experienced it in my graduate courses."

The metaphor experience was piloted in a multimedia graduate course and grounded on principles of a constructivist approach to pedagogy for technology integration. The course incorporates scaffolding techniques that encourage teachers to model desired outcomes with students in a project-based learning environment. To overcome anticipated apprehensions, the pilot class of 12 graduate students (practicing K-

12 teachers) applied a meta-instructional model: using the methods being taught in order to model the instructional process, applying appropriate scaffolding and leading the teachers through the same process the graduate students will be using with their K-12 students. We chose the metaphor of producing a digital video "movie" as something that was intuitively familiar to most teachers. Giving the teachers a familiar metaphor within which to consider their own learning experience proved to greatly help the scaffolding process and lowered the barrier to learning. The metaphor reflects the scaffolding construct that anchors its use and transforms the learning experience.

Scaffolding strategies are reflected in the instructor's "diagnostic" discussion with each student to determine the level of skill and degree of apprehension that could either strengthen or compromise course activities. Students are then placed into teams designed to support members who may oppose change or be overly anxious about using unfamiliar technology. Support comes from knowing that someone on the team knows about the anxieties produced in the face of change and understands how to provide a learning 'safety-net' to reduce stress and increase confidence. One project in Kentucky created an alternative "techno-academic" classroom where support and encouragement for efforts to try the untested facilitated the transition from passive to active learning. The environment continually reinforced actions and ideas that broke away from traditional roles of teaching and learning. While learning new technology, questions could be asked and doubts could be vocalized.

Based on the Vygotskian notion of making abstract processes more visible, scaffolding can take a variety of forms – teacher can model strategies and provide suggestions. Scaffolding can also be provided in the form of prompts and questions that help students understand the process involved in learning (Krajcik, Soloway, 1998).

Using this approach, the instructor takes the role of director, the teachers in the class become the actors--mastering their roles under the guidance of the director, in a teaching environment that is facilitated by the producer... an expert in the new technologies being used. The producer provides appropriate technology support and scaffolding to ensure a successful learning experiences for all participants. The use of pedagogical roles allow teachers to create and evaluate new instructional techniques and "gain insight into teaching approaches and further their knowledge of technology (Deal 1998)."

To further support this metaphor, the class uses actual digital photography and editing techniques, producing case-related video material that, at a minimum, becomes part of the electronic portfolio produced by each of the teachers. The motion picture industry provides a good analogy to help understand production in many media. The areas of photography, art direction, sound editing, special effects, lighting, screenwriting and adaptation, directing, editing, and all other stages of pre and post-production provide a media model with a century of success upon which to draw. The global public has developed a level of expectancy from every screen that begs attention. No matter that the screen is 70mm Imax or 15-inch Compaq the audience/students usually expect at least the level of production quality they commonly see on their home television sets.

Applying the metaphor

Fortunately, it is now reasonable for K12 schools and graduate programs to produce high quality digital video sequences, which can be distributed on film, CD-ROM, or streamed Web video. The cost of digital camcorders and desktop video editing systems have dropped dramatically in the recent past. Achieving the potential of media in our future means "unlocking its power through understanding." At this stage, leadership may turn out to be the most important single factor in advancing the social and industry understanding of media and the new telecommunications world. Dwight D. Eisenhower used to demonstrate the art of leadership with a simple piece of string. He would put the string on the table and say, "Pull it, and it will follow you anywhere. Push it, and it will go nowhere at all." Producers should lead by example and inspire by mastery of their craft. A traditional producer must be "a creative administrator…a judge of creativity" who guides and supports others toward a common purpose. (Houghton, 1991) Similarly, the teacher may be producer and/or director of the learning experience and fully responsible for providing the wisdom of an off-stage sage and at the same time guiding students to create their own technology rich productions.

In the context of leadership in producing new and better programs, media communications can create richer, more elaborate relationships and enhance education. Now, the strategies must be right and practitioners must understand the "why" as well as the "how" of media production. It is no longer enough to produce by rote or formula. One must understand media psychology to produce well in media. People are

driven by their emotions when they are correcting a deficiency, engaging in personal development or simply having fun.

Outcomes

In many graduate technology courses, students collaborate on project-based teams, and create a formal "production" guided by a set of rubrics. In one course, the product is a CD-ROM containing one or more lessons incorporating the technology and learning approaches that have been integrated into classroom instruction. The teachers, as part of the production company, have contributed to a common resource and have developed instructional strategies to be used with their own students. In another course, teachers create web-based learning modules to deliver both synchronous and asynchronous mentoring.

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The Alliance for Catholic Education (ACE): Integrating Technology into a Holistic Teacher Education Program

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Abstract: *The Alliance for Catholic Education (ACE) at the University of Notre Dame endeavors to develop a corps of highly motivated and committed young educators to meet the needs of some of our country's most underserved elementary and secondary schools. In this paper, we provide a brief overview of the nature and history of the ACE initiative, its partners, and its interface with the AmeriCorps National Service Initiative. We next explore the role of technology in the current program, followed by description of recent adjustments. We look at a needs-analysis in progress, including a technology survey of schools where the ACE participants are situated. Results of the needs analysis will be shared at the SITE conference.*

Overview of the ACE Program

The Alliance for Catholic Education (ACE) at the University of Notre Dame endeavors to develop a corps of highly motivated and committed young educators to meet the educational needs of some of our country's most underserved elementary and secondary schools. ACE combines the efforts of the Institute for Educational Initiatives (IEI) at the University of Notre Dame, the National Catholic Education Association (NCEA), the Departments of Education at the United States Catholic Conference (USCC) and the University of Portland. Founded in 1994 by Fr. Timothy R. Scully, C.S.C., and Sean D. McGraw, ACE recruits, educates, places, and supports talented, committed, and professionally trained recent college graduates as K-12 teachers to serve in under-resourced Catholic school systems throughout the southern United States.

ACE has become an innovative and successful model of teacher formation, targeting gifted and service-oriented applicants from a broad variety of undergraduate disciplines and representing a diverse set of ethnic and cultural backgrounds. To prepare and guide ACE teachers through the challenge of this two-year immersion experience, the program is founded on three central pillars: professional education, community life, and spirituality. Such emphasis on the holistic development of new teachers has resulted in high retention rates 92%) and high principal approval rates (97%) over the life of the program.

ACE participants include recent graduates from the University of Notre Dame and Saint Mary's College, as well as a number of other select colleges and universities. These graduates teach in approximately 90 parochial schools throughout the urban and rural Southern United States. To carry out its core teaching

mission, ACE recruits talented graduates from a broad variety of undergraduate disciplines, representing a diverse set of backgrounds and experiences, and provides an intensive two-year service experience encompassing professional development, community life and spiritual growth. These three components are at the heart of the ACE initiative. Its aim is to provide excellence in education and to maximize opportunities for personal and professional growth for program participants. Students accepted into ACE and the Masters in Education (M.Ed.) program are provided with the opportunity for a high quality master's degree experience, which builds on their solid undergraduate academic backgrounds in their disciplinary majors. The program leads to a Masters in Education, 2 years of experience as an instructor of record in a school system, and an initial teaching license.

From its inception, ACE has made every effort to insure that its members are prepared for the rigors of teaching, leading, and serving in a challenging classroom environment. ACE teachers experience an intensive teacher education program designed and administered by the University of Notre Dame. Under the direction of Dr. Michael Pressley, the ACE professional training spans two years and integrates graduate-level course work with an immersion experience in teaching. Over the first two summers after admission to the program, ACE teachers live and study together at the University of Notre Dame. The summer sessions combine an innovative teaching curriculum taught by seasoned practitioners and select faculty from the University of Notre Dame with supervised field experience in both the public and Catholic elementary schools of the greater South Bend, Indiana area, and in the Upward Bound program at Notre Dame.

At the completion of the first summer training component, ACE teachers travel to needy parochial schools of the South and Southeast to serve as full-time teachers during the regular school year. In addition to the support of mentor-teachers in the parochial schools where they teach, all ACE teachers are brought together twice during the school year in a retreat setting to deepen and enhance their commitment to becoming professional educators. Upon completion of two years in the ACE program, participants have fulfilled the requirements for a Master of Education degree, and have provided an urgently needed presence in the lives of our nation's most needy school children.

ACE teachers live in community, sharing the challenges and rewards of beginning teachers. Each local ACE community becomes a mutually supportive environment, forming part of the local parochial and neighborhood school community. The program offers an ongoing evening seminar during the summer session, as well as two workshop-retreats during the regular school year, to provide participants with skills to live a healthy community life. In addition to the support ACE teachers receive from one another, local diocesan resource personnel and Notre Dame Club members assist the teachers in establishing an effective presence within the local communities

ACE and AmeriCorps

ACE is a member of the AmeriCorps National Service Initiative. AmeriCorps is the national service program that allows people of all ages and backgrounds to earn help paying for education in exchange for a year of service. AmeriCorps members meet community needs with services that range from housing renovation to child immunization to neighborhood policing. The Alliance for Catholic Education enjoys a unique association with the Corporation for National Service and AmeriCorps. In 1994, the Corporation for National Service selected ACE, in a highly competitive national competition, as one of 11 National Demonstration Programs. Through the Corporation's Learn and Serve America: Higher Education and AmeriCorps departments, the corporation has provided both program funding (including the innovative summer teacher-training and service-learning program) and a substantial education award to all qualifying ACE participants, who are thereby considered full-time AmeriCorps Members.

ACE and Technology

In keeping with its continuous improvement goals, ACE has initiated an effort to enhance and further integrate the role of technology in its year-round teacher training. In addition to their summer coursework, ACE teachers installed in the various dioceses assume additional coursework throughout the academic year

via distributed learning. Online courseware (Web-CT), listservs and e-mail are utilized as primary or supportive technologies. With some exceptions, listservs were the primary tools used for course discussion. ACE faculty observed problems stemming from e-mail accounts coming from various sources, use of listservs, etc. Two educational technology consultants were hired in the spring of 1999 to evaluate Internet issues and begin to explore avenues for integrating technology into the curriculum, including the intensive summer pedagogical experience.

Some of the Internet concerns were addressed during the summer of 1999 by determining a standard delivery and response mechanism (including Web-CT, listservs, and the Netscape Communicator with its various e-mail, browser, and chat features) supported by the University of Notre Dame educational and technology support services. All new and returning ACE participants received training in Web-CT, an online courseware tool. Interested faculty members were also trained in this application, with additional faculty training slated for small group and one-on-one training through the year. Listservs remain in heavy use by faculty.

Faculty poll: The 1999 summer faculty were polled to determine what types of software and hardware applications they used/would like to use and what types they taught/would like to teach. The summer faculty elected to use mostly current Mac or PC desktops or laptops. Many of the national faculty brought their own equipment. The great majority of faculty used integrated software applications such as Microsoft Office or ClarisWorks. Many supplemented their instruction with one or more Internet applications. Some were quite sophisticated using a range of tools from Web-CT to Hypermedia.

Instructors were also asked to identify what aspects of their content area they would like to explore for technology infusion? Some faculty coordinated student training in PowerPoint and WWW search/evaluation of lesson plans and instructional sites with ACE technologists. Each training session was oriented to a specific course. Students were required to integrate their newly acquired skills into their assignments. Other faculty delivered their own introductions to relevant software, arranging "hands-on" computer sessions for one or more class sessions. Many modeled use of technology infusion with software applications relevant to course material.

Survey of ACE schools: A survey was developed to evaluate the level of technology in the various schools where the ACE participants are serving. Mailed in August 1999, survey responses arrived intermittently throughout the fall. A total of 53 of 90 possible schools responded to the survey for a response rate of 59%. Analysis commenced in November and is ongoing.

The survey was developed in accordance with established principles and precepts (Babbie, 1990; Dillman, 1978; Krathwohl, 1993) and somewhat similar to various technological survey formats (QED, 1999; Becker,1995). The survey is comprised of a mixture of closed and open-ended questions. Respondents were asked to select some responses from a list provided by the research form. Respondents fill in a numeric or text response according to direction), dichotomous response questions or ("yes/no"), multiple choice questions (respondents choose from several options), checklist questions (respondents choose as many as may apply). We devised two extensive open-ended questions and several opportunities to describe "other" options in questions groupings. These permitted some freedom in answering the questions and an opportunity to provide some depth in the response.

Quantitative survey data was collected in Microsoft Office 2000 Excel in compliance with the coding structure developed from the survey form. The results were imported into SPSS 9.0 for Windows for data analysis. Frequencies were calculated for all coding categories. Some preliminary results are discussed in the following paragraphs.

Of the 53 schools that responded to the survey, 11 were elementary only, 27 were elementary plus middle schools (K-8), 4 were middle/secondary schools, and 11 secondary schools. More than half of responding schools were K-8. Many of the elementary and K-8 schools also contained pre-kindergartens as well. Fifty schools responded to the questions about number of teachers and students in each school. Of these, they

reported 1,226 teachers and 18,009 students for an average of 26.7 teachers and 360.2 students per school. The overall teacher/student ratio is 1:14.4.

Schools participating in the ACE program reported a strong orientation toward PC platforms, although there was some Macintosh usage in elementary or K-8 schools. Where used, the Macintosh computers are dated. Macintosh use in secondary schools is rare. The quantities of computers reported in Pentium I or II category are larger than the combined totals of computers in all other categories. Factors contributing to this predominance were not collected for this study but may reflect price and performance considerations given the constrained resources of the many of these schools.

Type and Location of Computer Access in Schools				
	Computer Labs	Instructional Rooms	Library/ Media Center	Offices/ Administrative
Pre Power Mac (Apple II GS, LCs, etc.)	3.3	3.6	0.2	0.2
Non-G3 PowerMacs	0.6	0.6	0.2	0.1
IMac/ Mac G3	0.6	0.1	0	0
Pre-Pentium (PC 386, 486)	9.3	6.9	0.9	1.2
Pentium I, II	17.1	10.7	2.7	5.5
Other	0	0.1	0	0.1

Table 1: Type and Location of Computer Access in Schools

Ninety-four percent of responding schools reported some form of Internet access ranging from dial-up modem to ISDN. The most common forms of connections were T1 or ISDN. Those schools without Internet access intend to hook up by 2002 or earlier. Eighty percent of the responding schools had a library/media center with at least one computer and Internet connection. Eighty percent of the respondents reported a computer lab, 72% of these were connected to the Internet.

We also wanted to explore school access to a variety of instructional equipment. The results are displayed as percentages in the Table 2. Please note that this information does NOT reflect quantities of equipment. Instead, it indicates whether the schools have access to equipment in a computer lab, an instructional room, or a library/media center. For example, a school might report access to a TV/VCR, but one TV and/or VCR may be shared among many rooms.

The majority of the instructional rooms have access to an overhead projector (78%), a television (82%), and a VCR (67%). More than 40% of the schools reported classroom access to some type of printer (42-46%). Nearly half of schools (49%) reported access to CD players instructional rooms while only 21% had access to a laserdisc player. There is very little access to digital cameras (4%), video cameras (9%), or fax machines (3%). Classroom communication equipment is constrained by very moderate access to cable TV/Satellite dish (24%), telephones (17%) and fax machines (3%). Graphing calculators were not widely available, although many of these skills can now be acquired using existing, available computers.

Understandably, a much larger percentage of schools reported access to various types of equipment in the computer labs and the library/media centers than in instructional rooms. Laser printers were more like to be available in computer labs (63%) and library centers (38%). Nearly half (45%) of the computers labs had access to scanners; approximately one third benefited from telephone access. Library/media centers afforded more access to communications equipment and image capture equipment: telephones (70%), cable TV/satellite dishes (48%), video cameras (34%), digital cameras (17%), and fax machines (4%). Percentages of access to scanners, TVs, and VCR were similar to corresponding classroom access figures.

There was no reported access to assistive or adaptive technology for instructional rooms. Only one school had assistive technology accessible in a computer laboratory. Two schools noted access within a library or media center. The ACE program will begin to address this issue as part of a new exceptionality initiative at the University of Notre Dame.

Percentage of Schools Owning Equipment: Types of equipment available by Type of room (Criteria: At least One Item of Equipment in at least one Type of Room)			
	Computer Labs (by %)	Instructional Rooms (by %)	(Library/Media Center (by %)
Fax machine	4	4	10
Laser printers Black /white	63	15	38
Other Black/white printers	48	42	40
Color printers	35	46	50
Computer Projection Devices	15	29	15
Graphing calculators	4	3	04
Overhead Projectors	28	78	56
TV	44	82	81
VCR	37	67	80
Scanners	46	23	23
CD Players	30	49	45
Laserdisc Players	11	21	15
Cable TV/Satellite Dish	15	24	48
Telephone	35	17	70
Video camera	13	9	34
Digital camera	2	4	17
Assistive/Adaptive Devices	2	0	4
Other	0	0	2

Table 2: Types of equipment available by type of room in Schools using ACE pre-service teachers.

As may be seen in Table 3, virtually all schools reported access to extensive integrated software packages such as Microsoft Works, Microsoft Office, ClarisWorks, etc. Approximately 25% of the schools also reported access to word processing applications in computer labs, instructional rooms, library/media centers, and administrative offices. A smaller percentage reported access to presentation, database, or spreadsheets instead of or in addition to integrated software packages. Overall, 24% of the schools indicated access to at least one hypermedia application such as Hyperstudio in their computer labs. Only 16% of secondary schools, however, reported access to a hypermedia application.

Percentage of Schools Reporting Software Titles in at least One Room By Category of Software Applications by Kind of Room				
	Computer Labs	Instructional Rooms	Library/ Media Center	Offices/ Administrative
Integrated software	90	76	88	98
Word processing	29	24	31	29
Presentation	20	12	10	10
Database	24	12	14	28
Spreadsheet	24	12	16	28
Hypermedia tools.	24	2	8	4
Image Manipulation	28	8	8	22
Reading software	47	45	41	4
Science software	39	41	24	6
Math software	39	51	24	4
Other	8	8	6	0

Table 3: Percentage of Schools Reporting Software Titles in at least One Room

28% reported access to image manipulation software in computer labs. Nearly half of the schools reported that computer labs and instructional rooms had one or more software titles for mathematics, science, and/or

reading (range of 39%-51% by type and location of software.) These elements, in conjunction with evaluation of relevant technology trends across the nation and a review of pertinent literature, will be incorporated into a cumulative needs assessment report. Since 46% reported access to scanners in the computer labs, it would appear that the respondents might not have considered the software applications that usually come bundled with the scanners.

Conclusion

We expect to further define and explore the acquired survey data by identifying and aggregating appropriate combinations of variables. These elements, in conjunction with evaluation of relevant technology trends across the nation and a review of pertinent literature, will be incorporated into a cumulative needs assessment report. Some aspects of needs assessment are already under consideration.

- The introduction to educational technology should be tightly focused on immediate usability, given the brief, intense duration of their summer training component. Wherever possible, short-term assignments should be coordinated with other faculty to reinforce and model integration of technology into the curriculum. One project and/or several substantial assignments, due after the ACE students have initiated their professional practice, would reinforce and enrich their summer introduction in technology.
- Given the preponderance of the PC platform, it appears prudent to focus additional hours in technology instruction to develop their skills on the PC platform. To assure that students can function on whichever platform available to them in their assigned schools, we will continue to provide crossplatform training. Since the integrated software applications are nearly ubiquitous, pre-service teacher training might be best served by focusing on the goals of teacher productivity and methods for integrating word processing, spreadsheet, database, and presentation software into the curriculum.

Additional efforts will include recommendations for hardware, software and procedural modifications relevant to technology and its integration across the curriculum within the ACE program. We plan to share our findings to date with peers and colleagues at the Site 2000 conference and invite their comments, suggestions, and constructive criticism.

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CTER OnLine: Providing Highly Interactive and Effective Online Learning Environments

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Abstract: New computer and network technologies have opened the possibilities for practicing teachers across the world to update their teaching skills and engage in lifelong learning activities. Online courses and programs are growing in number, yet some early reports have stated that students are not satisfied with the quality of these courses. Many colleges and universities are recording lectures; transferring their syllabi and multiple choice tests to the web; and expecting students to listen, read, and learn with little instructor feedback. Using a different, highly interactive model, faculty at the University of Illinois created an online Master of Education program. We will report on this model, including an in-depth evaluation of its effectiveness in providing an online learning environment for practicing K-12 teachers and administrators.

Introduction: CTER OnLine

Beginning in the summer of 1998, the College of Education at the University of Illinois revised several graduate level courses into an online format and currently provides practicing teachers the opportunity to complete a Master of Education degree that focuses on Curriculum, Technology, and Education Reform (CTER). http://cter.ed.uiuc.edu A series of eight courses taken over a two-year period includes topics such as: (a) Using technology in a classroom setting, (b) Revising curriculum to include the use of technology, (c) Addressing issues related to classroom management, ethical, legal and school policies dealing with educational technologies, (d) Assessing and evaluating the use of educational technologies, and (e) Changing classroom and school practice to enhance learning. In this paper, we report on the process of developing highly interactive and effective online learning environments.

A combination of synchronous and asynchronous technologies is used in these courses. Course descriptions, syllabi, grading procedures, student participation and expectations are available on the web. A variety of communication tools have been used depending on the type of interaction needed. At the present time, instructors use the WebBoard® conferencing system for asynchronous discussions and synchronous chat sessions. Individual email and group reflectors are also used for one-to-one or one-to-group correspondence. RealPlayer® is used to stream audio and video files. Text translations of audio files are provided for hearing impaired students. Audio narrated PowerPoint® presentations have been created for some topics. TappedIn, a multi-user object-oriented environment (MOO) coordinated by SRI, International provided interactions between the CTER students and educators across the country. A specialized tool, known as CTERbase/TEbase, was developed to help faculty provide individual feedback to students, grade assignments, and publish exemplary work on the web (Levin, Buell & Levin, 1999). In each course, the instructor first determines the type of interaction he/she wishes to have with the students then picks the technologies that best handle the interaction.

CTER OnLine instructors combine multiple methods of instruction to enhance student learning (Levin, Levin & Waddoups, 1999). The framework developed for online asynchronous discussions allow students flexibility to participate on their own time. Students currently teaching in K-12 and college settings are given the opportunity to implement their coursework into their classroom practice. Simulations are used to provide experience when dealing with sensitive topics and issues. Various grouping arrangements have allowed students to learn from one another. These multiple instructional methods have

been used to also demonstrate how current theories of learning can be incorporated into educational practice. Indeed, many students have incorporated these methods into their teaching practice.

Dimensions of Effective Online Teaching and Learning

The dimensions of effective online teaching and learning have been developed over the two-year-long formative program evaluation. Data has been collected from all students including pre- and post-surveys and university course evaluations. Case studies of four students were also conducted during the same period, and included interviews, site visits to the practicing teachers' classrooms, and collection of their electronic communication and completed assignments. Many have discussed the need to address issues of quality and effectiveness of online teaching (Campbell, 1997; Findley, 1997; Powers, 1997). We think the dimensions of effective online instruction are particularly relevant for providing educational opportunities for K-12 teachers, but perhaps have wider application.

Relevant and Challenging Assignments

We have found that students in an online program have more of a consumer orientation. Repeatedly, students ask that the assignments, discussions, and readings be relevant to the work they are doing in their schools and classrooms.

One of the hallmarks of good teaching, regardless of medium, is helping students connect learning to their lives. Relevance is important to the students in the CTER program because they are practicing teachers who see their participation in this program as an extended professional development opportunity. Relevance in the online context should be thought of as helping teachers prepare curriculum and develop practices directly relevant to their teaching while also expanding their ideas about what is and should be considered relevant in their professional practice.

The most popular instructional activities in the CTER Online program are the assignments that ask students to create curriculum projects that can be used immediately in their own classrooms. Survey and interview data indicated (81% or 18/22) that the projects they developed or evaluated for their own professional practice were the most useful. This captures the idea of relevance in its most basic form.

One course in the CTER sequence focused on educational reform. In this course, small groups of CTER students worked together to write proposals to implement some form of educational change in their school or district. One group of students working at the same school put together an implementation plan to create a community school. The objectives of this plan included "creating a learning center to involve parents, students and community members coming together to enhance the neighborhood ties". They continued: "Our newest project will be the creation of the Publishing station. Students, faculty, community members, and alumni at this elementary school will write and publish their created books. Each book published at the publishing station will become a permanent part of the elementary school library. This is just one of many examples of how CTER students created curriculum activities in their CTER courses that they immediately implemented in their own classroom and school.

Additional evidence of quality in online instruction can be found when students expand their notions of what is relevant to their professional practice. The Internet provides a particularly helpful environment for connecting practicing teachers to other educators to collaborate on ideas that are relevant for K-12 teachers.

Many teachers in the CTER online program were initially content to focus on curriculum projects for use in their classrooms. However, in the CTER Online program we have provided them with opportunities to engage in activities that have expanded their notion of what is relevant for their teaching activities. Assignments are not relevant simple because teachers can use them in their classroom, but because teachers can see that engaging in the assignment will provide an opportunity to engage in practices and develop skills that may be relevant for a teacher's professional practice. In the CTER Online program, we have included assignments that are not directly applicable in the classroom, but engage them in learning activities that extend their thinking of what it means to be a teacher.

An example of expanding the notion of relevance can be found in a simulation that was used in a course about Ethical and Policy Issues in Information Technologies. A fictitious student named Suzie created webpages containing materials that would be considered improper for a school setting. CTER students were asked to reflect on how they would handle the situation and to discuss issues raised with their

peers. While controversial at times, the activity heightened their awareness of information on the Internet and its potential impact on a school setting. For their final project, students developed a set of Educators' Guides on a number of issues centrally affecting the ways in which new information and communication technologies are changing schools today. The topics include: Access Issues, Credibility and Web Evaluation, Free Speech vs. Censorship, Privacy, Commercialism, Intellectual Property, Copyright, and Plagiarism, and Computer Crime and Technology Misuse. These guides are available online at: http://lrs.ed.uiuc.edu/wp/.

Constructing seamless online learning environments

In addition to relevance, students expressed the desire for classes that are clearly organized so they do not have to search for the assignments and wonder whether they are following the schedule. This is particularly important in online courses, because students can follow the class only to the extent that there is a relatively clear structure that has some level of cohesion. What this typically means is making it more explicit how the class fits together and making an overt attempt to address issues of organization to the students. Being more explicit can be as simple as placing dates throughout the syllabus instead of using more generic terms such as Week 1 or Week 2 and using consistent headers and terminology when using multiple software tools.

What we are suggesting is that a seamless learning environment is one in which the threaded asynchronous communication tool, the syllabus, and the homework completion system are connected. The first week's topic described in the syllabus should be directly linked to and easily identified in the asynchronous communication tool used for discussions for that week and instructions for the assignment should be clear and concise.

Another element of a seamless online learning environment is providing technical support. We have found that there are three levels of technical support needed in an online course for both faculty and students: development, training and ongoing support as shown in Table 1.

Levels of Support	Faculty Support	Student Support
Development	Deciding which tools are most appropriate to use in the course and assisting in the development of the course in an online format	
Training	Initial training in how to use the tools	Initial training in how to use the tools and access course content
Ongoing	Assistance when using some communication tools	Technical support with access, hardware and software issues during courses through email, telephone, and voice mail.

Table 1: Kinds of technical support for faculty and students to create seamless learning environments.

First, there are a number of decisions that an instructor faces when moving to an online environment. The instructor must consult with other instructors and technical support staff on which tools are currently in use and which would be most appropriate for the type of course offered. Once tools are selected, an instructor must gather and create the course materials. Often, technical support staff is needed to convert files from one format to another, digitize video and audio segments, transcribe audio files for students with hearing disabilities, and create usernames and passwords for student access. We have found that online students tend to have more of a consumer mentality and ask to see all course materials available at the beginning of the class so that they may pace the workload according to their own schedules. This is very often different than the way most university professors prepare for face-to-face instruction normally done just prior to each class meeting. Not only are professors changing the way they prepare and teach, but also they are learning how to use these new tools. This preparation and training takes a considerable amount of time.

Instructors also need ongoing support when using some of the latest technology tools. When audio or video streaming is used, technical support staff must be available to set up equipment, manage the cameras and microphones, and be on-hand in case of a technical failure. Even when synchronous chat is

used, the instructor is busy discussing course content and relies on the support staff to handle other questions through a "whisper" command that provides private conversations during a chat session.

Students also need to learn how to use the software tools that will be used throughout the program. For CTER OnLine, this support is initially provided in a face-to-face orientation meeting just prior to the beginning of the first course. Technical support continues throughout the program dealing with a variety of issues from access to consultations about hardware purchases and software upgrades. This type of support is provided through a combination of email, a technical support help line, and voice mail that can be accessed by the support staff in the evenings and on the weekends. Providing technical support throughout the program is essential to handling day-to-day problems that arise with the use of technology.

Providing a seamless online learning environment also involves developing a sense of community between the instructor and students. If provided with some face-to-face interactions throughout the program, faculty and students get to know one another on a more social level which alleviates the sense of isolation that is often felt in distance education courses.

Providing adequate and timely feedback: Teacher-student interaction

We have found that providing adequate and timely feedback to students is another important element of online teaching. Because students are remote, it is important to develop mechanisms that provide feedback to students on their progress. There are three levels of feedback that are necessary in the online classroom. These include online office hours, instructor response to individual and groups work, and feedback on individual assignments. To successfully provide these layers of feedback in the online course the instructor must have, or develop, a good facility using different types of communication technologies.

Conducting online office hours is one way in which student-teacher interactivity can be accomplished. In the CTER Online program, we have utilized two-way synchronous chat spaces and a combination of one-way streaming audio used by the instructor and synchronous text chat used by students for the purpose of office hours. Office hours are used as a time for students to interact with the instructor in real-time, to ask questions about the assignments, or to clarify a topic in the readings. While the questions tend to be specific, the entire office hour is archived and all students can view the chat discussion at a later time. Students have responded that the consistent use of online office hours has helped them feel more connected with the instructor.

We have noticed two patterns of instructor response related to individual and group assignments and discussions. One form could be described as just in time response and the other as archived response. Just in time response refers to the instructor responding to individual assignments or discussion messages from students as they occur in the ongoing discussion. Archived response is used when the instructor reads all the students messages (for the day or week), then replies to the entire class in one message addressing the points he/she would like to make.

Instructors provide individual feedback on student assignments through a specialized tool we developed called CTERbase. Students submit their assignment or enter a URL pointing to their assignment, and the instructor can review and reply back to the student on what they might want to consider changing before submitting the final version. Instructors can also provide feedback in a more public forum, like WebBoard, so that all the students can see the instructor's comments and modify their work accordingly. This second method of instructor feedback is more efficient for the instructor by providing adequate feedback for students, however, some students have reported their preference for individual feedback.

Constructing rich environments for student interaction

Another indicator of quality in an online course is the creation of highly interactive learning environments for interaction between and among students. In the CTER Online program we have used a variety of methods to organize group and one-to-one student interactions.

Three methods we have used to form groups include student-selected, topic-selected, and instructor-selected groups. Each method offers both positive and negative results. Student-selected groups allow students who know one another or work in close proximity to work together on group activities. When students are able to choose their own groups, they have arranged meetings at a member's home or

local pizza restaurant to work on assignments. On the other hand, students who are constantly given the chance to self-select group members tend to pick friends or individuals they know which actually narrows their scope of learning, minimizing opportunities to share ideas with students in other geographic areas. Some instructors have allowed students to choose a topic of interest and formed groups based on that topic. Depending on the course content, topic-selected groups can produce a mix of interests among the group members or narrow their scope of learning as in the self-selected group. Instructors have also assigned members to groups to ensure that each group have a particular mix of interests. While this grouping method can provide a wide range of expertise among its members, it can also lead to more tension or personality conflicts. We have found that using different methods for selecting groups throughout the course provides a good opportunity for students to work with different students to minimize negative group dynamics.

To maximize communication in an online environment, it is important to provide online conferencing space or conference call opportunities for each group to communicate among themselves. Instructors can provide simple group assignments in the beginning that build upon subsequent assignments and become more challenging toward the end of the course. Another effective strategy includes heavy instructor involvement in group activities early in the semester with less involvement as time goes on.

Research on distance education has repeatedly pointed to a high drop-out rate related to students feeling isolated from a social setting (Keegan, 1980; Kember, 1989). We have attempted to address this issue by providing a number of activities that foster student to student discussion. Students enrolled in our online courses come to the university for a three-day face-to-face orientation prior to their first online course. This time is provided to train students to use the software tools needed to participate in the program while offering time for students to socialize and get to know one another. Students share common goals, strengths and interests with other classmates in face-to-face and online activities. Chat and online conferencing space is provided so students can interact on a social level throughout the course. Students are also encouraged to provide peer reviews throughout the program.

Fostering anytime anywhere teaching and learning

Many students registering for online distance education courses are interested in the flexibility this medium of education provides. Therefore, another important element of quality online instruction is the careful balance of asynchronous and synchronous communication--to foster anytime anywhere learning. For an instructor this means choosing the appropriate technologies for the task they are trying to accomplish. Indeed, the technology and task fit is an important principle for those designing and delivering online distance education courses. One model we have used successfully combines the use of asynchronous technologies to facilitate much of the classroom interactions and synchronous communication to facilitate small group interactions and course office hours.

Of course, the right balance between flexibility and the need for interactivity will vary with each course. In some cases, an instructor may use all asynchronous communication for classroom and group communication and limit synchronous interactions to online office hours. At other times, weekly real-time video or audio conferencing may be most appropriate for the topic.

Another consideration to anytime, anywhere learning can be described as anytime, anywhere teaching. Both synchronous and asynchronous communication can be accomplished effectively by instructors regardless of location. This is most evident when instructors travel to conferences to report on their research instead of providing a substitute instructor for the course. They can now pre-record an audio or video presentation for the students to view at their convenience. With a laptop computer and telephone line, instructors can continue to respond to student email or online discussions away from their office. In addition, these new technologies offers the flexibility universities sometimes need to hire adjunct faculty to teach online courses or more easily involve experts in a particular field to participate as a guest lecturer or discussion participant.

Conclusion

The Internet and communication technologies provide educators with a wide array of educational tools to create highly interactive and effective learning environments. The question for many is how best to utilize these technologies. In this paper, we have reported one model for developing an online learning

environment that promotes high levels of interaction among K-12 teachers as they learn to integrate technologies into their classrooms. We have suggested that there are many issues to consider including making assignments relevant to teachers' experiences, constructing seamless learning environments, providing timely feedback, creating rich environments for interaction, and providing for flexibility by fostering anytime anywhere teaching and learning. Paying attention to these dimensions has led to the creation of robust learning environments for K-12 teachers to become leaders in the use of educational technologies in their classrooms, schools, and districts.

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Using WebCT to Extend Learning in Graduate Educational Technology Courses

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Abstract: This paper examines the use of WebCT in two graduate level Educational Technology courses. The paper briefly describes the content of both courses and the ways in which WebCT was used in each course, and the reasons for that usage. Data on how WebCT has enhanced or extended the learning of course material has been collected from reflective e-mail responses from all the students in the Fall 1999 class, from bulletin board postings, and from taped interviews with three students who were registered in both classes. This data has been interpreted to address specific features of WebCT responsible for this enhanced learning. Of particular interest is whether WebCT is an effective learning tool and medium by which and through which graduate students can more effectively learn course content.

What is WebCT?

WebCT (or Web-based course tools) is a software program that generates a course template. It is especially useful for busy professors, to enable them to create "sophisticated web-based learning environments" (http://www.uregina.ca/webct/facultyintro.html page 1). WebCT can be used as a complete on-line course, with no face-to-face contact, as in the WebCT version of Math 101 at the University of Regina (see http://www.math.uregina.ca/MathOnline/) or it can be used as a course supplement. The WebCT program has a variety of tools, divided into four main groupings (communication, study, personal account information, and quizzes and surveys). People developing courses using WebCT select the tools they require for their course. In both of the WebCT courses discussed in this paper, the major tools selected were the communication tools (bulletin board, private mail, calendar of course events, and on-line chat), in addition to icons for the course outline and course content.

Why Use WebCT?

My reasons for using WebCT in any form in two Educational Technology graduate courses are four-fold:

1. The provincial education department, Saskatchewan Education (http://www.sasked.gov.sk.ca/) is increasing its use of WebCT for distance education of classes in rural parts of the province.
2. I was part of a proposal in 1998 which received $24 000 to create an on-line version of Mathematics 101 (a first year mathematics course). I have followed the development of this course and the success of students taking this course (for more information on this course see Weston, SITE 2000).
3. A number of professors at the University of Regina are experimenting with different features of WebCT for course development.
4. The graduate students in my classes are mostly teachers or consultants and are likely to come into contact with a course being offered using the WebCT format, or they may wish to create a course using this format. They should therefore have some idea of the features of WebCT and of how to mediate the learning experience.

The First Education Technology Course

This course, offered in May-June 1999, can be located at http://webct.uregina.ca:8080/ Click on course listing, then on "Classroom Computers: Advanced" (the title of the course) and then enter guest as

user ID and password. This was a new course and was therefore run on an experimental basis; it included eight graduate and eight undergraduate students. Explored in this course were advanced features of Power Point, Internet searching, Hyperstudio, web design, how to teach in a one-computer classroom, how to use e-mail effectively in teaching, and so on. Students in the course were expected to create integrated curriculum projects using multiple multi-media tools, to regularly participate in bulletin board postings, to respond to numerous readings, to participate in the chat room, and to do class presentations.

An instructor-directed organization was visible throughout all the material posted on WebCT and most of the activity that occurred on WebCT. Students were given a user ID and password and accessed and used WebCT features only as students. All the content to be taken in the course was presented to the students on the first night. Their feedback was welcomed and any suitable modifications became a part of the course. All course content was organized into modules and posted on WebCT at the above address. Course readings were organized by module and distributed to students in advance. For each topic I created a forum for WebCT bulletin board discussion.

Within the above structure there was opportunity for students to exchange ideas, help and encourage each other, present to each other, learn from each other, and in general be a community learning together. WebCT, specifically bulletin board discussions, played a crucial part in this exchange of ideas. The boundaries between the graduate and undergraduate students merged. The undergraduate students excelled in their technology skills and in the creation of multi-media products. The graduate students excelled in their ideas of how to apply the technology to their classroom learning environments and in how to integrate the technology to the curriculum. Each group needed the other to attain a holistic idea of how to use technology effectively in classroom-appropriate ways. Each group was impressed with the knowledge base of the other.

Each week students formed reading groups (4 students to a group) and were responsible as a group for reading and responding to all of the readings. One member of each group was responsible for posting on the bulletin board a summary and critique of one reading assigned to the group. Others in the same group could respond to that summary and critique. Members of other groups could also respond. The articles for each week formed a topic and this topic was assigned a bulletin board forum; not only were the readings relating to that topic discussed, but the conversation among class members evolved to discuss the topic in more general terms. It was very exciting for me as the instructor to read and participate in the conversation of the different groups of students discussing a topic.

The Second Education Technology Course

The second Educational Technology graduate course was offered in the Fall 1999 semester. This course can be located at http://webct.uregina.ca:8080/ Click on course listing, then on "Internet and Curriculum Integration" (the title of the course) and then enter guest as user ID and password.

This course had a significantly different focus from the one offered in May-June. It was designed solely for graduate students who are familiar with basic computer-related technology skills and concepts, and their pedagogical appropriateness in the K-12 classroom. Specifically, the course was designed to explore effective and appropriate integration of the Internet into the curriculum. Students examined different ways in which the Internet can be organised, with frameworks such as:

- Virtual Architecture [the work of Judi Harris--see Harris (1998, 1999, and the Virtual Architecture website at http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/)].
- Virtual Environments [the work of Chris Dede -- see Dede (1991, 1998)].
- Filamentality [the work of Bernie Dodge and Tom March -- see Dodge (1995) and the original WebQuest home page at http://edweb.sdsu.edu/webquest/webquest.html].

Students explored these frameworks in order to develop a conceptual understanding of possible ways that the Internet can be effectively used in the classroom and integrated into meaningful curriculum-based activities. In conjunction with the above exploration students were immersed in learning theory, where they examined different learning theories such as:

- Cognitive apprenticeship and situated cognition (Lave, 1989; Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991)
- Communities of learners (Rogoff, 1994)

We also explored different world views about teaching and learning (e.g., objectivism and constructivism). From an examination of the world views and the theories, groups of students compiled charts which looked

at the world views and the theories according to the commonplaces in education--role of the teacher, learner, subject matter/content, and milieu (Schwab, 1978). Technology use was a part of each commonplace. The purpose of this exercise was to determine (1) if different views of teaching and learning would alter the commonplaces and affect how each commonplace would 'use' technology and (2) if we could see emerging a best use practice for using technology, especially the Internet, in pedagogically appropriate ways. For more information on this see Fulton, Couros and Maeers, SITE 2000.

WebCT, and the learning involved in creating pathways and posting topics, was an important but *secondary* part of the course. All students were expected to regularly access and use the bulletin board and chat room features of WebCT. In addition, all students were given instructor access privileges to the WebCT course. This enabled them to explore all the features of WebCT in the event that they may need to develop a WebCT course in the future. The students (in groups) were expected to create the content of one of the course topics, and, thereafter, to post it on the WebCT home page.

This course was not structured for the students in advance. At the beginning of the course (in September, 1999), the students and I examined the overview of the proposed course content with its emphasis on exploring learning theory and the work of Seymour Papert, Internet organizational frameworks, and critical literature. *Student input* into both the course content, and course development was *welcomed and incorporated* into the overall course structure.

I *mediated* both the structure of the course and the course content. I *enabled* (with some expert assistance) students to post topics on WebCT. I distributed *some* readings appropriate to topics studied, but they also brought readings. Readings for future topics were discussed in class and each person responsible for any reading explained the purpose of the reading and if and how a summary and response would be made. Some *external experts* related to some of the course topics were invited to share their work with us. We also heard from *students in the class* who are experts in their work. The sharing of this expertise was encouraged by *everyone*. It is important to note that students recognized and celebrated this individual expertise and learned from each other. The students (in groups) created and posted course content modules on WebCT (this will be completed by the end of the Fall 1999 semester).

Investigating the Use of WebCT in the Above Courses

Because I had used WebCT in different ways in each course I was interested in finding out how students had learned through the different WebCT organisations. I designed a questionnaire which was e-mailed to all students in the Fall 1999 class, asking them about how WebCT as an element in the course enhanced their learning of course content. I also interviewed three students who were registered in both classes and I examined bulletin board postings for any indication of how the actual process of using the bulletin board affected learning of course content. In addition to these procedures I also had my own notes on the use of WebCT in each course. All the above information was examined for recurring themes that related to the use of WebCT. These themes are outlined below. Unless otherwise indicated all comments relate to both classes.

Findings

Skill Development

Some of the Fall 1999 students initially experienced frustration with the skill component of accessing and using WebCT. This frustration related to locating the part of WebCT they wanted to use, reading, responding to, and posting 'articles' on the WebCT Bulletin Board, and to creating and posting the course content There is a steep learning curve in using this course tool technology. Although the students realized that WebCT was being used as a course supplement, and the focus was not on learning *about* WebCT, the students felt that more skill-based modules about *how* to use WebCT features would have been beneficial. University experts on the use of WebCT came to class and took us through a summary of how to use WebCT as instructors, and how to create and post course content. For most of the students, this instruction came too early and was presented too quickly. When it came time to 'post' course content material they had forgotten most of the earlier instruction.

Course Content Modules

As stated above, the actual posting of the course content modules proved to be a difficult and somewhat frustrating experience for most of the students. But, once posted, everyone appreciated having the entire presentation of the content, and all of the links, available at one place on the WebCT homepage. All the WebCT content postings looked professional and contained up-to-date and very interesting material. Most students reported that they have revisited the content modules and their corresponding links a number of times.

Bulletin Board

The class met every Tuesday from 4-8 p.m. Monday evening and during the day on Tuesday saw the most activity on the bulletin board each week for both classes.. Students in both classes stated that the bulletin board was their most popular feature of WebCT. All class members in the Fall 1999 class reported that their use of the bulletin board enhanced their learning of course content. The following are what the students reported as the main advantages of using the bulletin board. This information addresses the use of the bulletin board in both classes.

Fora and Organization

In the role of instructor students were able to create a bulletin board forum if one didn't exist; as students they could select an existing forum into which they could post their 'article.' Some students in both classes were avid composers, making comments in almost every forum and about every presentation. Others chose specific fora or specific 'articles' to respond to. Each group of students in the Fall class was responsible for monitoring one forum (the one created for the course module they created). Monitoring involved posting to the forum, reading and responding to other postings in the forum, and writing a summary of the 'conversation' of the forum. The students generally liked being in charge of a forum, but the fora were not all created at the start of the class. They were created at the time of the group module presentation. Thus, if a module was presented in mid November, there would not be as much 'traffic' in that forum as in others that had been created earlier. The discussion around the presentations was disappointing for the presenting groups in both classes, as it occurred mostly around the time of the presentation. Some students suggested that all the fora be created at the start of the class and that students be assigned a forum and be expected to post one 'article' to the forum very soon after the start of class. Another idea was to give the bulletin board more structure at the start of class and have each student responsible for a topic throughout the class. Although the articles were threaded, there appeared to be few main threads running throughout the course. Some students stated that some articles were quite long and perhaps should not have been in the bulletin board, but perhaps part of an 'article' pathway, or maybe have a separate forum for longer articles and even a forum for article summaries. The students said that at times the bulletin board was like a chat room to get to know each other, to ask (dumb!!) questions and that perhaps a separate chat area or more informal forum be created where students could conduct more informal dialogue. Other students felt that all the articles should be organized according to the forum most related to the article topic.

Time to read and Digest Material

All the students stated that having the bulletin board was a great comfort and anxiety-reducer. A lot of the course content material was new to the students, was controversial, exciting, dynamic and at times quite overwhelming. Being able to discuss the ideas in class, read about some of them in hard copy articles and/or electronic articles, and then having time to digest the material and respond to it on the bulletin board, and to read the responses of others, helped the students have a much deeper understanding of the material and a greater respect for the opinions of others.

Busy Lives--a Class Beyond a Class

All the students in the Fall 1999 class, and half of the students in the May-June class are teachers, consultants, or principals--very busy people. Some said that the bulletin board helped them to stay on top of things, keep up to date with what was happening in class, stay up to date with what others were reading (and thinking)--all at home in their own time outside of class hours. The class was like 4 hours on Tuesday and at least four more hours on-line, reading bulletin board comments and/or visiting websites recommended by classmates. The students were all very conscientious about keeping up with the bulletin board postings--it was almost like they didn't want to miss out on any part of the conversation about the

course content. One student reported "I find, especially at the graduate level, that a classroom discussion does not end after an hour--it does physically, but mentally it does not; my mind keeps on mulling over the topics that have been discussed. Using the bulletin board as a place for ongoing reflection, during the week (as opposed to only during class time), has extended/expanded the range of reflection. Further, I can respond to the reflections of others and add to the group discussion/reflection."

Clarify/Stimulate Thinking

Because much of the course content was new, and many new and quite different ideas were presented continuously, the bulletin board became the depository for at least a summary of the class content and offered the students a place to go to (at leisure) to review and reflect on the ideas discussed in class. One student reported "it stimulated many thoughts on how I would apply the learnings to areas within my own school and professional environment. The postings provided me an opportunity to spend some time reflecting on situations and events I was experiencing or had experienced in schools." Another student stated that "the bulletin board was a good way to keep conversations going between classes. It provided us a chance to 'clarify,' ask questions if needed, and to exchange ideas."

Sharing Websites, Books, Articles etc.

It was very difficult to take class 'notes' as new material and ideas were constantly being explored. Note taking would have resulted in missing part of the conversation. It very quickly became clear to the students that the bulletin board was the perfect environment to share great websites, new search engines, books that have been read and reported on in class, journal articles, sites with on-line articles, electronic journals, class power point presentations, and so on. Knowing that everyone would have immediate access to most of what was happening in class took the pressure off taking notes and enabled students to focus on understanding and thinking critically about what was being presented.

Learning from Peers

Most students reported that anything they posted on the bulletin board was an idea in progress to be shaped by responses from others. Some students felt uneasy about posting content that they did not feel completely grounded in and thus felt they were taking a risk in being challenged. All students found at least one topic that they felt comfortable with and knowledgeable about to post and respond to. The bulletin board became a place for all the students to read about what others have been reading and to learn from others. Individually, each student did a vast amount of background reading and research both for their course module and for their public presentation.

Bulletin Board vs Chat Rooms

Some students compared their use of the bulletin board to the chat rooms, and also to some experiences we had with Tapped-In, a virtual environment or MOO at Pepperdine University. While some (who are fast keyboarders) quite enjoyed the chat rooms, others stated that they much preferred the relaxed style of the bulletin board. One student stated "I found the chat line frustrating. I can't type, read peoples' comments, and think all at the same time. It was too rushed for my liking. I hate making mistakes in front of other people. The bulletin board is more my style where I can think about things and post it at my convenience." In both classes the chat room features were formally used on two occasions--in class, but the main advantage in having chat rooms is to use them when we are NOT in class. Students recommended that specific chat times could be established for discussions, and specific questions be posed.

Personal Reflections

In the Fall 1999 course, in retrospect, I made assumptions about the students' ability and interest in pursuing and using a variety of WebCT features with minimal help. As stated earlier, the purpose of this course was not to teach students how to use WebCT either as students or instructors; it was not to *learn* WebCT, but rather to *use* WebCT to learn. In the May-June course I created the WebCT content, with the assistance of an expert WebCT planner sitting beside me walking me through every step. The students used WebCT only with student privileges: they were not expected to post course content, create pathways, student lists, passwords, and so on. Because WebCT was new to all the students in the May-June class (and also quite new to me) I did spend some lab time teaching the students how to compose 'articles' for the

bulletin board--and assign these 'articles' to the appropriate forum, how to enter information in the calendar, how to access the course schedule, and so on. The student use of WebCT is not very difficult. But the instructor use is quite complex, even for the few features that we focused on. Having a number of 'instructors' working in groups, all working on different computers, in different locations, using different design software (e.g., Hyperstudio, Power Point, different websites) and then coming together in the lab to merge and post all their work proved to be a major undertaking. I have since discovered that many professors do not even attempt to create and post their own course material directly on WebCT. They usually create it on an Office application, perhaps as an HTML file, and then an 'expert' WebCT designer will upload that content and create the course in WebCT. It has become quite clear to me that if students are to learn how to use WebCT as students perhaps a number of short introductions to the use of various features is fine, but if students are to be expected to become familiar with a variety of tools as instructors, they need a lot of assistance at many points throughout the course. Naturally, the students all experienced some frustration when it came time to post their course content. One student reported, after reflecting on a WebCT presentation, "The initial explanation of how the WebCT worked was mind-boggling and gave me the feeling that I wouldn't ever know how to do anything on it. That discussion now (at the end of the course) would be quite a bit more useful."

For all the reasons stated above, students would not have had time to read everything that was discussed in class (thus summaries really helped), nor would they have had time in class to engage in the extensive and substantive dialogue that occurred on the bulletin board. At times this bulletin board discussion was fragmented as the students kept developing new areas of interest and new topics to discuss. Within the bulletin board feature of WebCT there was need for more initial structure and guidance for the students in how to start and maintain discussion on specific topics.

From the survey questions completed by the students and from the interviews with three students it is clear that the use of the bulletin board on WebCT played a crucial role in extending the learning of the content of the course. The students have a much deeper understanding of how technology can be meaningfully integrated into the curriculum and much of this understanding can be attributed to what they have learned from each other through the bulletin board.

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Targeted Instructional Staff Development Project: An Evaluation

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Abstract The goal of the professional development project was to facilitate the integration of instructional technology in the classroom. Twenty-five teachers in grades 3-5, from 9 different schools, participated. The project consisted of four workshop modules on technological training and five modules on development of interdisciplinary thematic units for integrating materials to achieve the Mathematics, Science and Technology, and English Language Arts New York State Learning Standards. Effectiveness of the project was determined by giving all participants a General Pre-test to determine baseline measures for each of the aspects of the Project and a General Post-test. Results indicated that the project was highly successful, although teachers did identify several limitations that need to be considered for future professional development activities.

Introduction

The Targeted Instructional Staff Development Project was a professional development project to facilitate integration of technology in the classroom. The ultimate goals were: to empower students to use technology in all phases of their education, to facilitate teachers as learners, and to achieve the New York State Learning Standards by developing interdisciplinary thematic units focusing on Mathematics, Science and Technology, and English Language Arts. At the same time, the project attempted to facilitate integration technology into the curriculum. The one-semester project consisted of nine separate workshop modules. See Bauder, Rossi, & Mullick (in press) for a description of three of the technology oriented modules.

The purpose of this paper is to describe the evaluation procedures used to determine the effectiveness of the project. Literature suggests that one major limitation of action oriented research has been the particular research designs employed. In 1997, Bauder, Carr, Mullick & Sarner reviewed research techniques employed in evaluating effectiveness of programs and found that few employed sound research designs.

As a result, the authors developed a set of guidelines for researchers that were adopted for the current study. A pre-post test design was employed. This design is particularly appropriate for assessing both formative and summative information. Because each subject acts as his/her own control it minimizes any random influences of extraneous factors and determines the effects of the project on changes between pre and post-tests.

Previous research by Ely (1990) and Bauder (1993) has shown that there are a number of conditions that facilitate or impede implementation of educational technology. An additional goal of the evaluation aspect was to determine the effects of the project on changes on some of these perceived barriers to integration of educational technology into the curriculum.

The Evaluation of the Project

All participants were given a General Pre-test to determine baseline measures for each of the aspects of the Project. Upon completion of the nine workshop modules, a General Post-test, consisting of many of the same items, was administered to the participants. These questionnaires provided summative information regarding the overall impact of the various modules on teachers' responses. In addition, pre-test and post-test questionnaires were administered for each of the individual modules. The individual results were used for formative information and allowed the procedures and information being presented in each of the modules to be monitored. The results were also used to refine the activities during the modules and to refine questions asked on subsequent surveys. Only the results of the General Pre and Post-tests will be presented in this paper.

The Questionnaires

The Pre and Post questionnaires had four common parts. Part I contained demographic information and examined frequency of use of hardware and software, perceived importance of these technological aspects in achieving the New York State Learning Standards, and the teachers' degree of comfort in using each of the items. Part II examined teachers' experience with technology including the use of technology in the classroom and the specific activities for which students used technology. Part III examined the extent to which teachers integrated technology into the classroom and Part IV tapped teachers' perceptions of barriers that impeded integration of technology into their classroom instruction. The Post-test included a final section that asked teachers to rate each of the modules on three dimensions. These responses provided an overall summary of the teachers' experiences throughout the project.

Results

Demographics

Twenty-five teachers from 9 different schools participated in the Targeted Instructional Staff Development Project. Of the 25 teachers, 80% were females who taught grades 1 through 5. The minimum number of years of teaching was 1 and the maximum was 30 with an average number of years of 12.84. Approximately 82% of the teachers had five or more years of teaching experience. Therefore the participants were relatively experienced teachers.

Pre-Post Changes to Determine the Effectiveness of the Development Modules

Part I : Frequency of Use and Degree of Comfort Working with Hardware and Software

For summary purposes, Total Indexes were developed by summing the ratings for the subsets of items related to frequency of use of hardware, frequency of use of software, comfort in using hardware and comfort in using software on both the pre and post-tests. Table 1 shows the average scores for each Total

Index. In general teachers rated the items higher on the post-test than the pre-test. The only exception was average comfort in using the hardware items. For that item, the average on the pre-test (52.00) was higher than on the post-test (49.96).

		Mean Pre-test Index	Mean Post-test Index
Frequency of use of	Hardware	32.09	47.87
	Software	47.22	69.87
Comfort in using	Hardware	59.48	49.96
	Software	52.00	84.30

Table 1: Mean scores for the indexes for total frequency of use and total comfort for hardware and software items.

To examine the data more fully, t-tests for dependent (paired) samples were performed using the Total Indexes as the dependent variables to determine if significant changes in teachers' responses occurred as a result of their participation in the project. The findings from the analyses of the t-tests for the Total Index for frequency and Total Index for comfort of use of hardware and software are displayed in Table 2.

Post test – Pre test	Mean differences	t	df	Sig. (2-tailed)
Total frequency of use of hardware	15.78	6.76	22	.000**
Total frequency of use of software	22.65	5.33	22	.000**
Total comfort of using hardware	9.52	1.73	22	.098
Total comfort of using software	32.30	7.32	22	.000**

** $p < .01$

Table 2: Summary of the t-tests for dependent samples on changes on indexes for total frequency of use total comfort in using hardware and software.

These results show that comfort ratings for using both hardware and software, were higher at the completion of the project than at its onset. Only one t-test failed to achieve significance. The t-test for changes in the teachers' overall ratings of level of comfort in using the hardware was not significant. This finding is not surprising in light of the fact that the types of hardware used during the project tended to be the same types that teachers reported having experience with prior to the project. However, it is important to note that their frequency of use of hardware did significantly increase by the completion of the project.

Part II: Changes in Experience wit Integrating Computing into the Classroom

Changes in responses dealing with experiences involving technology in the classroom yielded similar results. All of the t-test achieved significance. These results indicate that teachers believed they were better able to implement technology into their curriculum at the completion of project. They also believed that they were better able to integrate technology into their curriculum and into specific units, guide students in the use of technology and, at the same time, accommodate different levels of expertise. In addition, teachers were better able to relate technology to curriculum objectives and to student achievement. Finally, the teachers indicated that upon completion of the project, they felt more confident in developing materials for student management using instructional technology and in preparing materials to be used by students in the classroom.

Part III: A Comparison of Perceptions of Teachers Use of Computers in the Classroom Compared to Students

Part III of the Post-test compared teachers' perceptions of frequency of various activities involving the use of technology in the classroom by the teachers themselves and by their students. Teachers believed they used computers more frequently compared to their students for organizing and storing information, for e-mail and for retrieving information from the Web. However, no significant differences are perceived between teacher and student use on text editing, creating non-visual graphics, developing Web pages and performing calculations.

Part IV: Changes in Perceptions of Barriers to Integrating Technology into the Curriculum

Part IV of the post-test was designed to examine the teachers' perceptions of some of Ely's (1990) factors that impede their ability to integrate technology into the classroom. In addition to examining changes for each of the individual factors, a Total Index of Perceived Barriers was developed for both the Pre and Post-tests. The results of the t-test analyses in Table 3 indicate that participating in the project did significantly effect the teachers' perceptions of the extent to which the factors act impediments to integrating technology into the curriculum.

All of the analyses yielded significant results, except for one. In the pre-test teachers believed that Technology integration is a high priority within their school and therefore did not act as a barrier to integrating technology in to the classroom. The result in row 6 of Table 3 supports this perception. Even after participating in the project, teachers still perceived their school's commitment to integrating technology as a minimal barrier. In all other cases, the perceptions of degree of impediment of integration of technology into the classroom significantly decreased. This change in perception may have occurred because as teachers gained more confidence in their abilities to work with hardware and software and as they learned new ways for integrating technology into their curriculum, they also perceived these factors as less of an impediment.

Perceived barrier Post – Pre test	**Mean Difference**	**t**	**df**	**Sig.(2-tailed)**
Not enough or limited access to computer hardware	-4.09	-7.27	22	.000**
Not enough computer software	-3.57	-6.16	22	.000**
Lack of time in school schedule for projects involving technology	-3.83	-5.76	22	.000**
Use of technology not integrated into curriculum documents	-2.87	-4.33	22	.000**
Not enough teacher training opportunities for technology projects	-3.83	-7.57	22	.000**
Technology integration is not a school priority	-.61	-1.14	22	.256
Difficulty in finding substitutes in order for teachers to attend training	-3.87	-5.86	22	.000**
Lack of technical support	-1.57	-2.37	22	.027*
Lack of instructional support	-1.78	-3.19	22	.004**
Lack of other supporting materials	-2.78	-4.49	22	.000**
Total Index for Perceived barriers	-28.91	-9.13	22	.000**

***** $p < .01$***
**** $p < .05$***

Table 3: Changes in perceived barriers after completion of the project.

Part V: Overall Evaluation of Each of the Modules of the Project:

In order to obtain summative information for the impact of each of these individual modules the last part of the Post-test asked teachers to evaluate each of the models by: giving an overall favorability rating to each, indicating the extent to which they believe that each Module would be beneficial in achieving the New York State Learning Standards and, indicating the extent to which they expected to apply information from each of the module in their future classes. These responses provide an overall summary of the teachers' experiences throughout the project.

The results show that teachers had a favorable impression for each of the modules. On a nine-point scale where a rating of 9 indicates high favorability, the average rating ranged from 6.48 to 7.88. The average ratings of the extent to which teachers' believed each of the modules would help to achieve the New York State Learning Standards were also highly favorable with mean ratings ranging from 5.84 to 7.6. Ratings of the extent to which the teachers expected to apply information from each module in their future classes showed a similar pattern of results. The mean rating for each module ranged from 6.4 to 8.0. In all cases,

Three separate Analysis of Variance analyses for repeated measures using teachers' overall ratings for the modules as the within-subjects using the overall ratings were performed. None of these analyses achieved significance. These findings indicate that although the teachers' overall ratings of the individual modules were not significantly different from one another. All modules were rated consistently high.

Overall Evaluation of the Entire Project

Three items were included in the General Post-test to assess the respondents' overall evaluation of the entire project. On the item that asked them to indicate the overall evaluation of their experiences in the entire Targeted Instructional Development Project, the average rating was 8.70 out of a possible 9.0. When asked if the teacher would recommend this project to their colleagues, the average rating was 8.65. The final question to determine the overall evaluation of the project asked teachers to indicate the extent to which they agreed or disagreed with the statement "If given the opportunity, I would participate in a project like this again". The average rating for this response was 8.35 indicating a strong degree of agreement. Taken together, these results clearly indicate that the participants had very favorable experiences in the project and believe that the knowledge and information they gained will be helpful to them in integrating technology into the classroom. The results also indicate that teachers would be willing to participate in similar projects in the future.

Open-ended Responses

On each post-test, teachers were asked to indicate the single most valuable feature of the module/project and the weakest feature of the module/project. A review of these statements indicate that teachers liked the interaction with other teachers, hands-on activities, learning strategies for integrating technology into the classroom and the ability to create materials that could be used in subsequent classes. The most common responses regarding the weakest feature tended to focus on lack of technical support; lack of equipment, connections and software; and the feeling that there was too much material covered in too short of a time period.

Conclusions:

The Targeted Instructional Staff Development Project was highly successful. The analyses of the results of the questionnaires indicated that the experiences of the participants were indeed favorable and that the project had a significant impact on the teachers' ratings.

There were three major sets of findings. First, the teachers' responses indicated that as a result of participating in the project they were using both hardware and software more frequently in their classrooms than they had prior to the project. Second, teachers believed that these activities helped them to learn new ways to integrate technology in the classroom and they felt more confident in using technology themselves and in guiding their students in the use of technology at the completion of the project. The third major finding was the significant change in perceived barriers to the integration of technology in the classroom. Factors that had been perceived as barriers prior to participating were seen as significantly less of an impediment as teachers gained new experience and knowledge about technology and learned new strategies for integrating technology into their curricula. This finding is particularly interesting since few of the activities within the project addressed the perceived barriers directly.

The duration of this project precluded the opportunity to conduct a long-term follow-up to determine if changes actually were integrated into the teachers teaching strategies and lesson plans. However, the Post-test did ask teachers about their future intentions of implementing these changes. Teachers indicated that they expect to apply the information they learned in their future classes. They also indicated that they not only would be willing to participate in similar projects in the future, but they also would be willing to act as resource persons to other teachers in their school.

Participants did identify several limitations of the project. Specifically teachers felt that the activities were too concentrated and there was too little time to deal with the material adequately. They also indicated that a severe limitation to integrating technology in the classroom is the lack of technical support when they returned to their schools. Finally, they felt that a major problem to participating in the project was the difficulty in finding substitute teachers to free them up from their classroom obligations. Future projects should therefore address these concerns.

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Designing Learning Practices as Professional Development for Teacher Educators

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Abstract: Since 1997 the Amsterdam Faculty of Education (EFA) has the status of experimental teacher-training programme. To support the experiment several research projects take place, aimed at providing the EFA with data that can guide the innovation process. As part of one of these projects a model is developed that can support teachers in developing innovative learning environments. The function of the model is bipartite. It is expected that the use of a model will lead to the development of learning environments that correspond to the innovative ideas of the EFA and at the same time fulfil a role in the professional development of teacher educators. In the study a method of development research is used. In several cycles of development and formative evaluation a definitive design model will be developed and tested. In this paper the specifications for the design model and a description of a first prototype are given.

Introduction

In 1997 the Amsterdam Faculty of Education (EFA) was awarded the status of experimental teacher-training programme by the Dutch Minister of Education. In the same year the institute started to develop and implement a new dynamic curriculum to replace the traditional static curriculum. Important parts of the dynamic curriculum are Learning Practices (LP's). LP's are learning environments in which students develop competencies essential to the teacher profession. In LP's students independently accomplish complex authentic tasks that must lead to a meaningful product. EFA has named this approach *productive learning*. Anticipating the importance of Information and Communication Technology (ICT) in the future profession, all LP's have an ICT component. Furthermore it is important that an LP consists of more than only physical facilities. It should contain the main characteristics of the professional practice, such as, feeling responsibility for the quality of your work, a necessity to work together in a group, the need to search for new information and a stimulus to call upon expertise (Wielenga, 1998). In the vision of EFA the dynamic curriculum must enable students to shape their own learning processes. The students must also have more freedom to organise themselves the evidence they want to present to prove that they possess the necessary teacher competencies. It is expected that the dynamic curriculum, will enable EFA not only to respond more accurate to the rapid changes in the field of education, but also that student teachers will be better prepared for their teaching careers (Dietze, Snoek & Wielenga, 1998).

From the start the EFAs' teaching staff has been involved in the innovation process. The opportunity was given to all EFA teachers to participate in developing the new curriculum. For this reason the Expertise Centre for Curriculum Development (ECCD) was set up. During one or two months a year members of the teaching staff are relieved from their teaching duties and can dedicate this time to the design and development of

LP's. EFA sees the development of LP's as a learning process in itself and an opportunity for the teaching staff to obtain a broad variety of new knowledge and skills. For the development of *Learning Practices* the ECCD provides technical facilities and technical support. Further, the centre creates opportunities for teachers to acquire new knowledge and skills by organising workshops and training. Until now especially the development of ICT- skills was given attention because these skills were new to most of the teaching staff.

Since the start of the innovation dozens of LP's have been designed and developed by teacher-educators. However, formative evaluation revealed that some of the LP's, developed by teacher educators, show little resemblance to the concept the EFA aimed at, at the start of the innovation. The researchers also noticed that interviewed teachers-educators had not had sufficient opportunities to learn during the developing process (Voogt, Odenthal, Taks & Otter, 1999).

Both problems are not unique for the EFA, but have been reported before. A changing view to education together with the aspiration to integrate ICT in the classroom urges teachers to develop learning situations that differ considerably from traditional classroom teaching (Sandholtz, Ringstaff & Dwyer, 1997). It appears that teachers underestimate the complexity of developing such learning situations. As a result learning situations not always possess intended and necessary innovative characteristics (Voogt & Odenthal,1999; Voogt, Odenthal, Taks, Otter, 1999). The second problem reported is connected with the method of professionalisation that EFA employs. The concept shows similarities with action learning, a form of action research, which is based on the notion that we learn from our experience through cycles of reflection and action (Brook & Watkins, 1994). Revans (1982) defines action learning as learning from and with peers while tackling real problems. A condition for actual learning by solving problems is that there must be an equal emphasis on both learning and doing. In practice however the emphasis is more on solving the problem and therefore on doing. Also people do not know innately how to learn from their experience and should be supported with it (O'Neil, & Marsick, 1994).

In this study a combination of an instructional design model and an action learning model is developed and tested. In the first part of the study the emphases is on the development of an instructional design model that fits the needs of teachers-educators developing innovative learning environments with ICT. In the second part of the study the main focus is on combining action learning with the design model.

The Study

In the study the method of development research is used. In development research a researcher works with a group of practitioners to define a problem, and then experiment with potential solutions to the problem. Data are collected on the results of the experiment and fed back to the group. If it is determined that the solution was not successful, the researcher together with the practitioners redefines the problem, further experiments are developed, and again and again the group cycles through this process of experimentation and reflection. The main role of the researcher is to guide data collection and analysis (Brook & Watkins, 1994). The research method of development research ensures that outcomes are useful to the practitioners and is seen as tool to support the implementation of complex innovations. The desired result of a development research is twofold,
(i) development of prototypical products, including empirical evidence of their quality;
(ii) generating methodological directions for the design and evaluation of such products (Van den Akker, in press).

This study will concentrate on product development, in this case an LP design model. The study consists of four phases. In the first phase exploration of the context leads to accentuation of the definition of the problem and specifications for the design model. Methods of data collection in this phase are study of literature, interviews with teachers-developers of the EFA, interviews with ECCD staff and evaluation of LP's. In the second phase of the study a first prototype of a design model is developed on the basis of specifications defined in the first phase. This prototype will be revised on ground of comments of ECCD staff , EFA staff and other experts. The third phase is the test-phase in which teacher-educators will test the design model in four overlapped cycles of LP development. This method is named a staggered case study (Walker, 1998). Advantage of this method is that experiences from the first case can immediately be used for improvements in the second case and so on. In this way four cases will be studied. During the test-phase data will be collected not only on the quality and effectiveness of the model but also on the learning needs that emerge from the process of development. Methods of data collection in this phase are interviews, questionnaires and evaluation of LP's. In the fourth phase is explored whether actions that are part of the design process can simultaneously be part of a learning cycle consisting of a string of action and reflection. This phase must also lead to concrete indications for

the ECCD staff how to support and stimulate the learning process of the teacher-educators during the development process.

Specifications for the LP design model

At this moment the first phase of the study is completed. Literature research and interviews with ECCD staff resulted in the first specifications for a design model. Specifications for the LP design model are based on the following assumptions.

- The LP design model has to fulfil different functions. Firstly it must support developers in efficiently developing LP's. Secondly it must ensure the quality of LP's. In the third place it must function as a communication device and improve communication between developers among themselves, communication between developers and ECCD staff, communication between developers and other EFA staff, and finally communication between the developers and students. The LP design model should therefore offer a clear communication frame.
- Development of innovative learning environments is a complex process (Richey, 1995). Support is desirable in view of the reported problems (Voogt & Odenthal,1999; Voogt, Odenthal, Taks, Otter, 1999). Prescriptions however are not advisable exactly because of the complex and incidental character of the development process of innovative learning environments and the aversion that teachers (as most developers) have to models and prescriptions in particular (Gustafson & Branch, 1997). The LP design model should therefore support the process of development but not prescribe it. The LP design model must form a heuristic basis from which the developers can begin to develop their own LP.
- A design model should consist of at least the following major activities; analyses of the context and needs; design of a set specifications for effective, efficient, and relevant materials; development and construction of all materials and supporting processes; implementation of the product and processes or anticipation on the implementation; formative and summative evaluation of the product and processes (Visscher-Voerman, 1999). The LP design model should at least consist of the above mentioned activities.
- The development process must not only result in an LP but also have surplus value for the professionalisation of the developers themselves. In complex situations where one *best* solution cannot easily be advocated, forms of action research can be a useful learning strategy (O'Neil & Marsick, 1994). Action research is the reflective process whereby in a given problem area, where one wishes to improve practice or personal understanding, inquiry is carried out by the practitioner – first, to clearly define the problem; secondly, to specify a plan of action- including the testing of hypotheses by application of action to the problem. Evaluation is then undertaken to monitor and establish the effectiveness of the action taken. Finally, participants reflect upon, explain developments, and communicate these results to the community of action researchers (McKernan, 1996). The LP design model should not only contain support for the development of LP but also provide a model for action research.
- The new curriculum of the EFA is centred round the concept of *productive learning*. In *productive learning* aspects can be recognised of contemporary ideas from the field of education such as contructivisme (Wilson, 1996) and situated learning (Brown, Collins & Duguid, 1996). In these concepts learning is seen as a process that results from a complex set of interactions between the actors within this learning space (Gustafson & Branch, 1997; Voogt & Odenthal, 1997; Wilson, 1996). In traditional design models development of instruction is generally understood as the process of selecting the best instruction method, given the desired outcomes under set conditions (Winn, 1993). In innovative learning environments however the characteristics of the learning space determine the nature of the learning process that actually will occur. The LP design model should therefore address those characteristics of the LP necessary to raise *productive learning*.
- One of the basic assumptions of the concept *productive learning* is that during the learning process students are confronted with their learning needs. The learning environment cannot be fully defined and prepared in front because these learning needs are not always predictable. Also the role that the teacher has to perform is often uncertain in advance because it is expected that the teacher meets the needs of the students (Wilson, 1996). Inherent to the concept *productive learning* and the connected concept of LP's, is therefore the continuation of the development process during the learning process. The LP design model should take into account that specific characteristics of the LP can not be specified in detail in front but should be specified

at a later point by the teacher or by the students as part of their learning process. Also, to ensure that an LP includes proper support and guidance, in the development of the LP should already be taken into account that characteristics of the LP might have to be changed or adapted several times. The LP design model must therefore reflect the iterative or recursive character of the process of LP development.

First prototype of the LP design model

On ground of specifications a first prototype for an LP design model was developed. The model consists of three related parts, a *process model*, a *product model*, and a *learning model*. At this stage the *learning model* has not yet been specified. The intention however is to insert a model of action learning. Action learning is a strain of action research and it is directed at improvement of professional practice. An action learning model includes questioning the framing of the problem, collecting data, and trying solutions (Brooks & Watkins, 1994). The *process model* has to facilitate communication between ECCD staff, EFA staff, students and LP developers. In the process model the preconditions for the development of the LP are created, such as time, financial and personnel support. The process model is therefore mostly determined by the organisational context of the EFA. Although developers and in practice can exchange information as often as chosen, the EFA demands two obligatory instants of evaluation. In the first evaluation by means of a project plan is decided whether the LP has enough potential to be developed. In the second evaluation the further development of the LP is delegated to teachers and students. After that teachers and students conduct a third evaluation, both as part of their learning process.

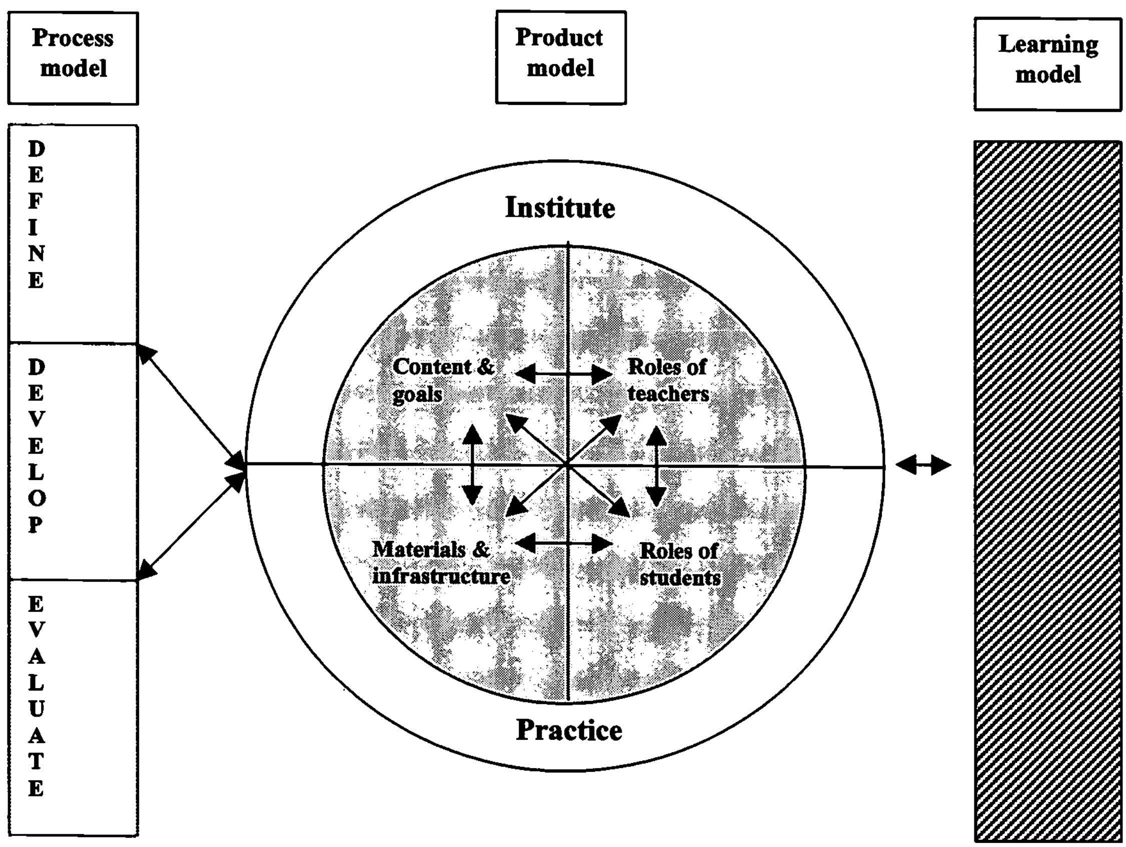

Figure 1: Prototype of LP design model consisting of a process model, a product model and a learning model.

Centre of the LP design model is the *product model*. Included in this model are the main components of an LP. These components are, content & goals, roles of teachers, roles of students, and materials &

infrastructure. In the model the LP is embedded in the institute of education as well as in the educational practice. For each for each of the components of the LP, the embedding in the institute, and in the educational practice characteristics are defined.

For the first prototype a list of characteristics of LP's was composed in co-operation with EFA staff (Voogt, Odenthal, Taks & Otter, 1999). It is the intention the list will be updated yearly on ground of state of art knowledge and results of the evaluation of LP in the preceding year. The actual development process of an LP starts with a definition phase in which for each component a first outline of core characteristics is given and for other characteristics realised in the specific LP. Important are not only which of the characteristics the LP will contain but also whether the characteristics of each of the components are in balance. For example, if in an LP students are expected to act independently, characteristics of materials and infrastructure as well as the characteristics in the roles of the teachers must support this independence. The definition phase results in a project plan that contains the first outline of LP including the characteristics the LP possess and how is it is embedded in the institute and the practice.

After the definition phase an iterative recursive process of LP development begins in which developers alternately work on the realisation of specific LP characteristics, develop materials and supporting processes for the LP and evaluate the process by comparing prototypes of the LP with the outline of the LP. This results in a LP manual which contains next to the description of the characteristics of the LP and their specifications, an instructions for the teacher and the students. In the LP manual should also be specified which of the characteristics of the LP need to be further developed by teachers and students together with indications of how these development can take place. Finally the LP manual contains specifications for evaluation of the LP and adaptations that might be necessary in practice. The development process is completed with an evaluation phase in which students and teachers test the LP.

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WE HAVE THE EQUIPMENT—WE NEED THE TEACHERS TO RUN IT

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Abstract

For at least the past decade national, state, local and philanthropic policies have focused on the goal of getting more computers into the schools and more computers connected to the Internet. These policies reflect the belief that Information Technology (IT) is a powerful teaching/learning tool and an essential skill set for future employment.

Recent surveys and state-specific data suggest, first, that the goal of providing IT access to all students is being realized and, second, that IT is not reaching its full potential because teachers are either not using it at all or using only its most limited capabilities.

This paper will discuss one masters program that is successfully preparing teachers to use the full potential of IT.

Access to Information Technology

The past decade has seen major policy and program initiatives designed to increase K_12 student's access to computers and the Internet. Wire the schools day, E-Rate, $9.9m in USDE Community Center Grants and a similar private sector program, PowerUP aimed at closing the "digital divide" in Internet access—these are only some of the programs driven by the belief that IT is a powerful teaching /learning tool and also a skill set essential for successful employment.

Following the federal lead, state budgets have increasingly included support for hardware and wiring; and individual school districts have undertaken large-scale bond issues to support increased IT in schools. California, for example, has spent over $400 on its Digital High Schools Program since 1997. The result is 19.3 students per Internet-connected computer.

Similarly, the New York State Legislature has approved $213m, $239m,and $292m over the past three years to support IT, producing a ratio of 15 students per Internet-connected computer.

These and similar efforts in other states have led to the conclusion that " a critical mass has been reached. More than half the nation's classrooms are connected to the Web, and schools have an average of one instructional computer for every 5.7 students". (Education Week, September 22, 1999)

Utilization of Information Technology

While the goals of It availability are being met, utilization of these resources by students and teachers shows a less encouraging picture. One reason for this may be the computers themselves. Of the computers being included in the availability counts, 19% consist of Apple IIe's and 386 machines that will not run recently created software or provide Internet access.

This percentage is consistent with the finding that teachers tend to underutilize the capabilities of computers at their disposal. A study conducted by researchers at UC Irvine and the University of Minnesota found that secondary science teachers are more likely to use computers for word processing and information finding than for "doing science".

Similarly, the 1998 National Assessment of Educational Progress in Reading found that student computer use in the fourth and eighth grades was infrequent at best. Eighty percent of fourth graders reported using computers either "not at all" (39%) or "once or twice a month" (41%). For eighth graders the respective percentages were 38% and 44%.

On a more personal note, I recall pushing and cajoling teachers who have the hardware and software but have their students use it as an electronic encyclopedia or search the Internet for material already available in the local library.

What Explains Underutilization of IT?

Answers to the underutilization question vary. Teachers say they do not have enough Time to learn the courseware or enough computers. Administrators say the teachers are not prepared to use computers.

No matter what the explanation de jour, the consensus points to teachers. Experts with a firm command of the obvious conclude that teachers are the key to increased, more skillful use of IT.

There is an equally strong consensus that neither pre-service nor in-service training is adequate to the job of preparing teachers for effective IT utilization. This inadequacy shows up in both the type and the amount of training. Most training focuses on operating systems and perhaps word processing. Yet teachers report that this type of knowledge/skill is insufficient to launch them as active IT users.

In terms of the amount of training experienced by most teachers, eleven hours a year is a high-end average figure.

One problem may lie in the fact that the skill levels and the time it takes to achieve these levels are not well understood or accepted. Any plan for training or assessment of training effectiveness must be based on a model or ideal of the trained professional. Most models envision four stages of development or proficiency. (See, for example, "Professional Skills for the Digital Age Classroom" www.milkenexchange.org/pec/)

Level One in this and similar schemas is basic skills—computers 101: how to operate a computer and use one or more of the big three applications, word processing, database and spreadsheet.

Level Two is adoption. At this stage teachers are developing the knowledge, skills and disposition to try out ready-made courseware for classroom use. This could be CD-ROM on some aspect of the environment, a math drill, or a Jostens reading program. This is "as is" instruction and typically does not require the teacher to change his/her style of teaching.

Level Three is adoption. Teachers at this stage are modifying and combining elements of IT to fit the needs of their students and the goals of the curriculum. Usually, the teacher will start to modify his/her teaching style at this stage. One example is a peer tutoring arrangement that involved fourth graders working with a class of first graders. The older students used PowerPoint to put up a picture and the first graders' stories about that picture—usually something about a sibling, their grandmother or their pet.

Level Four, Integration, occurs when a teacher has a solid base of technical skills, knowledge and disposition to integrate a range of IT elements to achieve a variety of curricular goals. A teacher at this level knows how to teach IT as a subject and how to use IT with her students.

A level four teacher might, for example, want to have students learn how to weigh evidence and develop theories. To achieve this goal she enlists the help of several other science teachers who are members of a listserv. All four agree to have their students build simple air quality measures and report the data to each other daily using e-mail. The data are stored in a database for several weeks. The students then develop and share theories about the way the data are behaving. "Maybe our equipment isn't working right"; "maybe air quality changes with the direction of the wind"; "maybe air quality is different at different times of the day". "Why don't we measure air quality inside?"

The students share their data and their theories, continue to gather data to support or not support the theories. They present their results to a home audience or each other using hyperstudio.

The most important point is to note the difference between level one and level four—huge. The other point is that teachers at level one can have little or no effect on student achievement. As teachers move toward level four proficiency, their impact and the impact of IT increases.

Few teachers pass quickly and effortlessly from one stage to the next. With constant effort and support, most teachers will take three years to reach level four. This is why some studies

have shown a confusing relationship between years of teaching and computer use. The expectation is that the younger teachers will show the highest levels of computer use. Often, however, these beginning teachers are at level one and will be teaching for several years before they reach higher levels—provided they have strong professional development support.

Because of the cost and time involved, progress toward a four-stage model of IT proficiency has been patchy. For example, 42 states now require some demonstration of It work as a requirement for licensure. However, only four require any documentation of continued IT training for recertification.

Nonetheless, state and federal grants are increasingly requiring budget commitments of 20 to 30 percent for training. The Literacy Challenge Grant is one example. Local bond issues are slowly starting to follow suit.

The Role of Teacher Education Programs

Teacher education programs do not generally get high marks for preparing graduates to be effective users of IT. Both the National Council for the Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) have looked at the effectiveness of teacher education programs as preparation for using IT and found serious shortcomings.

NCATE, in 1997, concluded, "Bluntly, a majority of teacher preparation programs are falling short of what needs to be done. Not using technology much in their own research and teaching, teacher education faculty have insufficient understanding of the demand on classroom teachers to incorporate technology in their teaching".

A year later ISTE surveyed 416 teacher education institutions (mine among them). Their report "Will New Teachers be Prepared to Teach in a Digital Age?" also faulted teacher education institutions. The survey found that while IT facilities were rated "adequate", teacher education faculty, by and large, did not use these facilities to model teaching/learning using IT. Further, the study found extensive evidence that while virtually all institutions reported requiring a version of Computers 101, few offered courses in curriculum integration. In terms of the four-stage paradigm, the institutions were addressing level one only.

However, it may not be realistic to expect a pre-service program to take students all the way to level four. Instead, the model educational program most likely to reach that goal is one that combines preservice teacher education, a mentored year in a school with current IT and an IT proficient faculty, followed by a masters program (or the equivalent) to complete the progression. Such a model may involve jurisdictional overlap between preservice, teaching and inservice institutions, but it may be a better way to think about how to achieve level four proficiency. The remainder of the paper will examine a masters program that functions as part three of the model noted above.

New York Institute of Technology Masters in Instructional Technology

NYIT's 36-credit masters program satisfies one requirement for permanent teacher certification. All of the students have provisional certification and are teaching full-time—not, unfortunately, all in well-equipped schools. Many come in at level one, having taken a "Computers in Education "course as undergraduates.

The courses form four groups. The first group consists of three courses (Introduction to Computers, Survey of Instructional Technology, and Multimedia Classroom Applications) and is roughly equivalent to the skills level in the paradigm. All three are lab courses.

Students learn the basic technical skills and knowledge: operating systems (MAC or PC or both), the big three applications, productivity tools like grade books, navigating the Internet and multimedia for instruction. Each of these topics is illustrated by classroom applications.

The second group of courses address adoption, adaptation and integration by having students apply the work of the course to their classroom teaching. Courseware Evaluation explores sources of courseware and develops evaluation schema for each of the students in each course. Sources of useful evaluation are compared as are specific evaluation criteria like the degree if diversity in a piece of courseware. Mostly this course works at the adoption level.

Technology for Special and at-Risk Populations identifies courseware and applications for two hard-to-reach populations. This is mostly an adoption course, but since it is often offered on line it also models the use of the Internet as an instructional medium.

Higher Order Thinking Skills focuses on sets of skills rather than a particular population. Students study courseware and applications that promote students' ability to, for example, analyze, synthesize and evaluate. This course begins to put curriculum and learning outcomes in the driver's seat. Based on their own classes, the graduate students create teaching/learning units using IT with their K-12 students.

The curriculum course—Instructional Systems Design—emphasizes integration by having students "plan backwards", starting from the skills and knowledge goals of a unit of instruction. By that time in the course the students have a menu of options to select from as they design a teaching/learning unit for their classes.

Each of the courses in this grouping is taught in a computer lab. Some are to one degree or another web based, with materials and the course outline all on line. Some courses have students submit work on-line.

The final two required courses focus on research, teaching the standard research skills as well as developing an extensive review of the IT literature in their discipline and conducting an experimental study of IT-based learning in their classroom. These courses spend one session in the lab using statistics software. Students use various Internet search engines and strategies to gather material for their review.

The two electives can be satisfied through transfer credit or two courses from the department. Examples include Networks—a lab course for computer coordinators and Instructional Application of the Internet. This course is entirely on line and models a constructivist approach to using the Internet.

While these 12 courses have helped a great many students achieve a level four proficiency, the program still needs improvement. First, there needs to be a tighter integration between the graduate students' K-12 teaching and the masters courses. As students move through their courses and attain levels two, three and four, they should have the opportunity to apply this coursework in their classes. For all the obvious reasons, this does not always happen. Having a strong district based professional development program also helps if one is available.

Another way to make this a tighter integration is to have each graduate student's curriculum available to both the instructor and the rest of the class. This would provide a broader context for curriculum development and would underscore the mantra of the program "Curriculum drives the Technology".

Second, the program needs to address the issue of assessment more vigorously and creatively. Given the dollars and the expectations behind the IT buildup, it is only natural to expect "results". Accountability at the state level generally means improved scores on standardized state tests, and the improvements should not be too long in showing up.

However, the desire for quick results is at odds with the four-level paradigm. It is not reasonable to expect improved student performance in a year or two if the time required for teachers to develop the requisite proficiencies may be as much as three. Thus our students must have a variety of alternative ways of showing results. The best approach is to show actual student work, but the masters program does not spend enough time on portfolios of student work that would demonstrate skill and knowledge development. Similarly, our students need to become familiar with the ISTE K-12 standards and be able to show that their classes are meeting these standards.

We know that curriculum is a zero-sum game. Adding work on assessment means dropping other topics. But unless we make these hard choices, we may not have the time needed to develop the fourth level of competency and the time for these skills to produce the results that justify the large expenditures and high expectations for IT.

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Technology Autobiographies in Teacher Education

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Abstract

This paper explores the impact of the integration of an online interactive website in a graduate pre-service literacy education class through an analysis of students autobiographical reflections. Students wrote their literacy and technology autobiographies as part of the requirements of a course. Through analysis of the autobiographies and follow-up interviews with students, several key themes emerged revolving around issues of teaching and learning, the responsibility of a university to adequately prepare teachers and the role of technology in the personal and professional lives of these students.

Purpose

The purpose of this study was to examine the technology lives and experiences of teachers through an analysis of their written, on-line literacy and technology autobiographies. The process of exploring their socio-personal history enables teachers to understand better and make sense of their own pedagogical positions and develop a deeper awareness of the factors that shape their teaching and learning (Schon, 1983; Friere, 1970). One outcome of this research is to encourage teachers to reflect on their technology experiences to become aware of their classroom practices.

Theoretical Framework

Richardson (1990) in calling for an "individualistic, psychoanalytic approach" to teacher education recognizes that the lack of reflection leads to "an idiosyncratic view of teachers. That is, the teacher teaches as he or she is. How then do we think about affecting change?" (p.13). Autobiography has been suggested as a possible way to help teachers alter what they do (Diamond, 1990) and is viewed by many recent researchers as critical to the process of professional growth and development (Solas, 1992; Duff, Brown and Van Scoy, 1995; Parsons and Matson, 1995). Knowles (1992) notes that we increasingly believe biography to have a significant bearing on the classroom behaviors and practices of teachers. Knowles, like Richardson, recognizes that by not adapting and dealing with the life history of teachers in preparation, future teachers are bound to become teachers who teach in the manner in which they were taught and who will be limited in the ways in which they can professionally develop. In Psychology of Personal Constructs Kelly (1955) notes that people use experience to create constructs through which they create new experiences and then verify or modify other experiences. We build each experience, then, upon experiences that are, in turn, modified through future experiences. This process is one in which we view the participants as "explorers" investigating their own historical landscapes (Pope and Keen, 1981). Autobiographical explorations can help teachers heighten their awareness of their own learning and the teaching-learning process.

This study builds on previous work that examined the literacy autobiographies of pre service and in service teachers. (Ringler and Rhodes, 1998).

Methodology

Eleven teachers enrolled in a graduate teacher education program at a major urban university volunteered to participate in this study. The participants were in their 20's, 30's and 40's and are studying for advanced graduate degrees in literacy education. They indicated varying degrees of familiarly and comfort with technology. These

levels ranged from those who had never interacted on-line either personally or professionally, to those students who identified themselves as very comfortable with email and on-line personal communications. None of the students reported using on-line communication in any of their undergraduate or graduate level classes.

As part of their course requirements, students were to write their technology autobiographies and post them on an interactive web site that we created for this course. Students were encouraged to read and respond to each other. We then conducted and designed follow-up interviews to provide insight into the specific links between autobiography and the ways in which it can impact upon the participant's current thinking and classroom practice that went beyond the information in the written autobiography.

A structured interview script was used as a basis for very broad questions. Responses from the first interview suggested the need for elaboration, and we conducted a follow-up interview to ask each participant about categories that were either not clear or sufficiently detailed. As a result we interviewed each participant twice during a two-month period.

Data Analysis

Interviews were first transcribed from the audiotape and then coded using the categories generated from the interview script. During the initial coding, we coded technology in all of its implications. During the subsequent coding, the participants' thoughts about their current philosophy and teaching practices, specifically we coded the use of technology in educational settings. Using the information from both the written autobiographies and the interviews, we identified themes. Finally, we constructed a life story for each participant beginning with their initial introduction to technology, their current views on technology and its uses and concluding with information about their current teaching philosophy and practices. We gave the participants the opportunity to read their "life stories" as constructed by the researchers for accuracy and to make any corrections or additions.

Implementation and Discussion

I set up an interactive web site so that the students in this literacy education class would have experience with such technology. I felt that during their careers as educators, they might be in the position of deciding whether and in what ways to incorporate distance learning in their classes. Several students were concerned, confused and worried that they would not learn all of the content of the course. We spent a great deal of time talking about the logistics of the course and the concerns of the students. We talked extensively about technology and its role in teaching and how this course could provide a demonstration of such a teaching/learning situation. We talked about taking risks as teachers and as learners. Most of the students agreed that this would be an interesting experience. A few said that they would never use technology in their teaching and two resented the inclusion of this component in a literacy class.

Since this was a course for future teachers, we decided to focus not only on the content of the course but also on the process of being engaged in a distance learning situation. We explored the research on teachers as reflective practitioners as we navigated through the course. Students were continually asked to reflect on their experiences as learners as well as in their role as future educators.

Results

While there were differences in the experiences of the students, there were many similarities. These similarities centered on several themes. Preliminary data analysis revealed the following key themes: A Desire to Maintain Current; Technology Talk with Little Practice; Affect of Technology on Philosophy and Practice; and The Personal Uses of Technology/Professional Uses of Technology. The following is a brief discussion of some themes that emerged.

A Desire to maintain current

Most of the participants recognized that technology would play an increasing role in their teaching and their lives overall. While three of the participants did not like this, the remainder felt that technology could be a

positive force. All, however, recognized that they must be knowledgeable about technology to be current. The following are typical of some comments made and written at the beginning.

> In order to survive, I'm going to have to deal with technology. Even though I am not convinced that it is beneficial, I have to know it in order not to be considered a fossil. I remember teachers who always seemed outdated and I do not want to be like them, they really weren't respected. (Jane)

> As a writer, I think the impact of words is vitally important in our lives and I fear that the internet will use so many visual cues and clues that words will be rendered secondary. So, therefore, I have a vested interest in maintaining the integrated of the printed word, whether it be printed on line or on paper. (Greg)

Technology talk with little practice

Leslie's concern for remaining current also addressed a limitation in the University teacher education program. Leslie and others pointed to the fact that a university should be demonstrating technology and making it a natural part of the courses. This, they felt, is even more crucial in a teacher education program.

> If I'm going to look for a job next year, I think I have to know about technology and teaching. I like hi-tech stuff and think I might be a good candidate for the incorporation of technology in my classes. The problem though, is that we talk about it in classes at Pace, but we never use it. If I'm going to be able to talk intelligently at an interview, I have to have had experience–not just at home doing fun stuff, but also experience using technology to teach and learn.(Leslie)

All of the students expressed similar concerns about this issue.

> I need to walk the walk not just talk the talk. Our school is supposed to be modeling best practice but we really don't see that. There are so few professors who are using any sort of technology. Aren't they supposed to be on the cutting edge? For some teachers, it seems that high tech is using a slide projector. I think there is a bit of hypocrisy going on here. How can you teach future teachers if you don't know the material itself? (Jeff)

> In order to teach math, we need to learn math. In order to teach technology we need to learn technology. (Sue)

Impact of technology on philosophy and practice

During the semester, I continually asked students to reflect on their emergent philosophy regrading teaching and learning. For those students who were new to technology, they often used these experiences to reflect on what their students might be going through as they study new areas and try new things. They most often related their frustration with technology to the frustrations their future students must feel when they are grappling with ideas and information which are difficult.

> As I struggle to connect on line and navigate our website, I find that I am constantly thinking of how very young children learn to read (this is, after all, a literacy course). I think I can better relate to them and the difficulty they have, then I realize, that I am a relatively successful adult, and I sometimes feel like I'd like to pack it in due to my frustration. Of course, I can, I've chosen this new career path and if it gets too difficult I can just toss it. Little kids can't just opt out of school. Computer and me is like a little kid learning to read. It's all a bit confusing and overwhelming, but I need to master it in order to function in the real world. (Barbara)

> This has been a great exercise in relating to the struggle of our students. I've always been an accomplished learner and scholar, but going through this experience has given me a keener insight into the experiences of others.(Jeff)

The personal uses of technology/professional uses of technology

Four students were not convinced that they would incorporate much technology in their teaching, but, like all the other members of the class, they felt much more comfortable with technology and much more enthusiastic about its role in their lives. The four students saw the value in internet research for their students but questioned their ability to help their students critically evaluate the sites and information on the web. The remaining students found that even during this one semester, they were using the web more, connecting with family and friends via email and seeing technology as a normal part of their lives. Jane said,

> I really feel much more comfortable. This must have been what people felt like when the telephone became prominent in people's lives. It is like a new horizon and all of us have to get on board or we'll become extinct. I found myself checking our online site each day and when I did, if I did not see any new messages or posting, I felt disappointed and disconnected. It was like when I was a teenager, sitting by the phone, waiting for one of my friends to call. If they didn't I felt sad.

Findings and Implications

Besides the themes represented above, this project enabled the students to take more control of their learning as they posted topics of discussion, interacted between and among themselves without heavy reliance from the professor and they engaged in collaborative conversations. In addition, they continually reflected on their experiences as learners and as future teachers. The data shows that this experience helped them to begin to articulate and examine their own teaching philosophies and gain a deeper appreciation of the struggle of students to learn new information and learn in new ways.

While this research is at too early a stage to draw any general conclusions, the findings support those of others (e.g. Green, 1978; Pinar, 1981; Richardson, 1990; Schon, 1983). However, we do have some preliminary thoughts. If affecting change is one objective of teacher education programs then using autobiographical material may be a way of helping teachers to understand themselves better and what they do in the classroom. The process, impact and uses of autobiography for teachers are still in their incipient stages and will, hopefully, serve as a vehicle to inform both teachers and teacher educators in the future. If teachers are successfully to integrate technology into their teaching, teacher educators must clearly do so too. By modeling behaviors and utilizing various technological activities that are natural adjuncts to our teaching we can begin to help pre service and in service teachers effectively incorporate technology into the lives of their students.

Research on the efficacy of integration of technology within traditional classroom settings is in its infancy. Technology is changing the way we learn, the way we interact and the way we teach. Pre-service teacher education students will need to incorporate technology in their teaching practices. Teacher education programs need to give students varied and numerous experiences that immerse them in technology and its uses. By studying the impact of technology within teacher education classes, we may gain valuable information that will enable us better to facilitate our students' transactions with technology. During this reflective process, numerous questions emerged which will be considered in future endeavors:

In what ways does the role of the teacher change or differ from that in a more traditional course?
In what ways, if any, does the content or structure of the course vary with the use of technology?
What role should the teacher play in facilitating the use of technology?
How can students and teachers best incorporate aspects of telecommunications?

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TUTORPEA for Adults' Teachers Lifelong Learning

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Abstract: This paper describes an intranet developed for an international project for adults' teachers lifelong learning (TUTORPEA), funded by the Socrates program of the European Community. TUTORPEA attempts the design, implementation and use of an Interactive Tutor System, addressed to adults' teachers. The objective is not programming a course, but creating an interactive environment that fosters cooperative reflections on specific situations that adults' trainers usually face with. With the help of a tutor, concrete solutions will be given to those situations lived with some difficulty by the teachers.

Introduction

The training period does not conclude with our formal schooling, but it lasts a lifetime. With the emergence of the Information Society, everyone must upgrade their skills constantly and obtain new qualifications. This acquiring of new aptitudes and abilities should therefore no longer be limited to formal schooling (primary, secondary and higher education), but should involve all sections of society: youngsters, middle-aged and older people; people at all levels of vocational qualification; people in work and the unemployed (Delors 1996). Education and training are to play a central role in the advance towards an information society, which will be a learning society, as asserts the White Paper on Education and Learning of the European Commission (European Commission 1995). With

the Socrates program, the European Community, through its Directorate General XXII (Education, Training and Youth), is taking action in the field of education aiming at enhancing its quality, by means of European co-operation. The project described here, named International Project for adults' teachers lifelong learning (TUTORPEA), is enclosed in the Socrates section for Adult Education. The following institutions are taking part:

University of Aveiro – Portugal

SEA-AIDEA (Sviluppo dell Educazione degli Adulte – Assoziacione Italiana di Educatione degli Adulti) – Italia

CEDETEL (Center for Telecommunication Development in Castile-Leon) – Spain

Provincial Directorates of the Department of Education and Culture from Salamanca and Palencia – Spain

University of Salamanca (coordinating institution) – Spain

TUTORPEA is addressed to adults' trainers and must be understood as a training network attempting at giving concrete solutions to specific educational situations. That is, the training plan is not organized based on contents but around real experiences the trainers usually face with. Therefore, it is not intended to program a course (with a start and an end), but to create an interactive environment where these trainers cooperatively think, study and take decisions about those experiences.

The geographical structure of the training network involves educational researchers and professionals from Aveiro (Italy), Castile-Leon (Spain) and Liguria (Italy). These three regions are characterized by similar circumstances:

Adult education is programmed at regional-national level.

There is a sparse population with small localities, where the trainers are full time dedicated to this task.

There are institutions doing research in the field of adult education.

Up to twenty four trainers constitute the experimental group of the network. The intranet has been implemented in a Research Work Group called "Canalejas", constituted mainly by Pedagogues and Telecommunication Engineers from the Universities of Salamanca and Valladolid (both of them located in Castile-Leon). The research of this interdisciplinary and inter-university group is focused on "Educational Multimedia and Telematics Networks in an Educational Context", evaluating the possibilities and advantages of applying Information and Communication Technologies (ICTs) to the learning process. Canalejas Work Group is integrated within CEDETEL, a Technological Center that has leading the Spanish region of Castile-Leon into the Information Society as one of its main objectives.

Description of the Tool TUTORPEA

TUTORPEA has been developed taking into account the needs for adults' teachers lifelong learning: continuous teaching of learning units about useful subjects, and other ones required by themselves. It includes the possibility for urgent questions, real-time seminars on the net and the possibility for managing and sending big quantities of data on any kind of format (video, sound, text).

The system is focused on what we call "the learning unit". The learning unit consists on the analysis of a real situation, taking as a starting point the problems and difficulties the trainers have to face in their own educational experiences. Each country proposes some different topics (with a psycho-pedagogical nature) and the learning unit for the semester is determined by them all.

As for the real-time seminars (chat or IRC –Internet Relay Chat-), these have exclusively been designed and programmed for TUTORPEA for two reasons: the on line chat must be easy to use and it must be integrated within the whole application.

We next mention the services offered by TUTORPEA:

The first one is the SOS Service, whose main objective is solving, immediately, the most urgent questions that may arise to the teachers. Its corresponding icon will be moving in case there are questions not answered or not clarified.

In the Learning Units Service, teachers can check in the current learning unit, propose new learning units that may be of their interest, and view information of learning units that have already taken place.

With the Task Service teachers may be assigned tasks within a learning unit. Besides, it can be a meeting point for the participants to exchange information.

The Questions and Answers Service is the same as SOS Service, but without the urgent nature of the latter one.

The Participant Service lists all the participants in the learning unit. We can contact them, navigate to their personal web page, etc. and check the tasks they have already done.

In the Calendar Service different kind of events can be published.

The Discussion Service is a real time chat, a meeting point for the participants where they can exchange different viewpoints on a particular subject.

As the Discussion Service, the Seminar Service is a chat, but with a specialist tutor that supervises the discussion.

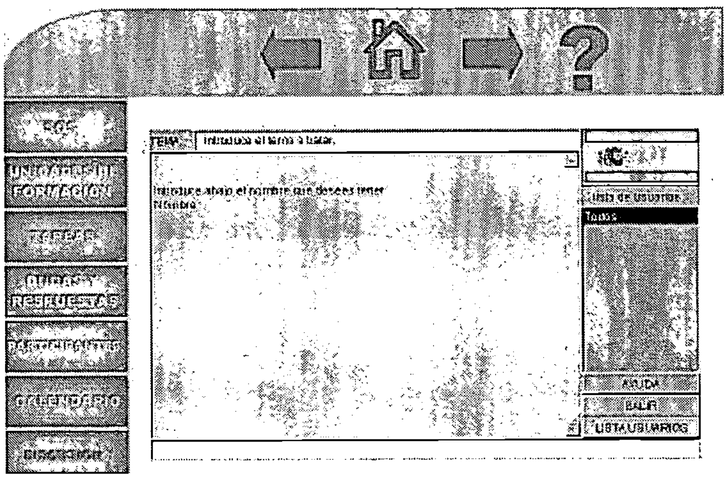

Figure 1: IRC Client in the Discussion Service of TUTORPEA.

Finally, there is a Glossary Service, that was asked for by the teachers on the very early tests. It relates different terms from different languages that might be misunderstood.

Development Process of TUTORPEA

Due to the experience acquired during the development of other projects, it has not been difficult to define the phases of the implementation process of TUTORPEA, nor to fulfill these phases with a perfect coordination between the teams of pedagogues and telecommunications engineers.

We briefly describe each of these phases:

1. Planning. In this phase, some decisions were taken:

    The application is supported by Internet, and, concretely, by the World Wide Web, due to its extended use.

    A Windows NT Server 4.0 was chosen as our server, the Web Server was the Internet Information Server (IIS) and the access to databases was accomplished through a component of IIS called the Internet Database Connector (IDC), and also with the help of ASP (Active Server Pages) when needed.

    Microsoft Access was used as Data Base Management System (DBMS).

    The modules and services that should be offered by the system were defined.
2. Design. The second phase consisted on the design of the database and the graphical interface of the whole application, including the IRC client. The data base should include data from the participants (teachers and tutors), the learning units and the seminars. The graphical interface should be an easy-to-use and intuitive interface, since some of the teachers participating in the project had never used such an environment.
3. Programming. In the third phase, the application was programmed, in the following order:

    Creation of the database.

    Development of the two modules of the application: participants (teachers and tutors) and master. This included the programming of the IRC with Java (a programming language perfectly integrable within the Web environment).

    Establishment of the relations between these two modules and integration into just one application: TUTORPEA

    Interaction of the application with the database.
4. Testing. Finally, the last phase of the development consisted on testing and checking the application with target users.

Future Lines and Conclusions

The imminent action to be taken is translating TUTORPEA into the other two languages of the participants taking part in the project (Portuguese and Italian). The teachers will be able to participate with their own language, although they should understand the other two. This is not a problem, taking into account the three languages come from the same mother tongue, Latin, and consequently are similar.

The first learning unit has not started yet; there are some proposals and one of them has to be selected. Therefore, we can not get any results yet, although an evaluation of the training network is already taking place. It includes four aspects:

Satisfaction level of the teachers

Knowledge and attitudes acquired

Efficiency in the educational experience

Interest level aroused in other teachers that are no taking part in the project.

To conclude, we would like to emphasize that the facts that the participating teachers, coming from different countries, collaborate and think about their own acts are achievements themselves. This collaboration aids the construction of a global education and a global culture. And the training process does not only consist

on increasing and improving teachers' knowledge but, as well, on raising their awareness about the importance of reflecting on their acts and training experiences.

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Integrating Technology into the School Curriculum with Thematic Units

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Abstract: According to national studies, there is an urgent need for in-service projects designed to assist teachers in learning ways to integrate technology into their curriculum, not simply to master the mechanics of the computer. Teachers have identified many barriers to the use of technology in instruction, including: poorly focused training, lack of time to revise lessons to include technology, and lack of time to share experiences and ideas on technology integration with other teachers. This paper describes one project that attempts to address these barriers while emphasizing curricular areas identified by the U.S. Department of Education as needing strengthening in the schools.

Introduction

In their 1996 "Technology Literacy Challenge," President Clinton and Vice President Gore identified four goals or "pillars" that provide the foundation for the preparation of every student in America to use technology. One of these four technology goals calls for professional development activities to prepare all teachers to integrate new technologies into the curriculum. "The creation of new content should be bolstered by continuous professional development for teachers that goes beyond the acquisition of generic computer skills to include mastery of technology applications specifically designed to improves student academic achievement. Teachers must learn to seamlessly integrate these new learning tools in the curriculum" (Steele 1998, p. 12). Despite increased emphasis on professional development, recent studies (Trotter 1997; U.S. Department of Education 1998) indicate that a large majority of the teachers surveyed continues to feel inadequately prepared to integrate technology into classroom instruction. One explanation for this lack of preparation is that professional development in the area of technology often continues to focus on the mechanics of hardware and software despite repeated calls for professional development projects designed to assist teachers in integrating technology into their curriculum (CEO Forum 1999; Conte 1997; U.S. Congress, Office of Technology Assessment [OTA] 1995). In addition to poorly focused training, teachers in these studies also identified lack of knowledge about how to teach with technology and lack of time both to revise lessons to include technology and to share their experiences and ideas on technology integration with other teachers as barriers to their use of technology (Conte 1997; OTA 1995). According to Byrom (1998), a key professional development strategy that will increase the likelihood that teachers will use technology is "to begin with teaching and learning, not with hardware and software" (p. 4).

Grant (1996) and McKenzie (1999) identify several strategies for designing effective professional development for teachers. These include: using assessment tools to guide the planning of professional development activities to match the needs and preferences of the participants; relating professional development activities to the teachers' classrooms, curriculum, and objectives; forming teams of peers possessing both common goals and interests, and diverse ideas, skill levels, and experiences; providing opportunities for collaboration with peers and experts to create cross-curricular thematic lessons for use in teaching; and supplying follow up support and classroom consultations. This paper describes a professional development project that addressed the barriers to technology use identified in the first paragraph and employed many of the strategies identified for effective professional development for teachers.

Project Description

The Teacher Education and Arts and Sciences faculties at Harris-Stowe State College actively participate in several partnerships and collaborative projects with schools in the St. Louis metropolitan area. These many and varied partnerships provided ample opportunities to learn of the professional development needs of in-service teachers. A professional development project was created to focus on mathematics, technology and content-area reading instruction in an integrated, unique plan to meet these needs. Two of the project objectives specifically address the integration of technology into curricular areas: to help teachers of third, fourth and fifth grade students develop and implement integrated thematic units of instruction for classroom use and which integrate mathematical concepts and applications, reading, technology and authentic assessment; and to increase teachers' knowledge and use of technology in mathematics and reading instruction. Three Harris-Stowe faculty members, each with expertise in one of the three areas of emphasis, worked with representatives of partner schools to develop the project. Twenty teachers from four urban schools participated in the project, which is funded through the Missouri Eisenhower Professional Development Program. The four elementary schools varied widely in the types and amounts of technology available.

Central to the project was the development of instructional and assessment activities for use in the participants' classrooms. Additionally, the teachers requested to work with curriculum materials they were currently using in their classrooms. Therefore, participants used technologies, books and materials available in their schools to develop activities. This was done in an effort to ensure success and usability of the products produced in the project. The teachers worked collaboratively in three, grade-specific teams. Key components of the project include three workshops interspersed over nine months; an intensive summer course on Integrated Methods of Teaching Mathematics, Technology and Reading in the Elementary School; on-site classroom consultations and mentoring by college faculty members; production of a booklet of the thematic units developed during the intensive course, and creation of a web site designed to support the project participants and increase the project's sustainability. Each participant developed grade-level appropriate curricula for each of three mathematical content strands, discrete mathematics, geometric and spatial sense, and recognition of patterns and relationships. Each thematic unit included daily lesson plans, materials, instructional methodology and authentic student learning and assessment activities. Activities emphasized connections across the curriculum and to real world problems and were tied to the state of Missouri's Show Me Standards (Missouri State Board of Education 1997). Throughout the course, time was allotted for teachers to work together, share resources, and discuss and critique developing thematic units. In the final session of the course, each team presented an example of the activities in one of the thematic units developed by one member of the team.

Participants learned to use and integrate a variety of instructional technologies into the thematic units. Prior to the summer course, each participant completed a survey in which the participant rated his/her knowledge and expertise with a variety of technologies. The information obtained from this survey provided a basis for the level of formal instruction and types of technologies covered during the summer course. Technologies were introduced through authentic contexts and examples related to the specific grade levels the participants taught. Because of the range of types of technology available in the four schools, tool software available in a variety of platforms was emphasized. The teachers also gained familiarity with the resources available on the Internet. Participants had opportunities for informal technology use with just in time assistance, and at the participants' suggestion, the opportunities for informal use of computers increased as the summer course progressed. The level of technological expertise of the participants ranged widely from non-users to experienced users. Experienced users regularly shared their expertise with the less experienced users during sessions in the lab.

Examples

The following brief examples provide a small sampling of the thematic units developed by teachers in this project. The description of each project emphasizes the variety of ways technology was integrated into the units.

Corliss Hinton, third grade teacher at Baden Elementary School, used a theme of "what's cooking?" for her unit. The third grade teachers' team selected this theme for their presentation in the last session of the course. The teachers demonstrated a variety of ways that technology might be integrated into this unit, including having students sample a variety of breads, survey each other on favorite bread and use a spreadsheet to illustrate the results of the survey. They also suggested having students use children's Internet search engines to research bread-making in preparation for writing a report.

Susan Oberkirsch, third grade teacher at Epiphany of Our Lord Parish School, developed a thematic unit using the story, "Cloudy with a Chance of Meatballs" by Judi Barrett. Reading objectives included increasing students' abilities to recognize and understand figurative language and to be able to use it in writing. Students learned weather terms to increase their understanding of the story. Math objectives stressed being able to complete basic operations involving money. Objectives included the ability to compute and provide the correct change in various situations. Students analyzed parts of a newspaper and the different types of articles in preparation for using a children's desktop publishing program to create a class newspaper. Students were encouraged to use figurative language in writing human-interest stories and advertisements for the newspaper. They sold the completed newspaper to students in other classrooms.

Nadine Camp, fourth grade teacher at Gateway Elementary Math, Science & Technology Magnet School, used *Justin and the Best Biscuits in the World* by Mildred Pitts Walker as the basis for her thematic unit. She used technology in a variety of forms throughout the unit. Students were introduced to western living and rodeos through a teacher-created PowerPoint presentation. The teacher developed an on-line scavenger hunt to help her students research African American cowboys, and in another part of the thematic unit, students used KidPix software to explore perimeter and area.

Joyce Barron-Hughes, fifth grade teacher at Waring Academy of Basic Instruction, based her thematic unit on disasters and tornadoes on "The Night of the Twisters" by Ivy Ruckman. Students used Encarta Encyclopedia for research on tornadoes and HyperStudio to present the findings of this research. Instructional objectives for this thematic unit related to reading, mathematics, social studies, science and technology.

Implications

Input from the teachers through on-going evaluations collected during the course helped the college faculty members be more responsive to the needs of the teachers. One barrier identified in the beginning of this paper was not fully eliminated – lack of time. While we increased available time for the teams to work together, most participants continued to request more time to work on individual curricula and in the computer lab. At the conclusion of the summer course, participants were asked again to rank their levels of expertise with a variety of technologies. Without exception, all participants who responded indicated increased levels of expertise with the technologies used in the course and rated their ability to integrate technology into their teaching as improved.

Among the best indicators of the success of a professional development project is whether participants are using what they learned and created in the project. Participants met in a follow-up workshop two months into the school year, and completed a questionnaire on how they have been able to use the information obtained from the summer course in their teaching. Responses were overwhelmingly positive. The following comments provide a sampling of the responses related to the technology emphasis in the course. "I feel more confident about using the Internet. The web sites are very helpful." "The computer information has been invaluable. I used it during the summer and am continuing to use it." "Yes, I have been able to use the technology skills more effectively." "Although I have not been able to use computers in our lessons, my attitude at the beginning of school was one of anticipation and still is even though our computers are not hooked up yet." "Yes, Yes, Yes. Many ideas I've shared with co-workers. Thank you for the experience." "I usually use thematic units to teach various modalities of learning. This summer I learned about filamentality, web pages, various web sites and I have a much better understanding of spreadsheets and other programs." "I have made a concerted effort to use technology more often and plan better around it." "My comfort level with computer usage has been greatly

improved. I can also see how helpful it can be in all curriculum planning. I feel much more challenged and anxious to make better use of our classroom and lab computers."

Did the teachers view the structure of this professional development experience positively? In the fall workshop, the teachers were asked to reflect on their experience in the course now that it was two months later and they were back in the classroom. They reported that they particularly enjoyed the opportunity to share information and work with other professionals, to create lessons using materials available in their classrooms and related to their curriculum, and to learn new strategies for integrating curricular areas. One participant concluded his evaluation with the comment that he wanted to "commend you for a job well done in providing teachers very valuable experiences enhancing our ability to provide our students the best possible education."

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Training Sessions Designed to Help Teachers Enhance Lessons with Technology

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Abstract: This paper presentation will focus on a successful model of inservice training for teachers. The model, used by a multi-school five year US DOE Challenge Grant includes five day and three day training sessions in the summer, followed by a 2 day retreat in the winter, as well as on-site inservice training and on-site coaching by both educators and technologists. The focus of the grant is to improve teaching, with a goal to engage the learner in the classroom. The training includes technology integration, lesson design, and brain research.

Introduction

"The Connections Project: Strengthening Learning Through Technology-Based Integrated Curriculum and Professional Development" has been successful in training teachers to use technology effectively. This effort is a five million dollar United States Department of Education Technology Innovation Challenge Grant, which includes four Nebraska school districts and two adjudicated youth centers as lead sites. The project is designed to improve student learning through effective teaching that included technology-integrated curricula reflecting state curriculum frameworks based on Goals 2000 and national standards. In addition, special focus is given to high risk students, as well as developing partnerships among educators, business, agriculture, industry, and parents. The grant evaluation team is from the University of Nebraska at Omaha College of Education Office of Internet Studies. The process of change used in this grant is important to teacher education, as all learn from the successes of P-12 schools and teachers. The professors on the evaluation team use the ideas and examples in their own lesson plans for both undergraduate and graduate teacher education classes.

The grant summer workshop consisted of a three day multi-topic sessions, that were presented at three different Nebraska sites. Participants were recruited through mailings and were given a stipend for mileage, lodging, and participation. The workshop was divided into three learning areas: technology, brain research, and lesson design. Each day the participants were given the opportunity to spend approximately two hours in each learning area.

Throughout the workshop, the trainers modeled many teaching strategies with a variety of activities that included technology, multiple intelligences, learning styles, brain based research, interdisciplinary teaching methods, constructivist theory, and effective lesson planning. The entire workshop and the workshop facilities were set up to model ideas that were learned in the workshop.

The trainers were teachers who were currently teaching in a classroom environment. In addition, these trainers completed a five-day in depth study of technology, brain research, and lesson design followed by four additional days dedicated to polishing the strategies to be used in the three-day workshops. During the four-day planning session, the trainers prepared presentations, handouts, and activities that modeled the grant goals. These trainers were continually provided with up to date information in the aforementioned areas. The well educated trainer added to the validity of the workshops because the participants could ask for and get actual new and needed ideas to take to their classroom.

The following is a note sent to the trainers by a participant in the Summer 1999 workshop held in Seward, NE. "Thank you so very much for your motivating and inspirational presentation on Wednesday afternoon after lunch. I had been depressed thinking about school starting because after 32 years I wasn't coming up with new ideas to get myself stimulated. Thank you for giving me the boost I needed. You all did a wonderful job. I gained a lot from this workshop." In addition, other participants responded as follows: "I can actually use what was taught in the inservice." "I can't wait for school to start to apply some of these strategies in the classroom." "Best inservice in my 25 years of teaching. I didn't want to go back to school and now I cant wait."

From reading these comments, it seemed the workshops had been very successful. With teacher behaviors changing and increased enthusiasm for trying new strategies, the classroom settings of the participants changed. It was hoped that student learning had increased as a result.

Topics for the Workshops

The workshops focus on three areas: Technology, Brain-Based Research, and Lesson Exploration. The explanations for each area is included below.

Technology

An important aspect of the Connections Project was the integration of technology into the teachers lessons. Several sessions within the first two days of the workshop were spent exploring the most current educational software and hardware. The participants were given time on the third day to integrate these new technologies into one of their own lessons. Teachers were encouraged to start by using one or two new technologies learned at the workshops. As Nebraska educators began to effectively use technology and curriculum integration to promote student learning and achievement, teachers were also encouraged to communicate with other participants through technology. This technology can facilitate shared learning, expanded educational resources and barrier free collaboration across Nebraska and the United States to further the national educational goals of educational reform. The following are brief descriptions of the technology pieces used in the summer workshops.

Video Editing: Avid Cinema was the software program used in the workshops. The lessons included three parts: inputting video, clip art and pictures, editing clips and adding effects, and processing movie and sending to videotape. Teachers were given guided instruction to adding video, sound, text, and transitions to video clips. Students and teachers used the program to make videos for a variety of classroom activities.

Desktop Publishing: Pagemaker, Clarisworks, and Microsoft Office, were the software programs used to spice up old documents and create exciting new documents. Graphics, columns, borders, charts, headers, and footers were just a few of the tools that were learned in the workshop sessions.

Web Publishing: Claris HomePage was the web publishing software program used in the workshops. As World Wide Web expands, teachers are continually called upon to publish pages for educational purposes. Web publishing programs do not require users to be proficient in HTML and participants took their web publishing skills back to their classrooms and taught these skills to their students.

Presentation: Hyperstudio and Powerpoint were the presentation software programs used in the workshops. When teachers share this knowledge with their students, the students can then merge smoothly into the business world with the ability to create presentations which are enhanced with color, sound, transitions, graphics, and short video clips.

Brain-Based Research

The participants understanding of learning styles, multiple intelligences, life skills and brain functions strengthened potential educational achievement of all students, especially students who were deemed high risk. The three day workshop included interactive models of how to integrate strategies to support these theories in the classroom.

Lesson Exploration

The third part of the workshop was integrating the technology and brain-based research into practical, teachable lessons. This training focused on providing web resources, practicing lesson integration, and building new lessons. These sessions gave participants time to revise a tried and true unit of study in their particular discipline.

Application of Training

Each participant was given eleven CDs that included tutorials, presentations, bibliographies, and other information used in the workshop. The participants were asked to share the ten CDs and their newfound knowledge with other Nebraska educators. Through the sharing of the CDs and knowledge, participants were applying the new learning immediately after the workshop. Participants were asked to provide the grant director with a list of CD recipients. Many trainers continued to hear from participants who had successful changes in their classrooms because they used knowledge gained from the workshop. The success of the workshop was evidenced through the waiting list for the next two summer workshops. Applicants had to be turned away because the workshops were at capacity.

Revision and Assessment of Training

Project personnel continually seek opportunities to be trained in new technologies and remain current with teaching/learning research. The trainers meet periodically to garner new information and revise their presentations. The coordinators from the lead sites meet monthly with participants to assess, to practice and to study the newest research in these areas.

Summary

The Connections Project Challenge Grant has begun to change the way teachers teach and the way students learn. This workshop could be replicated in a variety of educational scenarios. The workshop described is available at <http://ois.unomaha.edu/connections/>, <margohir@esu16.org>, and <tamiesh@esu16.org>. As the project continues, more and more training will be provided, and student learning will continue to be impacted.

The Computer Mediated Communication Environment as it Fosters Collaborative Ways of Knowing, Teaching, and Learning

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Abstract: This paper will summarize and give examples from a retrospective ethnographic and pedagogical theory analysis of some key features of a course concerning Graduate and Inservice Teacher Education and Instructional Design. The title of the course was "Researching the Paradigms: Collaborative Ways of Knowing, Teaching, and Learning." The course involved synchronous and collaborative computer mediated discussions (CMC) as well as asynchronous CMC written conversation and full use of the World Wide Web. The goal of the course and of this report of it is to explore and push the boundaries of possibilities for addressing the web of relationships among collaborative and other forms of non-foundational graduate and teacher education; collaborative language, literacy and culture learning; and multiple literacies including those only possible in CMC and hypertext environments. The results explicate the possibilities made available by fully implementing information technology and CMC for teacher education and instructional design.

Introduction

A group of inservice graduate student instructors and one faculty member worked together to address the web of relationships among collaborative and other forms of non-foundational graduate and teacher education. Our foci were on collaborative language, literacy and culture learning and multiple literacies, including those only possible in CMC and hypertext environments. Our acculturation to a new way of thinking, learning, and teaching based on a "non-foundational paradigm" was itself both formed and expanded by the opportunities available in the CMC environment. According to this model "knowledge is a consensus among the members of a community of knowledgeable peers -- something people construct by talking together and reaching an agreement" (Bruffee, 1993). Some of the results of our mutual and class-related development of this kind of knowledge will be explored here, and the possibilities made available by fully implementing information technology and CMC for teacher education and instructional design will be illustrated using examples from the course and the data from its participants

Class Members, Course Concepts, and Research Goals

This class of advanced graduate students, who are also inservice teachers of language and literature, along with myself as the faculty member who originally developed the course concepts, became proficient in using the CMC environment as both a model and a tool for co-creating the content and the ways of knowing and learning in the new learning community that we were forming. This non-foundational and co-created paradigm led us to a learning and research space that took critical research and experiential looks at some of the characteristics, as discussed in (Bruffee 1993), of collaborative and non-foundational learning environments: 1) The active role of both teachers and learners in the educational setting; 2) The culture of the learning environment; 3) The view that knowledge is not transferred from

expert to learner but created and located in the learning community. We also added the fourth essential element to this list, namely the exploration of the effects of CMC and of using instructional technology as the vehicle for the new learning paradigm, which in fact is then essential for defining the paradigm. Indeed the CMC sessions helped us establish a discourse community, and a community of mutual help and encouragement, trust and respect, that would have been very different, if even possible, in a traditional classroom setting.

In summarizing the key elements of the ethnographic analysis and the interaction of instructional technology, CMC, and a non-foundational learning and teaching paradigm in this paper, I am expanding on topic descriptors and definitions which we as a group crystallized from our experiences. These concepts will be illustrated with examples from the class texts and the web site portfolio (http://www.coh.arizona.edu/planet-xeno/) which I will be quoting from below. The site was composed by Claudia Kost under intense collaboration with Sumru Akcan, Adrian Wurr, Lisa Jurkowitz, Judith Arbella, Paula Gunder, and myself. Both I as the teacher and the students of the class had little idea of the kind of adventure we were embarking on, as we assembled for our first class of the semester. With time and some initial guidance and insistence from me, the seven individuals together began our acculturation to a new way of thinking, learning, and teaching, based on non-foundational paradigm described above. As the class gained more and more familiarity with the theories, terminology, and especially the practices of non-foundational learning and teaching, we became members of a new, transitional knowledge community.

Each of us has recollected several important moments that highlight class experiences and processes toward new ways of knowing. These moments are crystallized in the list of nine descriptors, which capture our identity as a classroom culture, and as a transitional community moving toward non-foundational, collaborative, reciprocally interdependent ways of knowing, learning, and teaching. When we realized how different this experience was from anything we had experienced before, we decided this was like being on a different planet, hence the name Planet Xeno. Since we spend most of our time traveling back to a more foundational context during the rest of our work and learning contexts in the university, we know we aren't permanent residents of Planet Xeno, merely resident aliens. The goal of the web site we developed, and of this paper, is to bring back what we learn on Xeno to other interested educators and like-minded travelers.

Developmental Stages of Inhabiting Planet Xeno

In reflecting on the developments and experiences of this non-foundational educational encounter, we realized that we were creating a reciprocally interdependent group, where one group member's output becomes another's input and vice versa. Group members have different roles and specialties. We also realized that we had to overcome some difficult and at times downright painful resistance on the part of the students, and to a lesser extent some limits in my own powers of imagining truly non-foundational education and communication within the traditional university environment. It is after all still, in most cases and in most graduate classes at most institutions, the assumption of all concerned that the role of the teacher is the "sage on the stage," playing to an audience of avid but essentially receptive audience members, called students. Having done the work for and within myself of distancing myself from the "sage" model to one where I considered myself the "guide on the side" who accompanies the students in their own development, I had to not only convince them that this was a valid and actually more fertile model for graduate education, but also that CMC was an essential tool for us to make this happen in our own context. One of the students, who had been pleasant but quite vocal about not really seeing the virtues of using CMC ("Why can't we just talk?") eventually pointed out to us all that she was realizing that the use of computers transformed the individual experience of writing to make it a social experience as well as. Most of the students voiced concerns and difficulties that they were encountering in accepting the essential role of computers and especially CMC in our undertaking. Reshaping social and individual experience relating to CMC became a focus of the members of the course.

As we worked through our resistance, we came to a turning point at midterm in the semester. It was at that point that most if not all of the members realized how CMC sessions help us establish a discourse community, and a community of mutual help and encouragement, trust and respect. These are important values that are not often thematized explicitly in graduate course work, and we all had to re-orient ourselves to adapt to the new community which I eventually dubbed "Planet Xeno."

With growing trust among the members in our class and feeling more comfortable with each other, working together becomes easier. Students began to report that everyone enjoyed working with their partners in the CMC environment, and nobody felt overpowered or dominated by anyone else. We also experienced both pleasant and powerful communication dynamics develop in the group. One essential ingredient became known to us as "the giggle factor". The giggle factor became a running theme for us. We would, as a group, have fun, laugh, or be very serious and on task, or at best, laugh a lot and be very serious and on-task and taking risks in our safe community all at once. These were aspects of the "giggle factor" as an affective variable in our learning community. We would comment on its relative effects at any particular working session. It was always a positive aspect of our community and it was an indication of new growth and difficult developmental stages of inhabiting Planet Xeno.

Another key moment in becoming more comfortable with living on Planet Xeno was "Birds of a Feather Day". That is the day we came into class and were randomly grouped by a slip of paper telling us what kind of "bird" we were. Then we responded to one of the questions that the whole class had submitted in an asynchronous preparation session (posted on a conferencing site called POLIS) about "Assessment in a collaborative or non-foundational setting", based on the reading from (Shohamy 1998). As we used synchronous and face-to-face CMC, as made possible in the facility we call the COHlab, we discussed the difficult issues surrounding assessment, and we had an excellent and very flowing discussion. Much of what was written and discussed went further and deeper into the issues than the original article. We had a lot to say and the students were all eloquent about it all. After the day, several of the students commented on the quality and quantity of the CMC discussion--how interesting it was, and worth reading. I wrote in my own evaluation of that day: "The quality and quantity of the responses (to be foundational about it all) seem excellent today, and for whatever reason better than we've had before. I agree with whoever said, "it was good" in that response. That person also wrote, " I guess we're getting better at this COHlaborative stuff with practice! " We're over some of the shock and disconcerting moments of have been rocketed off to Planet Xeno, and now we're getting pretty good at being here. Plus, everyone seems fully engaged in being good citizens of Xeno. Thank you, one and all. I'm frankly tickled pink with these developments (even though I wasn't in the flamingo group)."

How to Launch A Group to Planet Xeno

So far I have highlighted the positive developmental aspects of this approach to fostering collaborative ways of knowing, learning, and teaching in this graduate level class. There were, predictably perhaps, also many frustrations at the beginning. Graduate students and inservice teachers taking a graduate level course are perhaps the group of learners and teachers who are most vulnerable and most resistant when confronted with non-foundational and collaborative learning. These people have, in order to be successful students sitting in the class in the first place, been rewarded for and supported in the exactly opposite ways of knowing, learning, and teaching. They have become successful at being individual, foundational audience members for various "sages" on various "stages," doing work that is solely their own responsibility (e.g. individually authored papers and exams), and for carefully considering anything they write or speak in class before taking the risk of exposing their ideas. In essence what I was asking them to do in this class was to (temporarily) discard all they knew about teaching, learning, and knowing in an academic environment, all that they had been successful at and rewarded and awarded for, to try something non-foundational, collaborative, and computer-mediated. It was a big leap, and a serious risk for all of us. It is thus not surprising that I found myself, as the leader of the group that was still very resistant and prone to sitting like an audience in each class before the midterm, very frustrated with the success of my experiment so far.

The result was that I threw a bit of a tantrum. The issue at hand was that, since the beginning of the semester, I had been urging the group to consider the possibilities of a non-foundational midterm "exam". They were asked, in writing and repeatedly in class discussion, to make suggestions for alternatives for content and form of a midterm examination. I had only declared that it was worth 100 points (a clearly arbitrary valuation that consciously reinforced the reality that we were still connected to an institution with the constraints of assigning grades at the end of a semester). There had been no response at all from the students. In my frustration, I made a CMC based and tantrum-like call for engagement to the midterm event. This call proceeded to be the initiator of an important re-thinking of the whole class

structure by all involved. This is not to say, however, that I was able to anticipate that outcome at the time I made the call. I was reacting mainly out of frustration and a lack of trust, in both myself and in the students, of being able to actually accomplish what I had set as a goal for the course. I wrote: "If there is no concrete suggestion, collaboratively arrived at by the group, as to the form, content, and grading of the midterm, I will assume this responsibility. The fact that the class members were/are hesitant, or passively resistant, or apathetic, or too overworked to have taken any initiative so far, is a matter of great concern to me. What should we do, and how shall this task be organized and accomplished by Thurs, March 4, 1999, at 2pm?"

This fairly tantrum-like moment had as the goal, and then as the result, as well, compelling the class as a learning community to commit to the idea that collaborative and interdependent learning requires learners to define their own learning needs and to take responsibility for how they will learn it. At the time I felt myself to be teetering on the edge of giving up on a non-foundational and collaborative approach to co-creating a graduate course. It seemed that this might be the end, and that none of us, myself included, were able to think or interact beyond our institutional learning and knowing habits.

In retrospect, it was just this process of hitting what seemed to be a "last straw" wall that injected enough energy into the system of our struggles toward collaborative learning to really launch it into a new arena, as evidenced by the remainder of the midterm events. I see the complex adaptive system of the midterm events, which spanned over two full weeks and beyond, as the the center of our journey to Planet Xeno. Just before the midterm developmental events, I had written in a general journal that I was "having such a hard time getting my class to come with me to the 'learning space'". By this I meant that I knew we would need to move to an entirely different set of ways of knowing and ways of learning in order to really accomplish several of the class goals. But I also was at quite a loss at that point as to how to get people to go there, to follow me there, or to lead us all there. I was ready to just give up and move back into the familiar comforts of the "foundational space". I had recognized that the midterm would be a boundary zone for us all. It was a place where the typical institutional needs and constraints could meet what we had been gradually trying to create and then research as a non-foundational and creative, if turbulent, new kind of learning space. I had wanted us to all take the risk of modeling a non-foundational, collaborative, and learner/learning centered form with our own class activities, and then to take a step back and look at and research how it was working. Before the midterm, I had started to "realize", or talk myself into, the idea that I had wanted to take us all, including myself, too far too fast. I had hoped for more than was possible, I thought, and I had lost the energy to try to subtly guide and "irritate" the group into discovering it on their own. I felt I was going to give a really traditional, though fair, midterm and let it fall as it would. And if the class decided to sit back and let that happen, then I was just going to read and discuss for the rest of the semester—slip back into good old foundational mode. So I sent a perturbed email to everyone, drawing a line in the sand as to the future of our class in general, and the form and function of the midterm in particular.

When we got to class, it was a frustrated and pretty negatively inclined professor who entered the room. Suddenly, though, (all I said was, "let's discuss the reading, but first, what do you want to do about the midterm?") the class members took off. There was an intense and very earnest discussion about various options for the midterm. One of the students started the real interaction by making a non-foundational suggestion for what could be done to co-create the midterm. There was a lot of excellent, engaged, respectful, and creative discussion, with several different suggestions made. There were different levels of willingness for risk-taking behavior or non-foundational thinking among the members, but most of the group was getting more and more engaged. I took the role of a (delighted) observer for most of the time. Here and there I raised some more questions in a directive way, but I was mainly able and very willing to stay on the sidelines of the discussion. A gradual consensus emerged, various people took the lead at various points, and passed the "lead" on without difficulties when someone else had a series of constructive points. I was delighted to recognize that the students were going on very well, even beyond what I had at first imagined, without my having to do any more pushing. There was, indeed, as one student said toward the end of the discussion, an entirely changed energy in the room, and in the group.

It is on that day, before the midterm, that we became a community of learners and teachers (note the plurals) in a new learning space—one that is indeed non-foundational and co-constructed, collaborative, and connected to computer mediated communication in several modes. The energy, the changes of perspective, and the willingness for risk-taking in a community of people who are open and ready to seriously consider suggestions, content, and process from each other and with high mutual respect, has been maintained, even beyond the end of the semester.

The quality of the actual midterm event was also quite special. The students all suggested and voted on, in asynchronous CMC sessions, various extended interpretive essay questions based on our readings and discussions. The questions were randomly assigned on the day of the midterm *event* (we decided that calling it an "exam" was too foundational for what we were doing). The students then wrote essays in pairs, using the conferencing features of POLIS, our on-line instructional web based system, so that their discussions and gradual merging toward a consensus essay were evident.

As I read the products of this process, I noticed many differences in approach by the dyads, but I mainly noticed a very high quality of "answer", of engaged discussions that complemented each other in many instances, and of a collaborative and co-constructed event and product that was certainly much more than the sum of its individually contributed parts. This had been a real formative assessment event, where several voices had a chance to synthesize several of the ideas in ways that we had not been able to do before. I think my biggest challenge in the midterm event was to keep my mouth shut. It wasn't that I wanted to re-direct any part of the process;it was that I was (and am) so pleased with what was going on that I kept wanting to say—"Did you hear what you just said?" "Did you notice how that interaction just moved from a foundational to a non-foundational moment?" "Did you all hear the insecurity in participant X's last comment? What is the source of that, do you suppose, and what can we do to re-direct the insecurity?" The observer/teacher in me was being deluged with teachable moments, yet I didn't want to interrupt the wonderful process as it was unfolding in order to comment on it. Part of our continuing research into the products and process of the class is based on a detailed ethnographic and communication analysis of the CMC portions of the event.

In sum, I consider the midterm events to be the turning point in our class and in my own understanding of what interdependence can mean in a classroom setting It remains with me, in affective as well as in cognitive terms, as a key event, as a "top-of-the-mountain" experience in teaching and learning. Mainly I feel thankful that everyone jumped in, took the risks, and made it happen.

Descriptors, Definitions, and 'Artifacts' from Planet Xeno

Given the time and space constraints, I can best sum up some of the further products and processes of the Planet Xeno events by listing and briefly describing a set of descriptors that the class participants extracted from our experiences. These are a kind of artifact from our ethnographic study of Planet Xeno. I would again refer you to the web site portfolio of our class for more comments on and more voices describing or illustrating these artifacts. There it becomes clear what I can only report here, that our diverse and polyphonic voices shape the meaning and interpretation of all aspects of the new planet. Here the summaries remain as descriptors of some of the essential aspects of the landscape of Planet Xeno.

Collaboration is an interactive and interdependent act of working together in order to generate new ideas, increase knowledge, and achieve common goals which could not be accomplished individually.

Communication is a necessary prerequisite for any collaborative effort. It includes listening to what others have to say (i.e. understanding what they mean and not what one wants to hear) and having the chance to give one's own opinion. It requires mutual respect and trust for the negotiation of meaning.

Autonomous, active, engaged, interactive, interdependent learning process are terms which describe non-foundational learning. In this new learning environment, the roles of teachers and students change and students gain a higher sense of responsibility for their own and others' learning.

Process – product are ideas that highlight the habit of focusing more on the process of learning, and on the mutual exchange of ideas rather than exclusively or primarily on the outcome. The product, however, is also important and a matter of responsibility for outcomes presentable to others.

Co-construction and meaning making occur when people exchange their ideas on a specific topic, collaboratively creating new knowledge, a tangible product, or a common understanding of a concept, and reacculturating this knowledge into their own belief and knowledge systems.

Community of support is the power or energy that people give one another when working together to accomplish a desired goal. Such a community involves reciprocal interdependence where one member's output becomes another's input, and viceversa. Members work together and trust each other in a co-creative symbiosis. This community is a safe place for risk taking and voicing opinions without fearing sanctions.

Dialoguing implies the suspension of judgement in the exchange of ideas and opinions. In dialogue, the goal is not to reach a conclusion, rather, it is to foster an environment where multiplicity of opinion is valued.

Ways of knowing is our approach to challenging the positivist paradigm, which values one truth. In our context we placed value on a multiplicity of perspectives, the process of sharing, exploring, and hypothesis testing. Teachers who thought they were teaching knowledge that they considered "true knowledge" have to "unlearn" what they thought was true, and instead, integrate different perspectives into their teaching.

Coloring outside the lines refers to learning without limitations on ways of being, thinking, and knowing. Collaborative writing, learner-initiated tasks, inclusion of multiple literacies, especially computer mediated communication (CMC). Here process-oriented evaluation, encouraging and assuming reciprocal interdependence, and the co-construction of knowledge are all examples of moving away from the traditional paradigms of teaching and learning towards a non-foundational paradigm.

Concluding Remarks

In this beginning exploration of these rubrics, and using the texts and experiential reports by the members of the class, I have begun to illustrate and point toward further possibilities for the essential use of CMC and non-linear, complex, dynamic ways of knowing, learning, and teaching as the future for fully implementing information technology and CMC for teacher education. These ideas, brought into juxtaposition here, clearly support teaching, learning, and research paradigms that investigate multiple ways of knowing as the epistemological home for this inquiry. In the words of (van Lier 1998):

> Traditionally we have thought of scientific research as a matter of looking into causes and effects, and benefits have been cast in the shape of generalizations from a sample to a population and of accurate predictions of future occurrences. This research scenario . . .will no longer work once we venture forth into the real world of complexity, in which many people and circumstances act and interact. Here there are no simple causes, and predictability must yield to contingency. Research must be aimed at increasing our understanding, both holistically and in the smallest details, of the social setting as a complex adaptive system. (pp. 157-58).

This descriptive account shows, then, how a groups of teachers and learners could explore and push the boundaries of possibilities for addressing the web of relationships among collaborative and other forms of non-foundational graduate education, collaborative language, literacy and culture learning, and multiple literacies including those possible in CMC. Learning to inhabit Planet Xeno as resident aliens there meant acculturation to a new way of thinking, learning, and teaching, based on the non-foundational paradigm described here. As we found ways to live and learn the theories, terminology, and especially the practices of non-foundational learning and teaching, we became members of a new complex adaptive system which we know as our transitional knowledge community.

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Developing A Contract For Learning:
A Constructivist Approach For Professional Development

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Abstract: An increasing number of teachers returning to the Faculty of Education for advanced coursework are interested in learning technology skills—with a specific emphasis on learning how to effectively use computers in their classrooms. These teachers explain that the alternative has been to learn on their own or attend professional development days which often only focus on skills such as word processing, grading programs, or use of the internet, but not how to use technology to enhance student learning. In this longitudinal study, we utilized a constructivist approach (Duffy & Cunningham, 1996) facilitating the development of teachers' skills to increase their competency in using technology in the classroom. The primary focus for the use of technology in the classroom was to enhance opportunities for student learning and to develop higher order skills such as critical thinking and problem solving (Jonassen & Reeves, 1996). Through interviews, questionnaires, and observation, data were collected to address the specific research question, how can practicing teachers best learn to use technology to enhance the learning experiences for their students?

Background

In Canada, the implementation of technology in public schools lags considerably behind what can be found in comparable school settings in the United States. In the United States, hardware and software is more prevalent, however meaningful integration of technology within the classroom, particularly to enhance learning still falls short of expectations (Hill, 1999; MDR, 1998; O'Donnell, 1996). This study takes place in British Columbia where elementary school districts are just beginning to plan for the wiring and development of other infrastructure systems to support the integration of computers into the classroom and computers are just beginning to be available in classrooms throughout the school (BC Ministry of Education, 1995b). A curriculum document (called an Integrated Resource Package—IRP) with learning objectives in instructional technology for K-7 was recently developed (BC Ministry of Education, 1996) but then pulled from circulation and has been put on hold indefinitely. At the secondary level, computer use is most frequently found in computer science courses, with increasing use in technology education, science

and the fine arts. In most institutions, students graduating from universities from a teacher education program are not required to take technology coursework or pass exit requirements based on technology competencies and therefore enter the school system unprepared to integrate technology into the teaching/learning process. As computers do become more prevalent in the school setting, there is a great need to provide professional development for teachers so that the computers can be used effectively to enhance learning in the classroom.

Many professional development efforts to date remove teachers from their school setting and take them into a district computer center, often with equipment much different from that which would be found in their local school setting. Teachers are taken through step-by-step instruction on common software programs or introduced to the internet. Educational software is seldom presented and little instruction is provided to the teachers on how to integrate the use of computers into their classroom or connect technology experiences to the curriculum. Learning basic skills is of import to the teachers, most of whom have little to no formal training in the area, but the efforts fall short of what the teachers say is really needed. As O'Donnell (1996) comments, "the majority of teachers who are utilizing computers in their classroom have not fully integrated them into the curriculum but have only incorporated the computer with little change in actual curriculum and classroom strategies" (p. 3). Teachers are learning how to use computers, but not in a manner that appreciably impacts students' learning or connects to curricular content.

Participants

Five groups of teachers and two groups of parents participated in this on-going study of in-service efforts aimed at providing teachers with the skills to successfully implement technology and new media into the classroom to enhance the learning experiences for their students. All research was conducted in the Lower Mainland in British Columbia. In the mid-1990s, O'Donnell (1996) remarked that, "there are no studies that asked a broad spectrum of classroom teachers what their specific needs are for integrating computers into the classroom" (p. 16). To begin our studies, we were interested in first looking at what teachers think about the use of technology in the classroom and explore how they were currently using technology. Little research beyond Ministry-sponsored reports (BC Ministry of Education, 1995a; 1995b) is available from within a Canadian context, particularly in Western Canada, so our first research efforts were to gather baseline data.

Four small groups (n=~8) participated in the first stage of the research aimed at looking at what teachers and parents think about the integration of technology in the classroom. Separate focus group interviews were held with these four groups; one group of teachers consisted of elementary level (K-5) teachers, the other group were lower secondary level teachers (grades 6-8). Both groups of teachers were non-computer users, in the sense that they did not actively incorporate the use of computers in their classrooms. We included both new teachers and more established teachers from across their stated primary discipline affiliations. The parent groups were also grouped by grade level of their children (grades 3-5 and 6-9). During the second stage of research, an inquiry was made to find out how elementary school teachers were currently using computers in the classroom. In contrast to the focus group interviews, teachers in this group actively used a computer within their classroom. An effort was made to include teachers from a broad stated range of comfort and knowledge about using computers; every effort was made to be inclusive and not limit the participants to those most comfortable with technology. 120 teachers were surveyed to find out how they were using computers in their classroom. From this group, 16 teachers participated in an in-depth interview.

During the next stage, actual in-service efforts were examined. From our research, the district-arranged professional development did not seem successful in the teachers' opinions. In light of this, it was decided that we would next focus our attention on school-based and university-based efforts. Following the lead of literature recommendations (Duffy & Cunningham, 1996; Hill, 1999; Wilson, 1996) we focussed on programs that utilized a constructivist approach toward learning.

The first in-school group consisted of 14 teachers in a secondary setting, who came together as a community to learn how to use the internet in their classroom. They were guided by the computer studies teacher but were asked to develop their own goals. The CS teacher also took on the role of researcher in this study. The teachers were followed for one school term (six months). The other school-based group had just received a grant for new equipment and software—the school as a whole was looked at for how they decided to implement the technology and provide training for the teachers and students in the school. Fifteen teachers were observed in the computer lab setting (the researcher was on site as a participant observer three days per week for a period of six months). In-depth interviews were conducted both before equipment was purchased and after a routine of use had been established. (Follow-up research during the current academic year is being conducted to look at the sustainability of the efforts to engage teachers in integrating technology in their classroom).

The final group was university-based and consisted of 16 teachers from both the primary and secondary levels. This group shared some course experiences together, but was brought together as a community primarily through the use of a web-based course tool, WebCT and informal sharing sessions both on and off campus. In these three groups, the focus was on learner-centered and directed learning experiences (Duffy & Cunningham, 1996; Hannafin, Hill & Land, 1997; Wilson, 1996)—learners developed their own goals, constructed their own knowledge building experiences (facilitated by others in the group), and applied their learning to their individual classroom settings.

Methodology and Data Collection

For the focus group sessions, a professional interviewer was hired to interview teachers about ways to improve learning in their classroom. The teachers did not know the particular topic of interest, only that researchers were on the other side of a two-way mirror and were interested in the teachers' ideas about the teaching-learning environment. The interviewer was asked to guide the discussion toward how classrooms could be improved through the use of technology and what problems they saw in the implementation of technology. With the parents, the interviewer was directed to steer the conversation toward the topic of what the parents would like their children to know about technology and the skills they felt were important for their children to acquire related to technology. The group of researchers had a variety of research interests including the development of technology products that could help teachers in the classroom as well as how teachers' apprehensions about the use of technology in the classroom could be overcome. The interviews were tape-recorded and transcribed. In addition, the researchers during the interviews made extensive notes. In follow-up meetings, the team of researchers pulled out themes that seemed to emerge from the data and utilized a modified-Delphi technique to arrive at agreement on major themes, concerns, and issues that related to technology that surfaced from the interviews.

To look at the current state of affairs in the elementary setting, a survey was sent to 120 elementary teachers in British Columbia. A total of 89 questionnaires were returned for a response rate of 71%. Follow-up interviews with 16 of these teachers were held to confirm survey information and to provide a more in-depth look at the use of computers in the classroom. Interviews were transcribed and data triangulation methods were used to find convergence between survey data and interview data.

Based on the information gained during the focus group interviews and the survey of elementary settings, it seemed important to look at efforts to build technology skills of teachers both within school settings and through university coursework. Three separate case studies were initiated to provide a multi-faceted view of teachers learning to use technology. In all three settings, the researcher acted as a participant observer (Bogdan & Biklin, 1992). Interviews, observation, and personal research journals were kept as data sources. To identify and establish patterns or trends in the data, the constant comparison technique described by Bogdan and Biklin (1992) was used. Teachers in the settings were asked to develop their own goals and to connect their goals to projects that they would actually implement in their classroom setting. Their written documentation was also used as a data source and a method of comparison of how they intended to implement technology (learning goals, objectives, and instructional strategies) and what they were actually observed doing in their classroom settings.

Results

From the focus groups, it was immediately apparent that the teachers were uncomfortable with technology in the classroom. Their concerns focussed on three areas: their own lack of preparation and experience; the assumed chaos that would result if students were allowed to use computers on their own (at a learning station or computer center); and the teachers' inability to "fix" the computer when something went wrong (the teachers shared a perception that something was always going wrong with computers). This is consistent with Reeves' (1998) finding that across many studies, teacher confidence is a factor limiting computer use in the schools. The parents on the other hand were anxious for their children to develop a variety of computer skills ranging from basic word processing to the development of multimedia presentations and use of computer languages. The parents in both groups were convinced that their children's future success depended on strong computer skills.

From the survey of elementary teachers, it was clear that teachers learn their technology skills on the job and do not share common strategies for integrating computers in the classroom. Learning more about how to integrate the use of computers into the classroom and connect technology experiences to the curriculum was a common concern. District efforts were judged to be of less value, whereas learning on their own and interaction with other colleagues seemed to best aid teachers in implementing their goals. Obstacles to using computers were lack of time, inadequate hardware and software, and lack of appropriate training. This is consistent with findings from the U.S. as well (Becker, 1994; Chiero, 1997; Hope, 1995; Reeves, 1998; Sheingold & Hadley, 1993).

Additional findings were that teachers and students worked together to decide how to use the computer in the classroom and that groupings at one computer were usually in pairs or individuals. Teachers across the study agreed that the ideal set-up was to have both a computer in the classroom to help facilitate integration within the classroom, but to also have a computer lab for skill instruction and full class projects. 73% of the teachers said that having a computer in the classroom did not affect the way in which they taught. The focus group on the other hand felt that it would be chaotic to have a computer in the classroom and worried that they were unprepared (and in some cases unwilling) to change their instructional methods to accommodate computers. Because the survey group was comprised of computer-users, it may be that they were more comfortable with an open classroom approach (where students move about from their desk to the computer) and thus did not find integrating computers to be disruptive to their normal class routine.

In the first study in the school setting with 14 teachers interested in using the internet in their classroom, it was found that the development of a community was important in initiating an effort to increase the teachers' levels of competency. The project was started by the computer science (CS) teacher who offered to meet once per week with teachers on Friday afternoons to help the teachers develop and fulfill their own specific goals. These meetings turned into hallway conversations as the CS teacher found himself engaged in supporting the community during every free moment away from his regular classes. At the conclusion, many of the teachers successfully implemented the use of technology in their classroom, but to great cost on the part of the CS teacher. His thought was that the effort might not be sustainable without his direction. (The sustainability of the effort is being addressed in a follow-up research effort). The key to success from the view of the CS teacher was that the teachers chose their own goals for how to use technology in their classroom and that their efforts were supported by on-going interaction with other teachers in the school. The CS teacher also found that it was important to provide instruction that helped teachers reach their stated goals rather than offer general one-size-fits-all workshops. When the teachers were provided with the support they needed to develop their in-class technology goals, their engagement with technology overall increased and they were successful in implementing their planned projects. It was also found that these teachers were implementing technology in their classroom with the same constructivist principles that were guiding the development of their own learning. Students engaged in using the internet to solve problems of personal importance and to connect with students in different locations to gather information, opinions, and feedback. Their feeling was that the students in their classroom increased their ability to use higher order skills such as critical thinking and problem solving (though this is anecdotal, as they were not systematically measuring this).

Similarly, the university-based group formed a community of learners to support each other throughout the course of the project. They were also asked to develop ideas articulated in the form of a "contract for learning" describing what they would like to learn about technology and to specifically connect their learning to experiences that would enhance their students' learning in the classroom. This departs from the norm, where university technology courses often present theory or present a variety of skills to teachers unconnected to their classroom environment or to their previous level of experience in technology. In this research project, the teachers could choose at any time to attend workshops that focussed on the skills that they wanted to learn; participate in group discussions about technology issues; learn on their own or with peers; or work in an open lab setting with opportunities to consult with graduate student peers or the instructor. All learning experiences required the teachers to use their chosen in-school project(s). The teachers agreed that they learned far more from this initiative (as contrasted to previous experiences) and that they all were able to see the results of their efforts in their personal classroom setting.

The focus of both of these efforts was primarily to look at how teachers could learn to use technology in their classroom, facilitated by a university-based effort and a local school-based effort. The ideas for technology implementation were observable when they worked on their projects with the facilitators of these efforts. As well, interviews provided data that helped to draw conclusions about what happened when the ideas were actually tested out in the classroom, but direct observation of how the students engaged with technology in these teachers' classrooms did not occur. As stated previously, we were most interested to see that teachers used a constructivist approach when integrating technology in their classroom. Because many of the projects developed required students to use the computers as tools to develop and construct their own knowledge, it was felt that in many cases this was the approach used by teachers.

The final case was an examination of how one school addressed the implementation of technology after receiving a large grant funding equipment, software, and limited training. Initially, one teacher became recognized as a Lab Coordinator (though his appointment was as a fulltime grade 6 teacher) and made decisions regarding the development of a computer lab and class use schedule. He also organized and conducted lunchtime professional development workshops once a week. Of the 15 teachers on staff, about four teachers would come to any one workshop. After some initial prescribed workshops, the teachers began suggesting themes or topics for the workshop. Attendance at the workshops usually consisted of those teachers who were interested in a particular topic being offered or if they needed help to implement their ideas in their own teaching setting. The majority of the teachers used the lab for their class when it was scheduled, though some were sporadic while others tried to gain additional access. Because the Lab Coordinator was also a teacher and could not be in the lab during use, the researcher who was acting as a participant observer in this study (and was present 3 days per week, all day in the Lab), the researcher found himself in the role of facilitator. He was often asked to help students or to aid the teachers in achieving their goals. This also provided the direct observation that was missing in the other two cases.

Although both the Lab Coordinator and the researcher discussed using an open-ended learning environment (Hannafin, Hill & Land, 1997; Hill, 1999) to promote the development of the teachers' skill with technology, the initial training efforts more closely resembled direct instruction. Later as teachers initiated dialogue about what and how they would like to learn, a more open approach was used. This was particularly the case in the lab sessions when teachers interacted with the researcher in this study. The nature of his involvement clearly impacted how many of the teachers learned about and then used technology in their classroom as he took on more the role of facilitator rather than an observer. We did not feel that this compromised the study, as it further provided evidence that teachers are most comfortable initiating their own projects for the classroom and then seek the help of others to facilitate the integration of technology.

Our final observation in this study was that the comfort level with technology impacted significantly the way in which technology was used. A few teachers put on a false front, bringing their classes to the lab because they thought they were supposed to; others taught computer skills; while about half integrated the use of computers throughout their instruction and used the computer as a tool to accomplish instructional goals. Teachers who were more comfortable with technology (or were not afraid to let students see them as less than an expert) were able to engage students in a variety of opportunities to use the computer and

demonstrated a more student-centered approach toward learning. All teachers acknowledged that time was a major factor inhibiting them from fully realizing their goals. They spoke both of the time it would take for them to learn how to use the computer in a meaningful way and the time it takes students to learn the technology.

Conclusion

Early indications are that developing a community of learners to support each other in learning about technology and implementing it in the school setting may be of more value than district-provided professional development efforts as they are currently organized. Further, it seems important to have teachers connect their technology learning to actual teaching and learning experiences in the classroom and to play a more significant role in their own knowledge development. In addition, these efforts provide a more thorough understanding of how teachers are learning to use computers in Canada.

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Minds On, Hands On: The Linear-Nonlinear Problem-Solving Approach to a Multimedia and Internet Course

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Abstract: This paper examines how a bilinear instructional strategy incorporating both linear and nonlinear problem-based teaching approaches was designed and then implemented in a graduate applied technology course. It outlines how the course *Multimedia and Internet for Educators* was developed, and reports the responses of students in the course to the instructional approach used. These findings include student attitudes toward the following: usefulness of the course, effectiveness of learning process and learning atmosphere, proficiency in multimedia and Internet, perception of technology integration on completed projects, and additional information gleaned about student attitudes. Conclusion and recommendation for using the bilinear problem-based approach are provided.

Introduction

The importance of preparing future teachers to integrate technology continues to be a critical concern at the national level. A report published in 1997 by the National Council for Accreditation of Teacher Education (NCATE) entitled *Technology and the New Professional Teacher – Preparing for the 21st Century Classroom*, states "The nation's teacher education institutions must bridge the teaching and learning technology gap between where we are and where we need to be. Teacher education institution must prepare their students to teach in tomorrow's classrooms. Rather than wait to see what tomorrow's classrooms will be like, they must experiment with the effective application of computer technology for teaching and learning in their own campus practice. Today's teacher candidates will teach tomorrow as they are taught today (p 1)."

The traditional way of conducting technology courses must be considered inadequate for the needs of the 21st century classroom. The exclusive use of a didactic model is not only pedagogically ineffective, but reinforces a practice that will likely be reincarnated later. Cooper and Hirtle (1999) reported that a formal didactic transmission approach caused students to learn just enough to be successful in the context of the course they were studying, yet, the acquired skills were quickly diminished. They found in subjects a lack depth of conceptual understanding and an inability to construct meaningful

applications. Educational technology is a field in which knowledge, content, and skills change very rapidly. New technology such as multimedia and Internet are too complex and too multi-contextual to rely on traditional models of instruction. We need to find ways to prepare students not only to use technology in meaningful ways, but also to integrate it authentically into their teaching.

Problem-based teaching strategies have received the increased attention of many educators (Cooper and Hirtle, 1999). Problem-based approaches provide the student with the ability to more authentically interact with their subject and make connections that are more inherently meaningful to their own lives and previous learning. In an applied technology course, they provide an opportunity for students to develop greater technological competency while reflecting on their own learning processes, develop a deeper understanding of the tasks they are engaged in, and enhance skills needed to solve real-world problems.

Forcier (1999) describes two models for problem-solving strategies - linear and non-linear. A linear approach is characterized by a direct, sequential and outcome-driven strategy. A nonlinear approach is characterized by an indirect, random and process-driven strategy. This study examines the adaptation of a combination of both strategies implemented into an applied technology course, where each was employed sequentially to obtain the most authentic and effective combination.

The Study

In order to provide its students with experience in using updated technology to enhance instruction and professional development, the School of Education at the State University of New York at Oswego created a new graduate course, EDU 505 Multimedia and Internet for Educators. In an effort to construct the most authentic and effectively delivered course possible, the choice of course design was re-evaluated from those previously used, and the decision was made to employ an alternative model from the traditional course structures using formal, didactic transmission models. Ultimately, EDU 505 was designed using a model characterized by the following components:

1. A problem-based approach to processing content.
2. A sequence of linear and nonlinear instructional strategies.
3. The application of productivity tools for creating multimedia presentations.
4. The use of computer-based technologies including telecommunications to access information and enhance personal and professional productivity.
5. The use of computers to support problem solving, data collection, information management, communications, presentations, and decision making.

(ISTE-Recommended Foundations in Technology for All Teachers: Personal and Professional Use of Technology, 1998)

The Course

EDU 505 was offered in summer 1999. Enrollment in the class was restricted only to graduate students. The class was limited in size (16 students, 4 males and 12 females) and met for 3 hours twice a week for 6 weeks. The course covered three major topics: (1) Use of the major Internet tools for K-12 teaching and research, (2) Design and development of multimedia programs, and (3) Design and development of basic educational web projects. Coverage of each area was divided into a linear and non-linear component. Forty percent of the instruction was based on a linear outcome-driven approach intended to instruct students in the use of applications and provide guided problem based exercises. In this component, problems were designed to lead students through deliberate stages of facility with each of the requisite operations. Sixty percent of the instruction was based on a non-linear approach grounded in an inquiry/problem-solving model. In this component students were given tasks with more open-ended criteria. The focus here was placed on inquiry and self-directed, creative, collaborative problem solving.

The instructor was the primary designer and instructor for the course, and participant-observer in the data collection of the study. Two colleagues acted as additional participant observers and design consultants throughout the duration of the course. Data were collected from the following sources:

1. Field notes taken by the co-investigators
2. Interviews with students
3. Final reports from students

Component One: The Linear Problem-Solving Phase

Most students entered the course with word processing experience, but little exposure to multimedia and Internet applications. They had minimal experience with e-mail or Internet browsers, and had limited skills and understandings needed to integrate updated technology with their instruction. Therefore the initial emphasis of the course was to create a foundation of necessary concepts and skills.

The linear problem-solving approach follows a deductive cognitive pattern consisting of two phases; analysis and synthesis. The analysis phase includes defining of the problem, understanding the component tasks. The synthesis phase includes designing a solution to the problem, developing a solution to the problem, and then evaluating the results (Forcier, 1999).

To initiate each of three new topics, a problem was introduced to the students in the form of a case study. Both instructor and students collaborated to analyze the problem, seek the solutions, apply related computer technologies, evaluate the final product, and discuss possibilities for integrating new technologies into real-world problems/projects.

The following instructions were provided to students for each of the 3 projects:

1. Simple and general – initial analysis involved student-driven idea/topic generation. Students majored in different fields, so it was crucial to make sure students could understand the content and had a sense of their collective common interests and related their own experience to the project/problem. EDU 505 was organized around three general problems: finding a lesson plan on the Internet (topic 1); Powerpoint presentation on "Welcome to SUNY Oswego" and HyperStudio jeopardy game on "Do you know Oswego?" (topic 2); and the web site "Introducing EDU 505" (topic 3).
2. Straight and sequential – students had different learning styles, they viewed the same case of the problem with different perceptions. To ensure the prerequisite basis for effective problem-solving, the instructor provided the students with clear definitions, an understanding of the problem, the requisite task skills related to the problem, and possible strategies to help students find solutions. During the independent practice portion of the activity, the instructor assisted in the development of project storyboards, supplied content outlines for each problem/case, and provided formative feedback to students throughout the process.
3. Small and applicable – students entered the course with different computer technology capabilities, and experience and background were varied. This created an inherent problem related to how much depth and at what level of detail each application should be introduced. Given this, consideration needed to be given to the most appropriate applications and tasks for each problem/case. To reduce computer anxiety and students being overwhelmed by the vast capability of each application, the instructor begin with small and selected features of each application. For example, the instructor allowed basic multimedia functions to be included in products/problems without requiring students to engage in detailed programming. It was found that this introduction of basic skills and concepts was probably the best way to develop students' knowledge and confidence in this "hands-on" setting. A good rule is to teach simple concepts when the anxiety level is high, and more complex ones when there is a high level of comfort.

Component Two: The Nonlinear Approach Phase

With each topic, after an outcome-driven grounding using a direct linear problem-solving approach, students were ready for a transition to a nonlinear collaborative-inquiry approach. The main purpose on this phase was to let students operate in a flexible environment that would be more comfortable for more random thinkers and challenging and exciting to the more concrete and sequential thinkers. In addition, this phase has the added factor of being motivational, given that students selected their own direction and projects.

The nonlinear approach allowed individuals the room to determine their own path to goal attainment without having a hierarchical structure or predetermined outcome imposed on them. This strategy consists of a sequential three-part process: The first part is the "given" and is characterized by the information in the learner's possession. The second part is referred to as the "to find" phase and is characterized by the information the learner is seeking. The third part is the "procedure" characterized by the process the learner is going to use to reach her/his goal.

Three integrating projects were assigned for the semester. The following section outlines how the three part nonlinear strategy was implemented for each of the projects.

Project One: Using Internet as Educational tool

Given -- Related web sites: Sink or Swim: Internet Search Tools & Techniques (http://www.ouc.bc.ca/libr/connect96/search.htm), Online Resources for Educators (http://www.berksiu.k12.pa.us/kevin/); evaluation standards on web sites.

To develop – A clear, concise, convincing review article on one or more education area.

Procedure – Identify key words on interested topics, apply search engine strategies; review the related web sites; find separate sources that say the same thing, organize thoughts clearly; copy and paste cited web sites into a word processing file; and write final review.

Project Two: Educational Multimedia Project

Given – Multimedia applications (Powerpoint and HyperStudio); different multimedia examples and ideas (make a proposal or recommendation, present a research or scientific report, give a lesson or instruction, report progress or status, make a book report).

To create – A group multimedia project dealing with real world teaching and learning.

Procedure – Negotiate project topic with team members; plan the structure or create a storyboard; decide the purpose or goal of the project; create a time line for the completion of the project; assign roles to team members; search for information using textual, electronic, and pictorial sources of information; decide how information will be represented (text, picture, video); decide how the information will be organized, and evaluate and revise the design of the project.

Project Three: Educational Web Site Design and Development

Given – Web design software (Claris Homepage, FrontPage, and Netscape Composer); types of educational web sites (class web, web lessons, learning webs, educational resources, virtual field trips, and individual webs).

To develop – A group or individual educational web site.

Procedure – Decide the intended audience, project topic; decide the web site format; make internal pages (text, picture); evaluate and choose external links (reliability, authority, appropriation, validity); structure the internal and external links.

Being graduate students and current teachers, class participants recognized the attempt made at a bilinear model and appreciated the opportunities it afforded. In this phase, the instructor mainly stayed in the role of resource, guiding students in potentially fruitful directions and answering questions related to technical aspects of the course. When students were unclear as to how to best accomplish their project, the instructor acted as facilitator to help students "solve their own problems," and examine the lessons within the problem itself. While the students were given ultimate freedom, the instructor often needed to assist students in their decision-making regarding how to segment and sequence information to make it understandable, how information could best be represented (text, pictures, video), and how the information could be organized (i.e., hierarchy, sequence) and linked most meaningfully. In this phase, a primary role of the instructor was to act as technical consultant. In many cases, the technical problem's solution was best "discovered" by the student using their own resource and inquiry skills. However, some

problems substantially inhibited a student's progress, and in those cases the instructor needed to intervene to provide solutions and/or micro-teach lessons on application capability and use. In this phase of the instruction, students were strongly encouraged to collaborate with peers. As problems lead inductively to novel solutions and innovation often "two heads were better than one." Quality performance was judged less in this phase by product as by process outcomes.

Findings

Findings from written surveys reflected positive student reactions in the areas of instructional effectiveness, usefulness of the integrated model, and affect on classroom atmosphere. Student responses related to the use of the bilinear instructional strategy demonstrated that they felt their experience was for the most part both meaningful and productive. This could be seen in the following set of written comments: "I like the structure of the course because it allows graduate level students to explore and learn on our own with support from professor. I know that there are various levels of computer experience, so this allows everybody to receive the amount of help that they need." "The course was a useful one. It enabled us to do some things that other classes do not have the time for. This class enabled each person the opportunity to create a web site, and perform a multimedia presentation. The hands-on approach really was beneficial." "I feel that the class as structured was super. So many classes are just straight lecture and honestly I feel little information is actually retained. This class was instruction and then tons of hands-on practical experience which is the best way to learn. Instructor gave excellent step-by-step procedures on how to work on the project and always gave examples which I find extremely helpful when trying to understand a concept." "The learning process was fundamentally easy and satisfactory because theory and hands-on were combined into one. The professor did an excellent job presenting the materials in a level that everyone can understand. I enjoy the hands-on side of the course and the autonomy to be creative." "I appreciated the manner in which we were taught how to use specific tools and then allowed to utilize them immediately. In this way, the lessons were fresh in our minds and the skills were easier to master." "I enjoyed the way this class was run. Once the professor shows me the way I like to take my own course to reach the end product. This style was perfect for me."

Students felt overall that the integrated and hands-on nature of the course was conducive to their making meaningful applications to their own work. These sentiments were reflected in the following comments: "The use of technology for my projects made it more enjoyable and interesting. Not only did my proficiency in the subject matter increase, but also at the same time I improved my computer application skills. It is almost like two courses in one." "The material I created in this class will be used in my classroom This is exactly what I was hoping to get out of the course." "It definitely enhanced its appearance and clarity. Technology can be used in so many different ways that creating some of the projects we've done in this class is only a stepping-stone to what can be done with our students. It offers a more focused use of technology within our classes." "I plan to use the things I have learned in my classes. I set up my web site for my students. It includes some information about myself, my expectations for each class, and students' grades and homework assignments. I mentioned the idea to my summer school students and they said that they thought it would be very useful. I am really excited about showing the site to my principal and colleagues. The best thing about this course is that I have learned some things that I can actually use." "I think technology integration enhanced my project and enabled my audience to understand clearly my point of view." "My proficiency in multimedia skills and using the Internet has increased quite a bit. I plan to use both the PowerPoint and web page in my class this year, so my efforts will be well rewarded both in the near and distant future." "Being a technology teacher this course relates directly to my field of study, and NY State curriculum for technology education. I feel through this course I have increased my knowledge of the Internet and I got exposure to a new multimedia program HyperStudio."

Finally, students reported that the linear-nonlinear collaborative problem-solving approach created a positive environment in which to learn, seen in the following comments: "The learning atmosphere was great with many of us working together and helping people." "The format of the class was very laid-back, and a non-threatening environment was provided for learning." "Although I found all

of this overwhelming I was grateful that professor allowed us to work with partners. My partner was a patient teacher and made me do all the steps even though he knew how and it could have gone much faster." "The best thing about the class was the supportive atmosphere. There was not any pressure or stress when working on the computer. There was always help when you need it." "It was also nice that other students in the class were willing to help each other." "I feel that our class was a very safe and comfortable learning environment."

Discussion

As the findings suggest, using a purposeful combination of both linear and nonlinear strategies within a problem-based approach, provides students with dimensions of learning that neither one alone can achieve. To reduce students' computer anxiety and enhance technology integration, computer-based courses should be relevant to students' interests and learning styles, and incorporate an instructional model that employs a cognitive developmental framework most suited to the needs of the learners. The learning program should provide hands-on learning, opportunities for feedback, supportive and caring instruction, and active learning experiences in which students work on their own projects and see the application of computer skills to their area of study, (Yang, Mohamed, and Beyerbach, 1999; Comer and Geissler, 1998). The linear component outlined here also provides the concrete sequential learners, of which a high proportion are teachers (Shindler, 1998), a safe and well matched starting point. Likewise, participants' comments reflected a true appreciation for the challenging and self-responsible nonlinear component to each project. The more random and abstract minded learners were able to unleash their creativity while the more concrete learners could move more confidently into a less structured horizon having been grounded in the earlier linear experience. All students seemed to appreciate that whether the learning was outcome-driven and direct, or process-driven and indirect, it was "hands-on" and problem-based. Concepts and procedures, whether direct or indirect, were experienced within the context of an exploration of "real and material" action. Students walked away from their technology experience having developed a meaningful understanding of its capability within an authentic context. Moreover, because these teachers often find themselves reproducing the instructional environments that they themselves have experienced, the bilinear problem-based model provides a sound and innovative practice to add to their teaching repertoires.

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Staff Development: Task-Oriented Training

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Abstract: The present article documents a particular model for inservice faculty development at a computer-technology magnet school in a Midwestern city, Using the ACOT model the article recorded the beneficial training activities leading the faculty through different stages of developing their core technology skills and implementing instructional technology in their daily teaching. The most important strategies utilized in this school setting was task-oriented training, which contributed greatly to the faculty development of technology competency and the understanding of technology-related issues in classroom practice.

Introduction

In 1998, an ISTE (International Society for Technology in Education) national survey showed that information technology is increasingly available in schools. Related similar studies showed that K-12 schools in the United States have approximately one microcomputer for every five students. At the same time, past studies have also documented that teacher professional development including both preservice and inservice teacher training, has not kept pace with the rapid changes in the quality and quantity of information technology. During the next decade, the teacher work force is expected to experience a rapid turnover, not to be replaced by technology as such, but by teachers with technology skills and implementation strategies. (ISTE, 1999)

The Burlington Community School District Computer-Related Technology Plan states that "The effective integration of technology assumes that teachers are facilitators of learning, designers of individualized programs, and learners themselves. Efficient operation and management requires staff skilled in the use of technology tools. On-going training and access to information technologies are essential." (http://www.burlington.k12.ia.us/TECHDEV.HTML) This statement makes clear the role that teachers are expected to play. According to the U.S. Department of Education National Center for Education Statistics, relatively few teachers (20%) report feeling well prepared to integrate educational technology into classroom instruction (Teacher quality: A Report on the Preparation and Qualification of Public School Teachers, January, 1999).

Staff development or inservice training is a scheduled or regulated practice in both private and public schools. With an increasing time investment dedicated to training inservice teachers with basic technology skills and the skills of integrating instructional technology into their classroom teaching, there are correspondingly high expectations of seeing more technology implementation in the students' learning and their outcomes. Among the existing models popularly used in the schools, the Apple Classroom of Tomorrow (ACOT) sponsored by Apple Computer Inc., has gained particular recognition among the practitioners. The book, Education & Technology edited by Charles Fisher, David C. Dwyer, and Keith Yocam (1996) provides reflections on computing in the classroom. The most commonly shared realization among the participants is that technology implementation should bring changes not only in the learning environment, in teachers' roles and student behaviors, but also in the learning outcomes. Also those involved in training the inservice teachers should come to realizate that teachers need ongoing emotional, technical, and instructional support during this process. Teachers go through different stages in the development of their respective perceptions of technology and their skills to implement and integrate instructional technology in their classroom. The following five stages were proposed by ACOT:

Entry → Adoption → Adaptation → Appropriation → Invention

(ACOT, 1996).

While the above model can be viewed as a template for training inservice teachers, one must be mindful of the fact that variations on this theme will generally be necessary to make the model applicable in any particular situation. Furthermore, the transition from any one of the stages to the next can be an arduous one. Years of experience have taught us that the success of training very much relies on strategies that fit the special circumstances of a particular school or district, such as those related to financial resources, technology facilities, faculty perceptions and commitment, attitudes of administrators, and support from the community.

In Alan November's article "Drill the Teacher, Educate the Kids" (http://www.anovember.com/articles/drill.html), we find that "The goal should be to train teachers not to master specific technologies, but instead to design learning environments in which technology helps children learn." However, this statement is incomplete as one must strive to train teachers to have technology skills beyond the rudimentary levels, as well as to look into methods of implementation and creating interactive learning environments for our children.

Analysis of the School Situation

The present article documents a particular model for inservice faculty development at a computer-technology magnet school in a Midwestern city, thus fleshing out a particular version of the ACOT model given above. It is likely that small variations on this model will apply to other schools, as well. In the course of this faculty development, we found that the transition from the *adoption* in the ACOT model to the *adaptation* was especially difficult. Below, we describe this difficulty, as well as document how a solution based on project-based learning was effected to bring about a successful resolution of this difficulty.

The school in question had five hundred students covering grades K-5, with most of the students coming from low-income families. Part of a three-year federal grant was used to purchase 450 computers, to be distributed into four computer labs each with roughly 20 computers, and into individual classrooms, each having 12 computers. In addition, various instructional software packages were purchased and installed, which over the course of the three-year grant, included over 300 different software packages in all subject areas and covering all levels (K-5). Finally, one salaried teacher (trainer) with a Master's degree in gifted education was given the responsibility of curriculum development and of training the full-time faculty, which included 24 homeroom teachers, six special education teachers and close to fifty additional administrators and staff. Six times each semester during the period of the three-year grant, the teachers participated in technology staff development, with a portion of the grant money used to hire substitutes to cover the inservice teachers' classes. The training was primarily to help teachers become familiar with the school network, as well as with the software. Every teacher and staff member had one personal computer for administrative and instructional work.

The Beginning Stage

After a few basic orientation sessions for the teachers and staff, the trainer divided the teachers into two groups, grades K-2 and 3-5. The K-2 teachers were trained in the basic functions of word processing, use of spreadsheet and database software packages, and in the use of Kid Pix for graphic and text applications. Those in grades 3-5 were trained to use HyperStudio as a multimedia application in addition to the basic software packages mentioned above. The goals were for the teachers were not only to learn the basic skills in using these technology tools, but also to apply them in their teaching and to assist their students to use the tools in order to promote learning. Beyond this second stage in the staff development process, however, the teachers reached a plateau, learning very little in the way of real instructional applications of the technology. Where there was some use, this was generally of a record-keeping or organizational nature, rather than innovative instructional applications. Despite the training, by the end of the first year too many of the teachers did not feel sufficiently comfortable with what they had learned to create a technology-supported learning environment.

In order to help the teachers resume their learning, as well as to enhance confidence in the use of technology to deliver a more meaningful education, the training sessions were modified so as to be more *project-based* in their approach (Zhang, 1999). That is, rather than having the training being based on a variety of

microscopic skills in technology, it was decided to divide the remainder of the training into using technology to generate a few (four in all; see below) much larger-scale projects. This not only made the technology much more meaningful for the teacher trainees, but also it gave them a better opportunity to work closely with the students, as this was necessary for seeing the projects to their successful conclusions.

Computers and technology, unlike the vast majority of the more classical academic subjects, has found a relatively large number of devotees, even amount the relatively young school-aged children. Popular stories already abound that describe the young enthusiast who spends hours of free time each week, honing his or her skills on the computer, often to a level far in excess of the teachers. This can be at the same time a challenge and an asset for the teacher trying to become sufficiently competent with the technology to find creative uses in the classroom. In the learning project under discussion, it was our conviction that those students already having far surpassed their teachers in computer and technology-related skills should be used in an integral way, for the benefit of both the remaining students as well as for the teachers in training. Therefore, such students were identified and asked to serve as teachers' assistants to help facilitate the completion of the assigned projects. These "assistants" proved to be important catalysts in both the teacher training as well as in the student development.

Task-Oriented Training

The projects themselves were chosen to be both meaningful and relevant and mirrored similar real uses of technology in society.

- Project 1. Using audio-visual technology, students produced a 15-minute news broadcast, covering school or classroom news and events, student interest stories, student awards, as well as other special news.
- Project 2. Using Microsoft Publisher, students produced a school monthly newspaper, complete with news stories and editorials, as well as a literary section, drawing from students' stories and their writings, together with student photographs.
- Project 3. Using Kid Pix or PowerPoint as the primary software packages, students created highly professional-looking presentations covering a wide range of subjects. Some of the presentations were even dubbed onto video tapes and broadcast by the local TV station to the entire community.
- Project 4. Using a combination of desktop publishing tools and related products, different groups of students each month created monthly displays highlighting diversity as a theme. Classes were paired together to work on this project, with upper-grade students helping lower-grade students. This taught not only the technical skills, but also cooperative skills as well.

The above projects were valuable and meaningful introductions to technology for the students, and the teacher trainees also developed a much better appreciation of the potentials for creative introduction of technology into their curricula. In addition, these designated projects with specific responsibilities for particular groups of students were valuable in motivating teachers to assume their roles as facilitators and as leaders. As a result, after this third year, most returning faculty had the confidence, knowledge and skills necessary to apply instructional technology in creating an enriched environment for students learning. Of the teachers in the training project, fully 80% of them continue to use technology as integral components of their instruction as well as of their administrative duties.

With the completion of the above three-year training session, we were able to bring the teacher trainees, many having previously only the most rudimentary training, from the *entry* stage to a point well into the *adaptation* stage of the ACOT model. Many of the teacher trainees had come so far in the realization of the potentials of the application of technology, that they had made the further transition into the *appropriation* stage or even into the *invention* stage. This was brought about by a training session not only with specific goals and creatively conceived tasks, but also by a degree of flexibility to allow for solutions of unforeseen difficulties. The final result, quite apart from the better-trained teachers, is a new generation of technologically-literate students ready to meet the challenges of an increasingly complex society.

Conclusions

The above model can be considered successful partly because it brought a certain degree of pride among the teacher trainees, helping them into the process of becoming a self-regulated learners. Not only have they not stopped learning, but they have established a solid foundation on which to further their self-directed learning. In

turn, many have developed confidence to the point where they can play leadership roles in assisting technology trainers in educating future teachers in important basic technology competencies and implementation strategies

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Learning to Teach, Teaching to Learn: How Post Graduate Students on Initial Teacher Training Courses Develop their Information Technology Skills

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Abstract: This paper examines, from a contructivist perspective, the ways in which student teachers seek to improve their Information and Communications Technology (ICT) skills in order to gain Qualified Teacher Status (QTS). All trainee teachers in England and Wales have to meet nationally agreed standards of competence in the use of ICT in order to gain QTS. These standards (DfEE 1998) cover a wide range of skills and include both personal skills and the application of ICT within a school and classroom setting. The research examines the sets of conditions which prove most enabling for students integrating technology into their teaching and the implications for future course design in teacher training.

The education system in England and Wales draws a distinction between IT, the study of information technology as a subject, and ICT, the application of these technologies to teaching and learning situations in all areas of the curriculum. In this paper, we will use IT for all aspects, except when quoting papers that make specific reference to ICT.

Introduction

Over the past few years, the Department for Education and Employment and the Teacher Training Agency have introduced far reaching regulations and standards for schools and for pre-service teacher education. In this study, we are principally concerned with *Circular 4/98* (DfEE 1998), which sets out the information technology standards all students must demonstrate. These include skills in their personal use of the technology and the ability and judgement to use the technologies successfully and appropriately in the classroom. These standards apply equally to all students, irrespective of their subject specialism.

Each September some 200 postgraduates enter our one-year Post-Graduate Certificate in Education (PGCE) to train to teach in 'secondary schools' (ages 11 to 18). The year is divided into two semesters and in each, students have a short serial placement of two days per week in schools, followed by a longer period of full-time school experience during which their teaching load rises to 75% of a full timetable. The majority of the PGCE students are "mature on entry" — the median age is usually 31 or 32 — and they have a wide range of knowledge of IT. A rapidly increasing proportion have worked in jobs involving regular use of IT and the younger or more recent graduates will have had to make use of IT in school or on their degree courses. However, their IT experience is rarely "balanced": they may have been involved in DTP or as a multimedia designer, yet have little or no experience of spreadsheets or databases. A number of studies have considered the general spread of students' IT skills at the point of entry (notably Denning and Sellinger, 1999) and for the past six years we have monitored our students' IT skills both at entry and exit.

In previous years, following the initial IT audit, we have provided personal IT skills training for those in need. Such training was, in effect, voluntary, as there was no *requirement* to have any particular level of competence, nor to demonstrate its use in the classroom. Thus, those students who were "naturally" interested in new approaches and those who, for whatever reason, had an interest in information technology took up the training whilst, it seemed, those who were most in need could "safely" ignore it.

With the changes in the regulations for teacher training, all student teachers must now attain a high level of personal ability across a wide range of IT and must demonstrate, in their school placements, that they can apply these appropriately in a professional setting. In considering the relationship between 'knowing' and 'doing' we are using the comments offered by Pilkington and Groat (1999) "The distinction

between skill and knowledge is that a skill embeds knowledge in procedure." Thus, to demonstrate their IT skills, students' must show evidence that IT has become embedded in their teaching-related activities.

The required standards (DfEE 1998) are quite explicit about both the personal and professional aspects of students' IT skills and the requirement to demonstrate these cannot but have an effect on the students' approach to the use of IT. For example, the standards regarding classroom use say that "*students must be taught* [inter alia] *how to:*

- *decide when the use of ICT is beneficial* [or not] *to achieve teaching objectives in the subject and phase*
- *use ICT most effectively in relation to subject-related objectives*
- *identify in their planning:*
- *the way(s) in which ICT will be used to meet teaching and learning objectives*
- *key questions to ask and opportunities for teacher intervention*
- *the way(s) in which pupils' progress will be assessed and recorded*
- *ensure that judgements about pupils' attainment and progress in the subject are not masked because ICT has been used*
- [judge the] *impact of the use of ICT on the organisation and conduct of the subject lesson and how this is to be managed*"

They must also be taught "*the most effective organisation of classroom ICT resources to meet learning objectives in the subject*" and must "*be given opportunities to practise, in taught sessions and in the classroom.*" (The standards are, in fact, several pages long and can be found at http://www.dfee.gov.uk/circulars/4_98/annexb.htm).

The methodology which students use seems likely to have a great bearing on how easily they achieve these standards. There can be little formal teaching: the standards have been introduced into what is already widely felt to be an overcrowded and under-resourced curriculum: nor has there been additional resourcing to match the additional requirements. Basic training and development guidance will be offered, but it seems inevitable that students will play a large part in training themselves. Students will be faced with the need to use IT skills in planning and resourcing, teaching, monitoring and assessing and in recording and reporting. We, their tutors, need to learn how students improve their IT skills and how they learn to apply them if we are to plan effective courses for the future.

The Study

Our current research is not simply concerned with levels of resources or what particular skills are needed. We are more concerned with how the individual students build on their knowledge of and expertise in IT, what are the conditions for success and which circumstances lead to the use of IT becoming embedded in the students' planning, teaching and assessment. Research of this nature inevitably raises many questions: for example,

- does an initial facility with a word processor make it more likely that students will gain expertise in, say, using a spreadsheet to track pupil progress?
- does an initial positive attitude to IT lead to its use becoming embedded in the student's teaching?

To maintain good practice in teacher education, we need to understand the sets of conditions which prove most enabling for students integrating technology into their teaching. In assuming a constructivist basis for this integration (Brooks and Brooks, 1993), we shall examine the implications for future course design in teacher training.

There is support in the literature both for the general approach to the problem and for the nature of the questions asked. For more than a decade, researchers have argued that the effective use of information technologies in the classroom requires some shift from "teacher as source of knowledge" to "teacher as facilitator of learning". Chatterton (1985) showed that, when using IT in lessons, "The teacher is encouraged to work in a much more supportive rôle: he/she is no longer simply giving instruction (in the didactic sense) but ... reinforcing some aspects and/or extending the pupil's awareness into new areas." In similar vein, Gonzales and Thompson (1998) argue that "In order to tap the increased access to information made possible by technology, a shift in pedagogy from the model of 'teacher as information-provider' to the 'teacher as facilitator' is needed, but the change process is slow at best." It is by using a constructivist model that we hope to show the extent to which newly trained teachers can make this shift! Gonzales and Thompson go on to quote one example in which "[the] educator began with word processing in which case

the technology was used to do the same things always done, only faster. It appears that it is only with much personal experience with the tools that the potential is realized, such as using word processing to compose more effectively."

Willis (1993), importantly argues that "questions about hardware, software and how to use applications are no longer the most important topics in educational technology. Today, the major issues are related to instructional strategies, instructionally appropriate software, professional development and how to provide continuous administrative support." While this statement is certainly true in terms of the 'most important topics' and ones which we would be most interested in discussing, some of our students are still struggling with outdated computers inefficiently organised and situated within schools. They then have to expend considerable time and energy working with a system, the knowledge of which will not be of much benefit to them in future. As one student explained: 'Teachers haven't talked much about IT, but have explained which error messages indicate that it's better to give up at that point.'

The BECTA (previously NCET) publication *Managing IT* (1996) used a model developed by the MITs 90 Research Group which modelled the extent of IT integration within organisations in relation to its effects and benefits. The adapted model used five strategic levels of application of IT: localised, co-ordinated, transformative, embedded and innovative. The model may be used holistically so schools which are at the 'embedding' stage may well have teachers whose expertise varies widely but the school policy will in practice encourage all staff to improve their IT skills and use them as part of their teaching repertoire. However, in a school where the IT practice is localised within departments some may be excellent while others are failing to innovate at all and the school policy will not in practice implement IT across a range of subject disciplines. If we use a similar model here, concerning students and their IT development, then it is very important to gauge where a student is in terms of that development. We suggest, from the evidence gained so far from our students that 4 factors are of crucial importance, degree, job experience, subject area and placement school. Whatever the students do in terms of improving their own IT skills within the professional year the experience gained in those 4 areas is cumulative and significant. Students can only move so far in terms of their own personal skills, that experience itself promotes confidence but, unless teaching experience at school is available, they cannot develop as far or as fast as we would want them to. It seems likely that students are affected by the stage of implementation the school has reached. So, for example, Business Studies students are often asked to teach IT basic skills to pupils of 11 –13 years of age, and they are not only encouraged to use IT labs with suites of computers but have to do so. When they are in the labs the work is often already organised for the pupils so that the teaching students can go around and help with the teaching. English students find themselves in a different situation, where they know there are IT suites but they are often booked up, they do not see many English teachers using IT in their lessons and they are not asked to help with basic IT skills teaching.

Denning and Sellinger (1999) in their extremely useful commentary on data relating to student competences in ICT, pointed out the range of variance in school equipment, teachers' ICT expertise and the knowledge and experience of students (self-rated) when they began one year post-graduate courses in teacher education. They cited findings by Goldstein, (1997) that overall standards in IT varied unacceptably between schools and by the McKinsey group (1997) that penetration of ICT across schools was extremely variable, and that the experience, skills and attitudes of teachers and the way ICT was used varied widely. Denning and Sellinger, in their analysis of questionnaires from 983 students, also found that 'there are clear differences between the reported competence of students with different subject specialisms'.

Our research has looked specifically at students from different subject areas, placed in schools and colleges serving a wide range of communities. In phase 1 (reported here) we interviewed 24 students on the postgraduate course, 12 expecting to teach Business Studies and 12 English. At the time of this interview, the students were half way through their first teaching placement and so could be expected to have a fair knowledge of the school and its procedures and to have developed some opinions on the use of ICT in education. In a semi-structured interview, students were asked about their experience of IT before joining the PGCE course and what views of IT this experience had engendered. They were then asked about their experiences of IT within the university-based part of the PGCE course and within the school-based part. They were finally asked about their own use of IT in teaching, its benefits and drawbacks, and their views about what helped and/or hindered their own progress. The students' self-assessment questionnaires, completed at the time of their initial interview as PGCE candidates, were also available to the project. At the end of the academic year, when we will have interviewed the students during their second placement in a second school, we will have a year-long profile of their IT development.

Student Responses

All the students interviewed (and 91% of the cohort) had a personal computer at home, many of which had been bought, at least in part, because they were coming on this course. Most students had acquired confidence in basic IT skills before starting the course — a marked change in the last four years — and most had experience of IT in the workplace. Without exception, all the students who had worked with IT reported that *having to use IT* was a very significant factor in building their confidence. It should be noted that IT was used as a tool, they were not employed as IT specialists. Jobs ranged from marketing, to customer relations, to banking and insurance and these students generally had little or no experience of IT before starting work. Surprisingly, banking and insurance gave little training, but "*left me to get on with it*" as more than one student said: a situation with some resonance in teaching.

Of the younger graduates, with only vacation work experience, the degree course was inevitably more significant. All had had to use a word processor to submit assignments and, for the English graduates, that was all they had to do. Business degree students had surprisingly little further experience, in many cases using spreadsheets for finance was as far as it went. However, many of these younger students regarded themselves as "*part of the computer generation*" and expressed confidence in their ability to cope with IT issues and there was no significant difference in the attitudes of the English and Business Studies graduates. We found this surprising, as prejudice would suggest that business graduates would have much more computer experience.

In schools, however, there was a marked difference in the frequency of use of computing: given the nature of the subjects this was to be expected: English students used computers less than Business students. However, the story is not quite that simple: some of the English students were using IT more than some of the business students were. This would appear to be, in large part, a function of the resourcing of the school and of the attitude of the schools' staff: the two may well be related. In one school, an English student was encouraged to send small groups of pupils to the computer room as part of the normal process of the lesson. In another school, IT was not used for business studies below Year 12 (grade 12). In almost all schools, business studies had only limited access to computers and any given group was, typically, timetabled in an IT room for 25% of the time. In contrast, most business studies students found themselves teaching some IT to classes in the lower age-range of the school. This seemed to have a positive effect on their ability to deal with the technicalities of the school system and with the issues of classroom management and control.

How, then, do students bring their IT skills to bear in the classroom? Basic skills in IT seem to be transferable in a way that is not expected in many areas: simple maths problems may suddenly be found difficult in science lessons. When asked, students felt that these skills transferred because they, the students, had to be able to use IT and had to provide the evidence for it. Most of the students interviewed said that they had been involved in planning for the use of IT and all the business students and about half of the English students said that that they had already taught using IT. In a number of schools' English departments, the staff made little or no use of IT: the fact that our students were compelled to use IT was seen to be encouraging the department to make provision. This fits nicely with statements from the government and others about students and NQTs being 'agents of change' in schools.

Two cameos are presented here, to indicate the range of IT knowledge and use and also the range of expectation and possibility within our secondary schools.

Cameo 1:

Student A is at a secondary school which is a 'City Technology College', one of a small number of specialist schools built in inner-city areas, with matched funds from the private and public sector, to provide an IT rich environment. The initial influx of funds provided for hardware and software purchases in a modern, purpose built school.

Student A is 45 years old, used IT in his degree course and used many software applications during his 15 years in business. Since he came to the university for his PGCE course, he has used the intranet for contacting the library, for reference and for looking in FirstClass for information from his tutor about assignments, but otherwise he already had all the IT skills he has needed in teaching.

"All my lesson plans, schemes of work, proformas, PowerPoint presentations are on my own computer at home. The school has 480 computers for 900 kids. The place is brilliant, I'm enjoying it. I'm using skills I've already learned but, because I'm in a work environment, I can apply them in different ways. I'm experimenting too - when you're at work you don't have the time to deviate from the things you normally use. I'm getting a lot off the kids, I must say … in

effect they were actually teaching me. I say, 'Come on guys, you're wizard with this, show us the way.' We use IT for research, the Internet or CD-ROMS and encyclopaedias. I stipulate they have to *use* the information not just download it. ... It's really weird, the kids queue up at a quarter to eight, there's 300 of them waiting at the door in a line to get into school, to do emails, research. ... I like to involve the children in the lessons. I use real live scenarios or past scenarios that were real live events - I try to relate it to the children's own experience. For example they have to do a job evaluation, I've asked them to draw up an evaluation sheet for what they needed when they joined, what they had to have, what were advantages, what were bonuses as skills. Using IT allows me more time to interact with the children. They tend to be engrossed in what they're doing – if you took 4 or 5 minutes with one pupil in a normal class then the rest would tend to drift off task but with IT, it keeps them on task, focused on what they're doing. This school is a one-off in some respects. In some schools, for example my daughter's, there's a limited amount of IT ... but I've always seen IT as something positive, as a tool to do whatever I'm doing. It hasn't changed in that respect.'

Cameo 2:

Student B is aged 21, also at an inner city school, but one that has not been funded as a Technology College, teaching English. She didn't learn anything about computers in the school she attended as a pupil.

"I used a word processor for my assignments and things like that during my degree but not often. I just thought I'd better learn to do it, I didn't go on any courses or anything so I was basically self-taught. When I came for interview here, I filled in the questionnaire about using computers and afterwards I was asked to go on the pre-PGCE IT course, which was great. I learned to do spreadsheets and went on the Internet. But I haven't done so since then. None of the teachers has said anything to me about using IT at school and I haven't observed anyone using computers. No one has suggested I book any of the IT rooms. My mentor has discussed IT with me, as part of the student profile thing, and she was very helpful. She showed me where they had set up a system for making worksheets so I have used that often. But really I've learned more from my fellow student (who teaches IT) than from anyone else. He's often in the staff room when I am. I definitely use more ICT now, since I started on the PGCE course, mainly for worksheets."

Student A was able to talk volubly about his pupils and his teaching and the school itself, when discussing IT usage. Student B said far less, although, recently, she has used IT a great deal more, has developed her own skills and is learning from a peer in a context which is meaningful for her. It is interesting to speculate on the causes of this difference.

As part of the monitoring of students' IT experience, we have been considering a points scoring system where, for instance, a student gains up to 5 points in each of the following five categories: previous educational experience of IT; experience of working with IT; experience in the university-based part of the PGCE; semester 1 school experience; semester 2 school experience. On this basis, student A entered the PGCE with 10 points and is probably now at 20 points and is able to learn from every environment and his own pupils. Student B, however, gained perhaps 2 points from her degree and 3 from the PGCE course and 2 from her school/colleague, giving a total of 7. This scale is at the earliest stage of its development, but it is interesting to speculate that prior IT experience is directly transferable to this setting and greatly aids the students' development.

University staff were seen to use IT extensively in the preparation of lectures and seminars and, in schools, students followed this practice: all students said they did all their preparation — lesson plans, worksheets, evaluations etc — on their computer. This was seen as a great time saver and, equally importantly, students felt that this was 'expected' of them by the school pupils. PGCE students clearly felt that their materials should be produced to a good standard because pupils were used to well-presented material in the media. They felt that it would devalue the subject if material were poorly presented.

The interviewees were clear that having basic IT skills is essential to self-confidence. They felt strongly that they should be given help with learning about IT in the classroom and that this could be integrated into the normal university subject-based sessions, perhaps with an IT specialist working with the subject tutor. The example set by tutors is important: many students commented on the encouragement given by tutors and they felt it was good that they had seen materials prepared using IT as it gave them good ideas for their own preparation. Pupil-motivation was recognised as an important feature of IT but, more unusually, students themselves felt motivated by IT and most enjoyed the fact that pupils sometimes appeared to know more about IT than they did. IT was seen as increasing the pupils' self-worth and as directly beneficial to both pupil and student teacher. One student said, "IT engages their attention and is more interactive. IT is such an important element [of learning], it lets you do things in new and different ways - this is important, pupils can be inspired to a better view of English and see it as relevant to them."

Students recognised changes in teaching and learning styles when using IT, although most think of changes in teaching style in limited terms of differences in class management. Few considered changes in their behaviour without prompting and then only in limited terms - probably an indicator of their inexperience. There was marked disagreement between students about whether using IT makes classroom

management easier or harder. Those who found it harder tend to think in terms of room design, seeing the backs of pupils' heads, and problems with the physical side of the technology such as leads falling out, printing problems and so on. Those who felt it was easier tended to talk about pupils being absorbed in their work, sharing problems, teacher talking 1:1 with pupils etc.

Conclusions

Prior experience was, without doubt, a major factor influencing the students' attitude towards IT and their ability to make quick progress with relatively little direct intervention. PGCE courses are notoriously overburdened and it seems difficult for students to make a 'standing start' in IT: the 'flying start' given by prior experience is a huge advantage. Experience in schools also varies considerably, both between schools and between departments within a school. English students were likely to get little encouragement to deal with the school IT system; business students were expected to be closely involved in teaching IT. We would suggest that all students not teaching IT as part of their normal timetable should have to work as a classroom assistant in one IT lesson per week in the lower school. This would not involve planning or assessment, but would enable them to develop confidence in their own abilities in a relatively safe, but focussed setting.

Making use of pupils' knowledge of IT was generally felt to be beneficial for all concerned, although it is recognised that student teachers need to be secure in their place in the classroom to make full use of it. The mutual learning which can take place in such settings was positively encouraged by most schools and, from the student viewpoint, it was felt to encourage good relationships in the classroom.

Relationships with pupils were an important factor in issues around classroom management and control when using IT. Students who were, perhaps, less sure of their class management skills felt threatened by pupils facing the monitors rather than facing the teacher. This is, in part a function of how rooms have been adapted to house computers — typically with the computers on benches running round three walls, leaving the centre of the room for tables for non IT work. Conversely, the ability to see all the monitor screens in this arrangement was seen as positive by more confident students.

Our constructivist hypothesis that students will build on prior experience and knowledge of IT has been borne out. Students are at a conjunction in their teaching career where situation (the two schools where they spend the majority of their time) and context (government requirements regarding IT competences) matter significantly.

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INSTRUCTIONAL DESIGN

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As technological changes sweep through society, the demands on teachers to use a more interactive, student-centered, technology-based curriculum are increasing. Because of technological advances, students today have grown up in an environment where they are largely in control of both the access to and the flow of information. Accordingly, educational systems must keep pace with the explosion of content and the evolution of teaching systems. The presentation of information is changing; vivid images, streaming video, and audio clips supplement information that was formally presented solely through text (Strommen & Lincoln, 1995). Computers are ideally suited to bring technology into the classroom by virtue of the flexibility they can provide to enhance instruction while fostering flexible thinking (Spiro, Feltovich, Jacobson, & Coulson, 1992). As the field of instructional technology rapidly develops, the need for strong instructional design increases. Though many design models exist, the following authors impart their perspectives and address these design aspects as they impact their educational experiences.

Albion begins this section discussing the design of teacher education programs that include the preparation of teachers for working with Information and Communication Technology. The balance of student characteristics, prospective employer requirements, education authority requirements, community aspirations, university policy, and resource constraints is given due attention.

Next, Aris, Abu, Ellington, and Dhamotharan, discuss the design and development of a flexible and user-friendly interactive multimedia courseware package to improve Malaysian adult teachers' knowledge of and attitude toward instructional technology in education. During this design process, the ADDIE model of instructional design was used.

Bakoyiannis and Grigoriadou propose an information model for evaluating educational software. They look at factors such as the changes that educational software will cause in the role of the educator, in the student learning process, in the curriculum, in the meaning of the school book, and in the class/laboratory structure. Both qualitative and quantitative methods are utilized.

Howard's article addresses the dissatisfaction of constructivist instructors who attempt to develop a browser-based multimedia curriculum using traditional instructional design methodologies. He discusses various instructional development techniques, such as rapid prototyping, being mindful of student needs, iterative evaluation, and versatility and reusability of development tools, used in the creation of Iowa State University's browser-based Masters of Agronomy program.

Hunt and Karl continue the discussion concerning the instructional design and development of web-based curriculums. This paper is intended to serve as an instructional design blueprint for other curriculum designers and educators to use when dealing with curriculums based on scientific theory and data that incorporate a variety of emerging technologies, Internet tools, and innovative instructional strategies.

In many instructional design models, the use of storyboarding is a stage in which output, inputs, and navigation are determined and blueprinted. Liu presents PowerPoint as another means of storyboarding beyond the traditional forms such as index cards or other paper forms.

Maxey introduces an alternative approach to traditional instructional design models by suggesting that participatory communication theory creates a process which values the learner's voice. This paper defines the theory, explains how it works, discusses examples of participatory communication projects, and explores the uses and ramifications of the theory in an instructional design model.

Montgomery and Whiting report the findings of an action research project which was conducted during the course of an undergraduate "Technology in Education" class for preservice teachers. A constructivist approach was used in designing a learning environment which incorporated principles of brain based and engaged learning.

Moseley creates a context for design and a supportive environment to create applications for those who are physically challenged. He explores the use of direct manipulative user interfaces that have been specially enhanced for a learner's special needs.

Staupe and Hernes present the design and development of an on-line learning environment from a constructivistic and situated learning point of view. Basic principles of

learning theory are explained before moving on to the structuring of virtual learning environments on the Internet.

Summerville discusses the need for instructors in higher education to design, develop, and deliver courses via the World Wide Web. Her article explains the process of developing a Masters-level instructional design course for delivery on-line. The rationale, development procedures, successes and failures, and prescriptions for future developers are addressed.

RØbling and Freisleben address the growing interest in supplementing course materials with animations that illustrate the dynamic behavior of the content being presented. Several freeware tools are reviewed.

Romereim-Holmes and Peterson focus on the challenge for classroom teachers to design instructionally sound curriculum materials for diverse learners that utilize technology effectively. The process described in this paper shows teachers ways to develop an awareness of universal design principles in creating on-line materials.

Toma discusses the use of a new device called the video sequencer which can complete real-time automatic segmenting of sound and images. Coupled with IBM ViaVoice, the teacher can speak during this time span to create the necessary contextual help for an easier aural comprehension.

Tu suggests the current computer-based tutorials are constructed with a linear approach in which learners go through a long list to select one or more tutorials. In response to this problem, Tu reports the pros, cons, and revisions of a web-based database-driven tutorial used to support pre- and in-service teachers in learning web page creation.

Wilcox and Wojnar summarize a "how to" workshop that focuses on the design guidelines used when moving from an onsite course to an online course. A model is presented to guide teachers in designing online courses to increase learning and thinking through improved teaching.

This section concludes as Zhang reports how a group of inservice teachers who were involved in designing interdisciplinary units of instruction used a systems approach to fulfill the requirement of a graduate course. The application of Dick and Carey's Systematic Design of Instruction was met with initial resistance, but later adopted and utilized by the participants to successfully produce their final products.

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Setting Course for the New Millennium: Planning for ICT in a New Bachelor Degree Program

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Abstract: The design of teacher education programs, including the preparation of teachers for working with Information and Communication Technology (ICT), requires careful balancing of multiple considerations. Due attention should be given to the characteristics of students, the requirements of education authorities and prospective employers, broader community aspirations and local institutional imperatives including university policies and resource constraints. The process of preparing for the re-accreditation of teacher preparation programs at the University of Southern Queensland (USQ) provided an opportunity for a review of the provisions for teaching and learning about ICTs in the light of a changing policy environment for education. This paper describes how the existing degree program at USQ incorporates learning about ICTs and discusses some adjustments being proposed to ensure that the revised degree program may better meet the needs of graduating teachers in the new millennium.

When studies of computing first appeared in teacher education courses they were rightly seen as visionary innovations directed towards a distant future in which computers would be readily accessible in typical classrooms. Although computers were seen as important elements of the future in which students would live and work, they were rare and expensive pieces of equipment. Hence, the emphasis was most often on computer literacy and learning about computers. Even when personal computers became more affordable and began to appear in classrooms there were few programs, educational or otherwise, available off the shelf. Inevitably the incorporation of computing into teacher education courses tended to take a technocentric approach which included programming in BASIC or some other language.

Since that time there have been very significant developments in information and communication technology (ICT), its accessibility in typical classrooms and its treatment within teacher education courses. The hardware and software available in classrooms has advanced far beyond the level where it was necessary for teachers to have knowledge of computer programming in order to make use of the computer. Sophisticated computer hardware and software is widely available in classrooms and in Queensland the Government is committed to connecting every classroom to the Internet by 2001 (Education Queensland 1998b). By now most teacher education courses include required courses in computing. Moreover, the emphasis in those courses has moved away from technical knowledge and aspects such as programming. Instead the focus is likely to be on developing fluency with common software tools such as word processors and on the evaluation, selection and integration of software for the classroom.

Now as we enter the new millennium there are multiple factors which should impel us to evaluate and consider appropriate changes to current teacher education course provisions in respect of ICTs. Access to information and communication technology is now a given in most circumstances in western societies. Community aspirations for education have broadened to include expectations that students should both acquire skills in the use of ICTs and should have their learning across a range of areas magnified by their power. Recent discussions of the "new basics" for Queensland Government schools have included the proposal that the preparation of a multimedia presentation and the construction of a page on the World Wide Web should form part of a series of benchmark tasks for eight year olds (Education Queensland 1999). At present such a performance would be beyond the experience of many teachers or teacher educators and it presents a challenge for teacher preparation and professional development.

The Policy Environment for ICTs in Teacher Education

The preparation and employment of teachers is increasingly subject to advisory or mandated standards in relation to ICT. In the USA the ISTE/NCATE foundation standards (NCATE 1992) have led the way but additional requirements apply in some jurisdictions. In the UK the requirements for initial teacher training (DfEE 1998) include prescriptions for the capabilities teachers must demonstrate with ICTs. In Queensland, Education Queensland, which as the operator of the Government school system is the major employer of teachers, has adopted a set of minimum standards for Learning Technology to be achieved for all teachers by 2001 (Education Queensland 1998a). More recently the Australian Council for Computers in Education has begun work on a national document about teacher competencies in respect of learning technology (ACCE 1999).

Although technical skills in the use of ICTs remain an important component of the various standards prescribed for teachers, they are no longer seen as the sole addition that should be made to a teacher education program in order to prepare teachers for teaching with ICTs. The Education Queensland (1998a) minimum standards for learning technology are presented in four sections which deal with IT skills, curriculum applications including classroom planning and management, school planning (for IT) and student centered learning. The standards are as much about knowledge of curriculum and pedagogy as about technology reflecting a shift in emphasis away from IT as content with an orientation to future work skills and towards IT as a tool for teaching and learning.

To date, the formal ICT requirements for graduating teachers in Queensland are minimal and may remain so because the Education Queensland standards have been developed and interpreted in such a way that accreditation can be achieved only in the context of a specific school. However, there is a strong expectation that teacher education programs should prepare students to the point where they are immediately capable of demonstrating all but the most context specific competencies when they graduate. Other factors being equal, graduates with these capabilities will be advantaged in seeking employment as teachers.

Against this background it seems clear that any new or revised teacher education program to be offered in Queensland should include experiences which will prepare students for teaching effectively with information and communication technology. A first step in revising the approach to ICTs in a teacher education program should be to examine the provisions of the existing program to determine which aspects are effective and what might be improved.

Existing Provision for ICTs in Teacher Education at USQ

Students undertaking teacher preparation at the University of Southern Queensland (USQ) may be exposed to ICTs in one or more of three program elements.

The first of these elements is the "core curriculum" which was introduced some years ago at USQ as part of all undergraduate programs. For students in teacher education programs it comprises three key areas, namely, communication and scholarship, computing, and studies of Australia in relation to the Asian and Pacific region. For students in most other courses it also includes an introductory statistics subject. These areas were selected for inclusion in the belief that they would be fundamental to the work of future Australian professionals. The core curriculum is generally experienced by students in the form of four units of study each of which is equivalent to one-eighth of a standard student load for a year. Thus all undergraduate students study one unit in general computing which, for most students, concentrates on basic theory and common applications.

The second way in which education students at USQ may undertake course work relevant to ICTs is in an option (minor) study. The four year education degree comprises 32 credit points of which four points are taken in an option study selected by the student from a range of packages offered by different departments. Students may select from such areas as visual arts, music, sciences, mathematics, business and so on. A four credit point option in educational computing is offered within the Faculty of Education and includes such topics as desktop publishing and presentation, Logo, hypermedia creation and instructional software. Students may take an additional two credit points (above the normal degree program) to qualify for a specialization in educational computing. The additional units focus on the application of ICTs in the classroom with the intent of graduating students who have sufficient background to provide some leadership in the use of ICTs for teaching.

The third way in which students are exposed to ICTs is in the context of their general studies in education subjects where, over time, some instructors have begun to integrate the use of ICTs. Practices have included the use of applications such as word processors and presentation packages, demonstration and review of curriculum software, communication activities using email and optional or required activities involving creation of web sites. Although integration of ICTs is encouraged the adoption of new practices is scattered and does not form part of any coherent strategy to integrate ICTs into teaching within the Faculty.

Although each of these offerings confers some benefits for students, individually and as a package they exhibit some serious limitations and deficiencies.

Fewer than 30% of students undertake the option study in educational computing. Hence, most students experience no coherent course work component related to the integration of ICT into their teaching. Their only exposure to ICT is in the core subject. The program structure places the core subject in the first year to ensure that students have essential computing skills to support their university study.

The core unit is taught as a service unit by another faculty and makes only limited concessions to the specific requirements of education students. It does not significantly address the educational use of computers because it is done at a point in the program where students have little or no background in education and because it is taught by faculty with expertise in computing rather than education.

An increasing proportion of new university students is arriving with essential computing skills acquired in secondary education or prior employment. For them a core computing subject with a focus on introductory skills acquisition is probably unnecessary. For those who arrive without computing skills, the learning curve in the core subject is sometimes too steep and they might be better served by a more gradual approach with a clearer connection to their major areas of study. For both groups, the difficulties described above in making explicit connections to education may diminish the value of the subject as a preparation for future professional application of ICT.

The subjects which make up the option and specialization in educational computing were originally specified when the present degree program was accredited in 1992. Although they have been adjusted over time to reflect more recent developments in ICT such as the World Wide Web, they would benefit from significant revision to address emerging issues in the educational use of ICTs. They could also benefit from a clearer focus on topics relevant to the needs of future teachers who may be expected to accept a degree of responsibility for offering leadership in the use of ICTs within their schools.

Teachers who reflect on their practice recognize that there is a natural inclination to "teach as they were taught" and that to change teaching practice requires a conscious effort. Access to appropriate models of teaching is an important aspect of teacher preparation and teacher educators are one significant source of such modeling of practice. The importance of students being presented with appropriate modeling of computer use within their teacher preparation program has been noted elsewhere (Parker 1997; Zachariades & Roberts 1995) and at USQ there has been a noticeable increase in the use of computers within various subjects in the teacher preparation program. However, there is as yet no systematic approach to integration of ICTs.

Almost all of the computers available to students at USQ are installed in 20 seat laboratories that are timetabled on a fixed schedule for each week of a semester. This is unlike the model used in primary schools where computers are more likely to be found in groups of 3 to 6 in or near to a standard classroom. This arrangement restricts the opportunity for modeling the integration of computers into standard classes.

A second significant source of models of teaching behavior are the teachers with whom students work during practicum experiences. Some of these teachers are confident, competent and consistent users of ICTs in their classrooms but many are not. Students returning from practicum during 1999 remarked on the variability in integration of ICTs in the classrooms where they worked, reporting a full range from an unused computer at the back of a classroom to curriculum activities which used Internet resources as a focus. Because of the number of students who must be placed, there is little chance of the university being able to ensure that every student

teacher is placed with a teacher who is making effective use of ICTs. Access by students to appropriate models of teaching with ICTs remains a challenge.

Integrating ICTs in a Revised Teacher Education Program

The most significant deficiency in the existing program is that most graduates have had little or no explicit preparation for integrating ICTs into their teaching. All should have at least basic skills in the use of common applications on personal computers. Those who have studied the educational computing option or specialization will have both substantially enhanced skills and preparation for using ICTs in teaching but they represent fewer than 30% of graduates. To address the expectations of employers, the revised bachelor degree program will need to ensure that all students are adequately prepared for teaching with ICTs.

USQ remains committed to the core curriculum requirement in undergraduate programs. However, some programs such as Engineering have negotiated the use of a specifically designed subject in place of the standard subject taken by students in most programs.

Historically the core subject in computing was introduced to enable students to develop computer literacy appropriate to the professions into which they would graduate. Since the subject was first introduced the understanding of computer literacy has developed and it is widely accepted that it may mean different things in different professional contexts. Now that the major employer of teachers in Queensland has identified a set of minimum standards for Learning Technology it is reasonable to argue that this statement constitutes a *de facto* definition of computer literacy for the teaching profession. Hence, if the USQ core curriculum is to remain true to its original intent, these standards should provide a foundation for determining which aspects of ICTs should contribute to the core curriculum for teacher education students. Examination of the Education Queensland standards reveals that more than two-thirds of the content is tightly bound to educational contexts. This should be reflected in the way that ICTs are incorporated into the teacher education program.

Skills that are taught in the existing core computing subject should not be neglected. They will be fundamental to success in both university study and professional practice in the new millennium. However, many students already enter with significant skills in computing. Hence, rather than mandate a full subject in basic skills for all students it may be preferable to monitor entry skills and offer short courses and mentoring for those whose skills are insufficiently developed.

To supplement this approach other subjects in the program should be reviewed and aspects that might be enhanced through the use of ICTs should be identified. Key skills could then be taught or reinforced in appropriate contexts. For example, word processing could be developed in association with communication and scholarship studies, spreadsheets might be used in mathematics and science methods, and computer graphics in the arts. Integration of learning about ICTs into contexts where their use is a natural adjunct to the work being done should increase students' motivation. Under the existing arrangements at USQ, skills in the use of ICTs are often taught in isolation from their application and students do not appreciate their relevance. By the time students encounter situations where the skills might be applied they have sometimes lost most of the fluency they had acquired. Learning skills closer to the context of real use should also encourage reinforcement of learning through additional opportunities for practice.

Integrating learning about ICTs across the teacher education program should increase the exposure of students to modeling of the integration of ICTs into leaching and learning. However, there will be challenges to be met. Although the staff who contribute to the teacher education program are mostly comfortable with the use of ICTs to support their own teaching and scholarship, many would not be comfortable with a requirement to integrate the use of ICTs into their classes or with teaching relevant ICT skills to students. Mentoring is one approach which has been found to be successful in assisting staff to develop both the competence and the confidence to integrate ICTs into a teacher education program (Stewart 1999). Because the integration of ICTs into teaching will necessitate some cultural change the process will require time but the level of acceptance of ICTs for personal use achieved over the past decade suggests that such change is possible.

Among the goals set in the *Schooling 2001* project for Queensland Government schools are the use of learning technology in every subject at every year level and the connection of every classroom to the Internet (Education Queensland 1998b). Both goals imply that ICTs in schools should not be restricted to isolated laboratories but should be distributed across classrooms. Schools are progressively extending network connections to classrooms and creating mini-labs of 3 to 6 computers in classrooms or adjacent spaces.

In order to model these learning environments within the teacher education program it will be necessary to provide equivalent facilities. In some (secure) teaching spaces it will be appropriate to create a mini-lab. Teaching in other spaces that are less easily secured may be served through the use of sets of laptop computers and mobile multimedia systems. An application for a special grant to initiate these developments has been made to the University and additional budget options are being considered.

There are multiple reasons why the present core computing subject in the teacher education program is unable to appropriately address educational aspects of computing. The first is that the subject is taught by members of the Department of Mathematics and Computing in the Faculty of Science. Their expertise lies in computing as a discipline and not in education or the educational application of ICTs. A second reason is that students study the subject in the first year of their program because that maximizes their opportunity to utilize the skills during their university study. However, it precedes study of educational theory that would be required to support their appreciation of issues in educational use of ICTs.

If it were possible to excise the core computing subject from the program by some combination of substitution of short courses and integration of basic ICT skills in other subjects, then it would be possible to replace it with a unit taken later in the program. That new subject could address the ICT competencies identified in employer requirements and other key policy documents.

Because of the importance of appropriate modeling of behavior in the process of learning to teach, a subject dealing with the educational use of ICTs should include opportunities for students to observe and participate in the application of ICTs for teaching and learning in classrooms. Ideally this might be achieved through appropriate practicum placements associated with the subject but the variability in teachers' use of ICTs makes it difficult to ensure that all students could be appropriately placed. A partial solution might be found through the use of relevant multimedia case materials to supplement field experiences. Multimedia materials for this purpose have been developed (Gibson & Albion 1999) and the underlying principles of their design have been described elsewhere (Albion & Gibson 1998a; Albion & Gibson 1998b).

It seems likely that for the foreseeable future ICTs will continue to evolve rapidly. The implications for education include a continuing need for educational professionals with specialized skills in the application of ICTs in education and a capacity to offer support to their peers. The existing option and specialization in educational computing at USQ is intended to graduate teachers with these capabilities. Some revision of the subjects will be required to ensure that they adequately address current issues in the educational application of ICTs and that they articulate with other elements of the teacher education program. Because some of the introductory material currently contained in these subjects will be incorporated in the general program there will be additional opportunities to address more advanced matters such as planning for and managing ICT resources in schools and providing colleagues with support and leadership in the application of ICTs.

Conclusion

There appears to be general acceptance that ICTs are important to education both as content and as aids to teaching and learning. Widespread availability of ICTs in schools and the wider community will surely result in students entering teacher education programs with increasing levels of skill. Nevertheless, the rate of development of new technologies and growing sophistication in their educational use makes it likely that, for the anticipated seven year life of the re-accredited program, there will be a continuing need for specific instruction about ICTs and their educational applications.

The program should provide students with early opportunities to develop any additional skills they may need for study at university. Every encouragement should be given to students to use ICTs wherever appropriate in their

studies and, so far as possible, the teaching and learning methods promoted in the program should model effective approaches to the integration of ICTs. Formal consideration of the educational application of ICTs should be deferred until students have encountered relevant educational theory. Students with a particular interest in ICTs should have opportunities to extend their study in related areas.

There are no certain answers in a rapidly developing field such as the educational use of ICTs. The approaches recommended here are based upon a reading of the policy environment in respect of ICTs in education, experience of the recent past, and consideration of current research. Only time will tell how successful they may be in charting a course for ICT in teacher education into the new millennium.

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LEARNING ABOUT INFORMATION TECHNOLOGY IN EDUCATION USING MULTIMEDIA

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Abstract: The Malaysian Ministry of Education has given adequate opportunity for teachers to acquire knowledge and skills in operating the computer and information technology (C&IT) in order to fully utilised C&IT in the learning and teaching process, as well as, in the daily running of the school. Realising the vision of the Malaysian Ministry of Education, Universiti Teknologi Malaysia's teacher education curriculum was reinvented. New, efficient and cost-effective learning methods were also used to supplement conventional teaching methods. Computer-based learning (CBL) materials were used because many research studies that looked into the effectiveness of CBL on adult learning about IT have proven to be successful. Based on this fact, is it possible to improve Malaysian adult teachers' knowledge of and attitude to IT in education by giving them access to a flexible and user-friendly interactive multimedia (IMM) courseware package – Computer-based Educational Resource and Development In Information Technology (CERDIk IT)?

INTRODUCTION

Ellington (1995) believed that multimedia personal computers (MPC) have the potential to make a very significant contribution to the educational field. Interactive multimedia (IMM) courseware, therefore, has the potential to enhance learning by creating a realistic and appealing presentation of virtually any subject matter. Although the benefits of this learning technology have been documented, it appears that this educational resource has been under utilised for educational development, particularly for adult learners.

Szabo (1996, p. 219) made a point that "interactive multimedia is so new there is little research on it as a whole". This statement is supported by Thompson, Simonson and Hargrave (1996). In their book,

"Educational Technology: A Review of the Research", they confirmed that not a great deal of IMM research has been conducted in education. Therefore, it is not surprising that very few research studies are available related to adults learning about C&IT- both on cognitive and non-cognitive outcomes (Baldi, 1997).

THE RESEARCH STUDY

Many research studies that looked into the effectiveness of computer-based learning (CBL) materials on adult learning about computer and information technology (C&IT) have proven to be successful. Based on this fact, is it possible to improve Malaysian teachers' knowledge of and attitude to C&IT in education by giving them access to a flexible and user-friendly IMM courseware package?

A formal and comprehensive research study was thus conducted at Universiti Teknologi Malaysia (UTM) to supplement the existing body of research related to the use of an interactive learning technology and adult learning about C&IT. The research study was in line with the thinking of several prominent figures in the area of educational technology.

For instance, according to Percival, Ellington and Race (1993, p. 3):

> "... many people became aware that there was much in education and training which could be improved by thinking more carefully about *all* aspects of the design of teaching/learning situations. Such considerations led to a new, broader interpretation of 'educational technology' as the entire technology *of* education and training rather than merely as the use of technology *in* education, with the latter being regarded as merely a part of the former rather than the whole field..."

The objectives of the research project are as follows:

- To determine the content of an IMM courseware package (in a CD-ROM stand-alone format) through teachers' needs analysis, experts' opinions and the Internet.
- To develop a user-friendly prototype IMM courseware package (based on the ADDIE Model, which incorporates adult learning principles, instructional design principles and software engineering principles) regarding IT and its application to the field of education in Malaysia.
- To conduct formative evaluation via a pilot study in order to produce a fully-tested IMM courseware package (in a CD-ROM stand-alone format) which caters for different existing knowledge levels and attitudes and preferred learning styles on the part of the teachers.
- To conduct summative evaluation via a full experimental study in order to measure any significant improvement in teachers' knowledge of and attitude to IT as a result of being exposed to the IMM courseware package (in a CD-ROM stand-alone format).

The systematic methodology underlying the production of the IMM package was based on analysis, design, development, implementation and evaluation (*ADDIE*) model (Molenda, Pershing and Reigeluth, 1996), and incorporated adult learning principles, instructional design principles and software engineering principles (Aris, Abu, Ellington and Mogana, 1999). This research project thus involved the preliminary needs analysis, design, development, implementation and evaluation of an IMM courseware package at UTM.

Prior to the production of an IMM courseware package, both the objectives and the content to be included in the IMM courseware package were determined by analysing the needs of adult practising teachers. These needs were later compared with experts' opinions. Experts' views were obtained through books, interviews and via the Web. Based on a detailed and comprehensive analysis, appropriate and essential content was included in the IMM courseware package. The package offers information related to the general overview of C&IT, Malaysian Multimedia Super Corridor (MSC) and Smart Schools, history of the computers, computer hardware and software, communication and networking, and significant applications of C&IT in education (Aris, Abu, Ellington and Dhamotharan, 1997).

Instructional design principles include aspects such as instructional strategies and instructional presentations. An essential feature in any IMM courseware package is interactivity. This capability, as manifested by features such as clicking and touching, click-able objects, push buttons, scroll bars and moving objects was fully built into the package. Many of the screens in the package contain several navigational buttons to help the adult student teachers to move about within the system. These buttons give the adult learner the choice as to whether to process the information linearly using the 'Forward' and 'Back' buttons (Graphical User Interface), or on a 'need to explore' basis by using the 'Topics' button (Text User Interface). An 'Exit' button (Graphical User Interface) affords immediate exit capabilities. The navigation buttons were placed in the same relative positions on all appropriate pages. The 'Forward', 'Back' and 'Exit' buttons were placed at the lower right, to ensure ease of interface and consistency, while the 'Topics' button were placed in the upper left hand corner of the screen. This standardisation proved to be of considerable assistance in ensuring that the package was 'user-friendly'. Another extremely powerful aspect of multimedia is the ability to convey information and create an impact on the learner through the effective use of several audio-visual elements. The overall audio-visual layout design in the courseware was consistent with respect to style and format objects.

CERDIk IT, which stands for *Computer-based Educational Resource and Development In Information Technology,* is a Malay word for 'IT Intelligent' (Aris, Abu, Ellington and Mogana, 1998). Under this acronym, the first CERDIk IT package titled 'IT in Education' was produced with the main purpose of improving teachers' knowledge and changing their attitudes toward the use of C&IT in education. This user-friendly, easy-to-use and IMM courseware package was designed and developed by Baharuddin Aris. This IMM multimedia courseware package will henceforth be referred to simply as the CERDIk IT.

Macromedia Authorware version 4.0 was the authoring software chosen to develop the CERDIk IT. This software uses icon flowcharts and a drag-and-drop flowcharting metaphor. Instructions are obtained from dialog boxes with pull-down menus. This particular system was selected because it was user-friendly, and provided all the basic facilities that were required. Simple and readable text was used in the package. The computer graphics created in the package was used to support the content. The graphics and animation software used in the CERDIk IT included a very simple and user-friendly software called Ulead Cool 3D and the more advanced 3D Studio. Digitised still images file types used in the production of the CERDIk IT were bitmaps (.BMP), CompuServe GIF (.GIF) and Joint Experts Photography Group (.JPG). To create images from an external source, a scanner and a digital camera was used. These still images were used to enhance the appearance and to support important messages in the CERDIk IT. Digital audio format used in the development of the package was wave (.WAV). A SoundBlaster 16 sound card was used to digitise analogue audio recorded via a microphone. Sound Forge was used to edit digitised audio and add special effects to it. The analogue video footage was recorded using a video cassette recorder. It was then converted into digital format using a Video Blaster IE500 video capture card. Adobe Premiere was used to edit digitised video and add special effects to it. The digital video formats used in the development of CERDIk IT were Quick Time Movies (.MOV) and Video for Windows (.AVI). Digital video requires much more hard-disk storage space than any other form of medium. For example, a digital video clip in the CERDIk IT courseware package that runs for 20 seconds on the AVI (Video for Windows) format took up 44.9 Mb of hard-disk space. The digital video will require a smaller hard-disk storage space if it is converted to Quick Time Movies (.MOV) format.

The prototype version of the CERDIk IT was evaluated during its design and development phase (formative evaluation). Changes were made on the prototype version. prior to summative evaluation. Summative evaluation was conducted to determine its effectiveness in a university setting.

The sample selected for the research study consisted of 72 adult student teachers, mostly females. They had undergone a post-graduate diploma in education programme at UTM. They are generally in the age range of mid 20's to late 30's. These teachers have usually been in school for several years, and have taught subjects such as English, Mathematics, Science, Biology, Business and Basic Economics.

Data were gathered utilising multiple methods in order to obtain a variety of perspectives about the topic under investigation. Therefore, research instruments such as questionnaires, observation schedule, courseware evaluation form and interviews were used in the research study.

FINDINGS

The results of the research study were based on both formative and summative evaluation of the courseware package. Both quantitative data and qualitative data were collected to determine the effectiveness of CERDIk IT and the approach used by adult student teachers in learning a particular content area using a CBL material.

Three academic staff from the Department of Educational Multimedia and three adult students at UTM participated in the formative evaluation. Comments and opinions were made based on the design and usability of the CERDIk IT prototype package, and on the validity of the courseware evaluation form. For the purpose of this paper, only brief comments by the academic staff were highlighted.

The whole program certainly followed sound instructional design principles, such as, Gagné's 'Events of Instruction'. For example, the introductory sequence was very motivating. It was able to grab hold of the users' attention. The package was also easy to operate - move forward, move backwards and exit. Guidelines in operating the package were provided at the very beginning (right after the montage) of the package, or before the main menu of the package was highlighted. However, it would have been more convenient if there had been an option to by-pass the guidelines, especially for users who had not been there for the first time. It would be very annoying for these users to see the guidelines, over and over again.

The different topics in the main menu were systematically organised. So, the users could choose either the linear approach (as prescribed by the designer), or according to their preferences, without having any worries of getting lost in cyberspace. "The users will not be lost in the cyberspace", commented one of the staff.

Even though the screen design adhered to the rule 'KISS' (Keep it Simple and Straightforward), overall, the package still looked very professional, and very pleasant to look at. In general, the package had a simple user interface. Both the text and graphical user interfaces used in the package were easy to remember, and their placements were consistent throughout the whole program. The branching did not go beyond three 'hops' to avoid a more complicated branching. This, in return, will normally make the users more confused.

In general, the graphics that were used in the package were helpful in understanding the message in the content. They also found that the quality of visual display in the package was motivating, although some pictures needed to be changed. Some of these pictures must be suitable with the message being delivered on the screen, and also, needed to be clearer. The digital video was beautiful and appropriately used.

With respect to texts, bold letters were displayed in the package, with at least a letter size of 12. There were texts in Arial Black font. The evaluators suggested that the text should use commonly-accepted fonts, such as Times New Roman. This is because not all personal computers have Arial Black font installed in them. It was good advice, because some of the letters were missing when the package was played in a personal computer without Arial Black font installed in it. Scrolling text was used with a purpose. For example, users were able to scroll the objectives of the package with ease and speed, without having to move from one page to another, with the intention to recall the objectives of the package. So far, it was not easy to 'crash' the program.

Overall, the CERDIk IT package, even at the prototype stage, was very easy to use and very interesting to learn with. Apart from the comprehensive content, the package was able to hold the users' attention throughout the program. All of the staff agreed that the CERDIk IT could be used as part of the course 'IT in Education' at UTM.
The overall findings from the summative evaluation revealed that, as a consequence of being exposed to the CERDIk IT as self-directed learning approach, many of the participants admitted that their knowledge about and attitudes toward C&IT improved significantly.

Based on the quantitative data collected in the research study, the CERDIk IT promoted significant amounts of learning during the pre-test to the post-test interim at 0.05 level of significance (pre-test: mean = 2.50; post-

test : mean = 4.01; t value = 11.41). This clearly shows that the adult students have become highly *knowledgeable* with respect to C&IT and its applications in education.

Adult student teachers' attitudes toward the content 'IT in Education' was positive. The post-test scores were significantly higher than the pre-test scores at the 0.05 level of significance (pre-test : mean = 3.23; post-test : mean = 4.43; t value = 14.65). They considered the content *useful* to their career, after using the CERDIk IT. Adult student teachers also believed that CBL packages, such as the CERDIk IT, could be *effective* in delivering the content 'IT in Education'. Evidence has shown that the post-test scores acquired from the student teachers were significantly higher than the pre-test scores at the 0.05 level of significance (pre-test : mean = 3.04; post-test : mean = 4.34; t value = 18.83. Student teachers were more *willing* to use CBL package for self-directed learning. Post-test scores derived from the student teachers were significantly higher than the pre-test scores at the 0.05 level of significance (pre-test : mean = 2.53; post-test : mean = 4.40; t value = 19.20.

Additional research findings, based on qualitative data, disclosed that most of the student teachers interviewed found the CBL method exciting, easy to use, flexible and helpful for autonomous self-directed learning. They unanimously agreed that conventional lecture can be improved by coupling it with the CBL method.

Observing several groups of adult students using the CERDIk IT, the approached used by the adult teachers in learning using CBL materials was identified. Based on the results in the study, most of the students approached via the same strategy (linear or serialist) when using the package. All of them looked at the overall picture (holist) of the package first, before choosing their preferred topics.

CONCLUDING REMARKS

The data derived from the research study is consistent with recent findings in the use of interactive multimedia courseware as a learning and information tool in academia and corporate staff development. Therefore, the CERDIk IT (in the form of a CD-ROM stand-alone) has demonstrated its capabilities and potential as a support learning material in the ever-changing learning technological world.

RECOMMENDATIONS

UTM, particularly the Faculty of Education, not only has a teacher education curriculum that is C&IT-based in nature, but the techniques of delivering learning materials to its students are C&IT-based as well. This is because the successful use of C&IT in schools requires the student teachers themselves to be aware, knowledgeable and competent in the use of such learning technology.

Two lecturers who are experienced in designing and producing interactive multimedia courseware, Jamalludin Harun and Zaidatun Tasir who are under the Department of Educational Multimedia at UTM, have implemented the CERDIk IT with their students. CERDIk IT was used during the second semester of the 1998/99 session with students sitting for a two-credit course in 'Information Technology in Education'. The delivery method consisted of lectures, with the package being used as one of the supporting materials. Based on these lecturers' observations, they were delighted that the package was very helpful in their classes. They would definitely recommend its use to other Malaysian student teachers, inside or outside UTM, and also to Malaysian schools' practising teachers. Furthermore, these two lecturers also recommended that a nation-wide staff development programme should be implemented, with the CERDIk IT as a support learning material. They added that nation-wide research should also be conducted for greater generalisation of results in relation to the effectiveness of multimedia-based learning experiences among Malaysian student teachers, as well as, Malaysian adult practising teachers.

Apart from designing and developing interactive multimedia courseware on a CD-ROM stand-alone format, the Faculty of Education has also taken the initiative to implement the use of Web-based learning materials in

C&IT-related courses. Lecturers under the Department of Educational Multimedia, such as Mohamad Bilal Ali, Rio Sumarni Shariffudin and Manimegalai Subramaniam, have developed courses on the Web. These on-line courses can be located at *Cyberdidik*, http://161.139.52.251. For the purpose of on-line learning, CERDIk IT should also be converted and implemented in the Web-based learning environment. This alternative approach will further enhance the flexibility of adult student teachers learning using CERDIk IT.

To complement these on-line courses, formal research has been initiated by Noraffandy Yahaya to determine the effectiveness of his *Web-based integrated Learning* (*WiLL*) development tool. Lecturers at UTM will thus be able to use the WiLL in the design and development of on-line courses in their area of specialisation. In addition, easy retrieval of educational resources from databases should also be developed. Thus, a *Management Information Resource System* (*MIRS*) will be initiated by Mat Jizat Abdol.

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INFORMATION MODEL FOR EVALUATION EDUCATIONAL SOFTWARE

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THE PROPOSED MODEL FOR THE EVALUATION OF THE EDUCATIONAL SOFTWARE

Upon the incorporation of the software in the educational process, all the changes that it will cause in the role of the educator, in the learning process by the student, in the curriculum, in the meaning of the school book, in the class - laboratory structure and elsewhere must be provided. (see Squires D., Mc Dougall Anne 1994) (see Willem J. Pelgrum-Tjeerd Plomp 1993). Therefore there is a clear need to formalise the use of the educational software and its incorporation plan in the educational process. The educational software should address a means of didactic assistance to the teacher, but also give the possibility of a didactic approach to cognitive items by the student. After this the proposed evaluation model examines, whether the educational software is structured in such a way that could respond to cognitive sections that are required according to the didactic and pedagogical planning, whether it is suitable for the age to which it addresses, has a term equal to one didactic period, as the one defined by the educational environment and whether it responds to the school reality. It also evaluates whether the exercise / practical part of the educational software, that results from the aforementioned planning, observes this time limitation. Another point of evaluation is whether it has the ability and the application characteristics of multimedia of exploratory type and whether it operates in a network environment with ease in the use and communication, both in a local level and in a level of wider netting. (see ICMCS 94) Finally it controls whether its use can constitute a help for the educator in his daily work for the support of the learning process, and especially in his cognitive object as well as with intra-thematic possibilities and whether it gives the student the possibility of a didactic approach to cognitive objects.

THE USE OF FORMAL INSTRUMENTS OF DATA COLLECTION FOR THE SOFTWARE AS A MEANS OF EVALUATION

The use of formal instruments of data collection by the evaluators such as: check lists (see Barker P., King T. 1993), lists of characteristics and capacities (see Jacob Nielsen 1997) (see A.Dix, J. Finaly 1998), special tables of projects etc. (see IBM corporation 1997) is a basic evaluation instrument, whether these concern the educators, or the informatics and multimedia technologies specialists, or any other category of evaluators can be considered. In the said project the first check lists that corresponded to the characteristics of educational software were created, as this one has been analysed earlier and a research has been conducted, the purpose of which was to explore the readability and the response of the questions that evaluate an interactive multimedia software. After taking into consideration the results of this research, the check lists for the proposed evaluation model was designed. In the proposed evaluation model, the evaluators are distributed in the following categories: (see Chinien C., Hlynka D. 1993) (see Murray Tom. 1995) 1. Evaluators – educators of the cognitive object treated by the educational software, some of whom have a special experience in the evaluation of educational software. The evaluators of this category are used both in the formal quantitative evaluation process, and in the provided qualitative evaluation. 2. Evaluators – pedagogues and specialists in the didactic methodology who value the pedagogical and didactic approach of knowledge through the use of the educational software. 3. Evaluators specialised in the technical approach of the creation of an educational software, such as informatics specialists, experts of sound, colours, direction, video etc. 4. Evaluators – students who use the educational software in their educational process. For each of the aforementioned categories of evaluators an appropriate check list has been materialised through which the characteristics of the evaluated educational software are explored. For each characteristic a particular percentage of significance has been given.

THE OBSERVATION DURING THE USE OF THE EDUCATIONAL SOFTWARE AS AN EVALUATION OBJECT

During the evaluation process upon the use of the educational software the interaction and the experiences of the students – users are registered and afterwards analysed, either by video recording or by observation by educators who are assisted and co-ordinated by the person in charge of the process. The central idea is based on the presentation of some projects to a number of students – users and who thereafter use the educational software. The evaluators – educators evaluate the planning of the connection for the possibility of interactivity that it provides and they try to recognise any possible faults. The method uses an appropriately planned check list by which the marks of the evaluators are registered. In the version Jogthrough (see Bonekamp L. W. F. 1991) (see Duchastel, P.C. 1987) a video camera is used for the recording of the comments and the suggestions of the evaluators and as a result the process is accelerated. In the present project the Jogthrough version has been modified and materialised in such a way, that the evaluation of the educational software would be measurable according to the proposed check lists and especially through significance coefficients for each partial sub-question of each question. The purpose of the questions is the evaluation of the cognitive dimension of the interactive environment through the continuous use and the control of the possibility provided by the educational software in the specific action to be evaluated, for the concentration of the student's attention in the understanding of the projects as defined objects and not just as projects in the connection (click, drag, etc.). Therefore according to those aforementioned this is a formal evaluation based on a session of evaluators – educators specialised in the evaluation, or educators who are simple users and who: 1) observe characteristic projects during the period when the students uses the educational software, 2) note their estimations for each project in a special check list and 3) discuss about the (subjective) quality of the planning of the environment, 4) This process is completed with the filling of a check list, for the registration of the evaluators' judgements, that takes into consideration the factor «time of familiarisation» of the student – user with the interactive environment.

DESIGNING AND MATERIALISATION OF THE INFORMATION SYSTEM

The model of evaluation described is designed and implemented as an open information system, with complete description of the methodology. The information system consists of the following components: 1. A tutorial on the evaluation of educational software. It includes the evaluation method, the purpose and the specific objects of evaluation. 2. A data base containing the proposed questionnaires and the corresponding check lists for each category and type of evaluation. The questions in every questionnaire have different significance percentages. The categories of evaluations also have different weights. Finally, the two types of evaluation also participate with different weight in final result. All the significance percentages and anything relevant to them can be modified according to the judgement of any researcher. Also the check lists, as well as any included text can be modified and printed. The filling of the check lists is done in a simple way by selecting the evaluation mark or by filling in the necessary data. The system verifies the completeness of the filling and controls it if possible. In each check list there is the possibility of a hypertext for reference in explanatory texts, which facilitate the understanding of the included questions and must be answered upon the evaluation. These texts can also be modified. Also, at the end of the corresponding list each evaluator can enter remarks concerning the software. 3. A mechanism for data processing and extraction of the final result of the evaluation. The evaluation results are given, as a sum for each category of evaluators and for each evaluator. (Final marks = Quantitative Evaluation x X% + Qualitative Evaluation x Y%). Moreover, special evaluation results are given where the attitude and the particular characteristics (e.g. origin of school, students level regarding their knowledge etc.) of each evaluator are explored. Finally, there is the possibility for the user of the information system, to create simple or complicate statistical questions that were not provided and are considered necessary for the research of the evaluation of the educational software. The best marks of each check list as well as the best marks of all the evaluators in the quantitative formal evaluation are 300. In the qualitative formal evaluation the best evaluation marks depend on the number of the projects and the actions to be evaluated. The proposed methodology provides two projects of evaluation with five actions each. The best evaluation marks of each project are 120. Therefore the best marks for the proposed model, which requests 2 projects with 5 actions each are 1200. Anyway it lies at the disposal of any researcher who will use the proposed evaluation model to modify the significance percentages in each evaluated characteristic that is included in each check lists, of each category of evaluators, as

well as of each evaluation type. He also has the possibility to annul, if he wishes so, some characteristics or to replace them or to annul a certain category of evaluators or a certain evaluation type and the proposed model is adapted to the specific demands. Nevertheless we feel that in the proposed method all the categories of evaluators in both types of evaluation should participate.

ANALYSIS OF THE RESEARCH RESULTS

The selection criteria in the schools where the research took place, were the existence of educational software through which the research took place in the school, the use of educational software by the educators in the school, the land-planning distribution of the schools, the demographic origin of the students, the type of the school and the possibility of filling in the check list for administrative reasons. The educational software upon which the research was conducted, was Physics of High School of the company Inter*learn, which has been selected based on the criterion of its completeness regarding the characteristics of the educational software and its use by as many schools as possible so that we could have a more easy choice of research subject, educators and students.

From the answers of the educators (In the research there participate 15 educators) and from the comparison of their answers in different questions or in a combination of questions we observe the following:

- The answers show that despite the fact that the educators were users of the same educational software, their answers vary. Therefore either its use is occasional or it is used in particular subjects without further exploring its possibilities or simple the educator has observed the course of the software as this is presented by a specialised user or finally he is not able to use the extra possibilities offered by the software.
- The average evaluation mark of the educational software by women-educators (152) clearly exceed the average mark of the evaluators men-educators (119).
- The average marks of the evaluators educators whose school belongs to an urban area (198) exceed the average marks of the evaluator educators, whose school belongs in a semi-rural (80.5) and rural area (66).
- The average marks (80) of the evaluator educators whose years in service are less than 10 is clearly smaller than the average marks of the evaluators educators whose years in service are more than 10 (153).
- The average marks of the evaluator educators who are well disposed to the use of computer in the school environment is greater (135) than the average marks of the evaluator educators who do not believe that the use of the computer should be expanded in all the lessons or that their professional recognition is influenced by the use of the computer (119).

From the answers of the multimedia and computer science experts (In the research there participate 5 multimedia and Computer science experts) and from the comparison of their answers in various questions or in a combination of questions, we observe the following:

- There is observed a relatively homogeneous concentration of the marks in the various evaluated characteristics, something that shows the homogeneous judgement of the evaluators regardless of the fact that they have worked in the development of the specific software or not.
- Comparing the average marks (159) of the multimedia and computer science experts that have worked in the development of the specific software with the average marks of the evaluators multimedia and computer science experts who have worked in the development of a similar or generally educational software, the results of the research show that there is only a small variation of the marks (143), from which fact it is concluded that those who have worked in the development of the specific software are also credible evaluators.

From the answers of the pedagogues and specialists in didactic methodology and from the comparison of their answers in various questions or in a combination of questions we observe the following:

- There is observed a relatively homogeneous concentration of the marks (114-115) set by the evaluator pedagogues of various specialisation and specialists in didactic methodology in the various evaluated characteristics, something that shows the homogeneous judgement of the evaluators regardless of their specific specialisation.
- Some marks in the various evaluated characteristics are in the limits of neutrality, something that shows that the exclusive interest of this specialisation of evaluators is only the pedagogical approach.

From the answers of the students (60 students participated in the research) and the comparison of their answers in various questions or in a combination of questions we observe the following:

- The average marks of all the evaluators students (142,3) is very close to the average marks of the evaluator educators (135.5), as well as to the general average of all the categories of evaluators of quantitative formal evaluation (149,7), something that certifies them as evaluators category.
- The average marks of the male student-evaluator (138) is smaller than the average of the girl (147.92).
- The average marks of the evaluators – students who use a computer outside school as a game (124,84) is smaller than the average marks of the other students, which shows that they are more strict judges than the other categories of evaluators – students.
- The average marks of the student-evaluators who have a positive attitude towards the use of the computer or its contribution to their professional career is greater (151.59) than the average mark of all the categories of evaluators of quantitative formal evaluation (149.7).
- The average marks of the student-evaluators who believe that the use of the computer does not contribute to the improvement of the educational process (53,66) is by far smaller than the average of all the categories of evaluators of quantitative formal evaluation. The same stands but less intensely (105.6) for those that do not believe that the computers will be necessary in their professional career.
- The average marks of evaluation of the students whose mark in the respective lesson is less than 13 or greater than 18 (150,78 and 145,22 respectively) is smaller than the average of all the categories of evaluators of quantitative formal evaluation and the average marks of evaluation of the students whose mark in the respective lesson is from 13 up to 15 and from 15.1 up to 18 (132,41 and 135,87 respectively) is near to the average of all the categories of evaluators of quantitative formal evaluation. The same stands proportionally for the students with their respective mark limits in their previous class and not in the respective lesson, as above.
- The average marks of evaluation of the evaluators – students whose school belongs to an urban area exceeds (167,76) the average marks of the students whose school belongs to a semi-urban and rural area (110,26 and 121,35 respectively).

From the answers of the evaluators educators who participated in the formal qualitative evaluation and from the comparison of their answers in various questions or in a combination of questions we observe the following:

- The average marks of the women-evaluators (919) is less than the ones of the men-evaluators (939).
- The average marks of the evaluators – educators who are well disposed to the use of computer in the school environment is greater (939) than the average marks of the evaluators educators who do not believe that the use of the computer should be expanded in all the lessons or that their professional recognition is influenced by the use of the computer (919).

By modifying the significance percentages per evaluation type and per evaluators' category the final marks are respectively formed as follows:

Evaluators Category	*Mark*	*Significance %*					
Educators	135,5	25	40	40	55	60	70
Students	142,3	25	20	25	15	20	10
Multimedia and computer science experts	143,75	25	20	20	15	10	10
Pedagogues in didactic methodology	208	25	20	15	15	10	10
Quantitative evaluation		157,4	153	149,7	148,6	144,9	144,3
		(1)	(2)	(3)	(4)	(5)	(6)

Table 1: Quantitative Eevaluation

Evaluators Category	*Mark*
Educators	965
Qualitative evaluation mark	965

Table 2: Qualitative Evaluation

Taking into consideration each mark that results in the quantitative formal evaluation with the significance percentages for every evaluators category, that we have stated for each case and the mark of the qualitative evaluation as pair of prices, we can have the following tables by modifying the significance percentages for the quantitative and the qualitative evaluation.

Evaluators Category	*Mark*	*Significance %*					
Quantitative evaluation	157,4	40	50	60	70	80	90
Qualitative evaluation	965	60	50	40	30	20	10
Final mark		642	561,2	480	399,7	318,9	238,1

Table 3: Final Eevaluation (1)

Evaluators Category	*Mark*	*Significance %*					
Quantitative evaluation	153	40	50	60	70	80	90
Qualitative evaluation	965	60	50	40	30	20	10
Final mark		640,2	559	477,8	396,6	315,4	234,2

Table 4: Final Evaluation (2)

Evaluators Category	*Mark*	*Significance %*					
Quantitative evaluation	149,7	40	50	60	70	80	90
Qualitative evaluation	965	60	50	40	30	20	10
Final mark		638,9	557,4	475,8	394,3	312,8	231,3

Table 5: Final Evaluation (3)

Evaluators Category	*Mark*	*Significance %*					
Quantitative evaluation	148,6	40	50	60	70	80	90
Qualitative evaluation	965	60	50	40	30	20	10
Final mark		638,5	556,8	475,2	393,5	311,9	230,3

Table 6: Final Evaluation (4)

Evaluators Category	*Mark*	*Significance %*					
Quantitative evaluation	144,9	40	50	60	70	80	90
Qualitative evaluation	965	60	50	40	30	20	10
Final mark		637	555	473	391	308,9	226,9

Table 7: Final Evaluation (5)

Evaluators Category	*Mark*	*Significance %*					
Quantitative evaluation	144,3	40	50	60	70	80	90
Qualitative evaluation	965	60	50	40	30	20	10
Final mark		636,7	554,6	472,6	390,5	308,4	226,3

Table 8: Final Evaluation (6)

CONCLUSIONS

After the submission of all the results and the elaboration of the particular characteristics of the subjects that were researched the conclusions can be submitted as follows:

- The number of evaluators per category should be at least three in the quantitative formal evaluation and at most three students for the evaluation of each action of one process in the qualitative formal evaluation. (see Finding Usability Problems through Heuristic Evaluation 1992) (see Nielsen J. 1993) The students who participate in the process of the qualitative evaluation must have been taught the cognitive object in their class and constitute an average sample regarding their attitude towards the use of the computer, their didactic performance and the cognitive object and their school performance from the previous class. Also the students should originate from schools that constitute an average origin sample regarding the financial

level of their municipality (Rich – Urban – Downgraded) and regarding the characterisation of their area (Rural – Urban – Semi-urban).

- The number of the actions in the processes of the educational software that will be evaluated should be at least five. The procedures to be evaluated depend on their number in the whole educational software that also refers to the number of the educational hours that are provided to cover. In an educational software of ten didactic hours at least two processes with five actions each should be evaluated.

By evaluating the tables of the results of the marks with different evaluation significance per category of evaluators and type of evaluation, as they are stated above we observe the following:

- The marks for the evaluated software and for the specific evaluation, by modifying the significance percentages per evaluators' category of quantitative evaluation, have a small variation between them. It is obvious that in the evaluation of other educational software there will result different marks and their variations between the evaluators' categories will be different.
- The marks that are more close to each other appear in the significance percentages allocations in the cases of the Tab. 3 and Tab. 4. This is also confirmed by the documentation that has been submitted about the significance of the participating evaluators' categories in the quantitative evaluation per order of importance in the evaluation. With this data it is ascertained that the most important allocation of significance percentages is the one of Tab. 3, where significance percentages vary respectively for the educators, students, multimedia experts and specialists in the didactic methodology and are: 40-25-20-10.
- In the present evaluation and regarding the evaluated software, as it has been already mentioned, the variations in the marks of the quantitative evaluation with different significance of the various evaluators' categories are very small. As a result, evaluating in turn the tables of the final evaluation with different significance for each pair of marks of quantitative and qualitative evaluation, the variations are also small. However having documented the reasons for which we feel that the quantitative evaluation is by far more important than the qualitative one, and observing that the marks with coefficients the pairs 80-20, 70-30, 60-40 present the smallest variation between, we conclude that the significance percentages 70-30 respectively should be the ones that correspond the most to the objectivity of the proposed evaluation method.

The aforementioned show us that the evaluation model that was planned, according to significance percentages that have been described, can be considered as responding to the evaluation demands. However further research work of more educational software is necessary, when the use of educational software is incorporated in our educational system and it is disposed respectively in the school for use by the educators and students.

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Breaking with Tradition: Constructivist Development Methodologies for the Web

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Abstract: Constructivist instructors who attempt to develop a curriculum that uses browser-based multimedia technologies using traditional instructional design methodologies may find themselves dissatisfied with the results. In developing for the web the traditional ID model is not the appropriate development methodology. This paper discusses the instructional development techniques used in the creation of Iowa State University's browser-based Masters of Agronomy program. Topics such as rapid prototyping, being mindful of student needs, iterative evaluation, and versatility and reusability of development tools are discussed. By sharing our experiences in developing this program is our hope that others who are developing instruction in this still relatively new medium can gain from what we have encountered.

Introduction

Iowa State University has a long history of providing off-campus instruction and training, dating back to the mid-nineteenth century. After the need for a Masters of Science in Agronomy professional degree was perceived in 1996, it was determined that one of the goals of the instructional designer group was to provide a way for professionals working in industry and the government to gain an advanced degree in Agronomy without having to attend the campus in person. Various ways of delivering the program were examined and the Internet was chosen as the primary communication medium, with multimedia lessons distributed on CD-ROM.

Program Description

The curriculum consists of 12 classes, a 1-credit workshop, and a 3-credit creative component, totaling 30 semester credits. Development of the first three courses began in 1997 and completed in the summer of 1998. After the initial development period, the time required for course creation decreased and the program became available for admission in the fall of 1999.

Each course varies slightly in its manner of assessment, but they generally involve the submission of assignments, discussion postings, and midterm/final exams. The exams are offered off-campus by approved proctors.

The program is loosely synchronous in nature. Students are expected to make satisfactory weekly or biweekly progress within the time allotted for each course, generally a semester in length. Although the majority of the program can be completed remotely, the orientation session, Agronomy 593: Workshop in Agronomy, and a Creative Component seminar require students to travel to the ISU campus.

The project staff consists of three groups that came together over time: first, faculty from the Iowa State University College of Agriculture and College of Education laid out the overall goals and needs of the project; next, an instructional development group was recruited; and lastly, a panel made up of industry leaders in agronomy was formed in an advisory capacity. In addition, a pilot group of agronomy students have been using the courseware since the fall of 1998.

Students access the courseware by computer from their home or place of business via the Internet and CD-ROM. The courseware integrates interactive material on CD-ROM with a Student Notebook

System (SNS) on an ISU server. The SNS allows students to communicate electronically with their instructors and fellow students by using a calendar, discussion board, chat room, and several other tools.

The recommended minimum computer requirements are: a PC using Windows 95 or greater, a 150 MHz or faster processor, video, audio, and graphics capable, 32 MB RAM, 8X CD-ROM and an Internet connection.

How Our Development Process differs from the Traditional Model

The traditional model of instructional development as described by Dick & Carey (1996) is composed of several sequential steps:

1. determining the instructional goal,
2. analyzing the instructional goal,
3. analyzing learners and context,
4. writing performance objectives,
5. developing assessment instruments,
6. developing an instructional strategy,
7. developing instructional materials,
8. conducting formative evaluation,
9. revising instruction.

Each step has a clearly defined process to be followed and clearly defined boundaries separating one step from another. When we on the development team began this project, this was the process that we were most familiar with and were planning to use. However, three things led us to move away from this model.

First was our emphasis on student-centered instruction. In the traditional model, student input may not be taken into account until the formative evaluation step. As this program was conceived as a way to serve the needs of the students, we felt it was important that student voices be heard from the very beginning.

Second was the nature of the medium. Internet-based courseware allows for a higher degree of interaction than does traditional distance education media, not just between student and teacher but also between the students and their peers.

Finally, creating interactive multimedia is markedly different from conventional course development. HTML tools allowed for the rapid prototyping and revision of the instructional product. As each course was created, revisions were included in previous courses as applicable.

What has grown out of this is a development process that is student-centered, iterative in nature, and has a high degree of reusability. By sharing our experiences in developing this program is our hope that others who are developing instruction in this still relatively new medium can gain from what we have encountered.

Student-centered Development

The concept of student-centered instruction is not new. One of the tenets of constructivist ID is that the focus is on authentic tasks, authentic instruction, and authentic assessment that is meaningful to the students (Willis, 1995). What differs in our project from many other student-centered learning environments is the way in which students were involved. Our original development group consisted of instructional designers and media specialists from the College of Education. We soon added students to the group that either had or were working toward a traditional graduate degree in Agronomy. Their input and co-ownership of the project quickly proved to be invaluable, simply because of their inside perspective. As they graduated, we recruited other Agronomy students as replacements and gained fresh insights as they worked with the group.

Next, as the new program is meant for professionals, we enlisted the aid of the advisory panel mentioned earlier. While they wouldn't be taking the courses themselves, they are or potentially could be the employers of the students. Their comments gave a good counter-point to the content created by the Agronomy faculty and allowed us to develop authentic tasks performed by professional agronomists.

The last step was to gain as clear an understanding of the target students as we could. After the first three courses were completed, a pilot group of students was selected. A preliminary focus group and orientation was held where they told us what they wanted and expected from the program. They stayed in contact not only with the faculty but also with the development group, giving feedback and finding bugs that we had missed. At the end of the first semester, questionnaires were sent out to gain input their overall impressions on each course and the program in general. Their responses were used to make further improvements and revisions.

Iterative Prototyping

Prototyping has long been used in instructional design, usually taking place during the development of instructional materials (Tripp & Bichelmeyer, 1990). Prototypes at this stage reflect the nearly final form of the design, and tend to be difficult to modify in any significant way. In a more flexible environment, such as the web, developing what is called a rapid prototype at an early stage aids in the design process. Development of an instructional unit can be sped up by building and using a prototype that models the unit. Rapid prototyping differs from conventional modeling in that content is minimal at first, what is important is concept. As students use the prototype, developers get feedback from the students early on and discover exactly what does work and what doesn't. Changes are incorporated based on the feedback, and the prototype is re-evaluated.

In a medium other than the web, rapid prototypes can be as simple as a storyboard drawn on paper or a chalkboard. Using modern HTML development tools, a working prototype of a web-based instructional unit can be built and evaluated quite easily. Content is added to the prototype and it becomes, over time, not only the product but also a model for instructional units yet to be developed. The greatest perceived drawback that we saw to iterative development is the difficulty in tracking progress or counting milestones without stepping back and seeing the "big picture". There were times, during the first few months, that it seemed like we weren't getting very far. After the first courses were ready for the pilot group, however, the advantages to this method became readily apparent as course after course fell into place. We also found that this method kept in check what some have called "creeping featurism", or the bells-and-whistles syndrome. Additions that were considered unnecessary or overly complicated became readily apparent and little time was wasted on them.

Versatility and Reusability

Our selection of a development environment was based in part on the skills of the development team and in part on the software that was most available to the students. As a web browser we chose Netscape Communicator, as Microsoft had not yet integrated Internet Explorer into its operating system. Communicator incorporates some advanced HTML features, not the least of which are style sheets and JavaScript. For those unfamiliar with them, style sheets are essentially a way to externally control the look and feel of a web page without having to duplicate the HTML code in each page. If a change to the look and feel needs is needed, it can be made in one place and the changes take effect across the entire site.

The most important use we made of JavaScript was to write self-assessing study problems. When the format of the study problems was finalized, the various pieces of JavaScript code were placed in a common folder. By changing the arguments that are passed to a function from a particular page, the code became reusable. Again, if changes needed to be made, they could be made in one place.

In our choice of development environment, we also tried to look to the future and computer platform compatibility. Although our students, and the industry in which they work, use almost exclusively Windows-based PCs, the development platform with which we are most familiar for multimedia authoring is the Macintosh. Rather than retrain the development group to use a different operating system, we chose software, such as Apple's QuickTime and Macromedia's Authorware that could produce files that are usable by either computer platform. As the College of Agriculture at Iowa State does have a mix of PCs and Macintoshes in its classrooms, the content that has been created could be used again for other classes.

Conclusion

The program that we have developed may not be typical in size or scope to what many educators have developed as they turn to the web as a medium for instruction. What is typical is that we found developing for the web took us to a different place than we had been before. Rather than try to apply old rules to a new situation, we attempted to exploit the advantages that browser-based instruction could give us as developers just as we hope students can use it as a new medium for learning.

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Design and Development of an Interactive Web-Based Curriculum in Support of the Space Science Education Initiative: Mars Millennium

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Abstract: This paper provides an account of the instructional design and development process used by a team of students enrolled in a graduate level course in Distance Education as the team members conceptualized and created two prototype web-based instructional modules for the Lunar and Planetary Institute's (LPI) Mars Millennium web site and CD-ROM project to support the National Aeronautic and Space Administration's (NASA) Jet Propulsion Laboratory (JPL). It is intended that this paper serve as an instructional design blueprint for other curriculum designers and educators to use, should they encounter a similar need for interactive web-based curriculum based on scientific theory and data, which incorporates a variety of emerging technologies, Internet tools, and innovative instructional strategies.

Introduction

The Mars Millennium Project, an official White House Millennium Council Youth Initiative, is a national art, science and technology initiative created to encourage students to design a community for 100 people arriving on Mars in the year 2030 (see http://www.mars2030.org/). Each educational team participating in the Mars Millennium Project has been giving the goal to design a livable life-sustaining community on Mars that is culturally and artistically rich. The Mars Millennium Project is spearheaded by the U.S. Department of Education, the National Aeronautics and Space Administration (NASA) and its Jet Propulsion Laboratory (JPL), the National Endowment for the Arts, and the J. Paul Getty Trust. NASA's Lunar and Planetary Institute (LPI) is contributing to the project by developing web-based curriculum for the Mars Millennium Project and piloting the curriculum in Houston-area schools, libraries, youth and arts centers (see http://www.lpi.usra.edu).

In support of LPI's goal to provide educators and students access to on-line interactive activities as a part of it's educational mission for NASA's Office of Space Science and the Mars Millennium White House Initiative, the Institute's education staff is working with graduate students in the University of Houston-Clear Lake's (UHCL) Instructional Technology (INST) Program to design and develop a series of on-line multimedia activities. Utilizing the scientific research, data, theories and expertise of the planetary scientists at the Lunar and Planetary Institute, two prototype interactive web-based instructional units have been developed focusing on the planet Mars. The units will be featured as part of the education programs available for K-12 educators and students accessing the LPI web page. The Mars curriculum will be targeted to students in middle and high school (grades 5-12) and will be presented as part of LPI's support of the White House Mars Millennium Initiative which challenges students to imagine a human colony on Mars in the year 2030. The web-based materials will be tested with the LPI gifted and talented 5th grade students who attend a weekly "Exploring the

Planets" class and with educators at the LPI summer workshop, 'Liftoff 2000: Mars'.

This paper outlines the process used by the instructional design team as they began to systematically design and develop this web-based curriculum. The curriculum designers will explain how the team members used learner and context analysis data to guide them as they identified the most appropriate instructional theory to use as a basis for their curriculum development. The designers will illustrate how an instructional analysis of the subject matter impacted their selection of instructional strategies. And, the design team will describe their development of the web interface and page layout. It is intended that this paper will serve as an instructional design blueprint for other curriculum designers and educators to use, should they encounter a similar need for an interactive web-based curriculum, based on scientific theory and data, which incorporates a variety of emerging technologies, Internet tools, and innovative instructional strategies.

The Instructional Design Process

Given the fact that all members of the instructional design team had experience using the Dick and Carey model (Dick & Carey, 1996), the team agreed to base the project's instructional design process on these steps and processes as they created the curriculum. Although the UHCL designers were involved only with the design and development phases of the instructional design process, all decisions regarding instructional strategies were based on LPI instructional analysis data. A list of the process steps followed by the team are outlined in sequential order below:

- Review LPI data on Mars Millennium Project purpose statement and goals
- Review LPI data on LPI's preferences regarding instructional context
- Review LPI data on LPI's content analysis for specific modules of instruction
- Review LPI data on target learners
- Create instructional goals for each module of instruction
- Identify philosophical foundation upon which instruction will be based
- Break each module of instruction into requisite number of lessons
- Create instructional objectives for each lesson
- Select instructional strategies for each objective
- Design web interface for the curriculum
- Flow chart each module
- Storyboard each lesson
- Identify LPI digital resources to be used for each lesson
- Write lesson content and activities
- Import content, activities and digital images into the web interface
- Proof content and check links

The instructional design team consisted of a group of six instructional technology graduate students who were interested in providing a prototype distance education project for the Lunar and Planetary Institute's Mars Millennium web site and CD-ROM project. One of the members serves on the educational staff at LPI and secured approval for the team to undertake the assignment. This group member was also the team's contact for all LPI Mars Millennium resources, such as scientists (also referred to as subject matter experts), digital images, animation, logos, and instructional analysis data already compiled.

Under direction from the LPI staffer, the design team reviewed the current proposal for a curriculum design for the national program aimed at grade 5 through 12 that had already been developed by the LPI Education Staff. From this extensive listing of proposed curriculum, the team decided on two instructional modules: *Mars of the Mind* and *Ocean on Mars*. Two separate groups of three team members each were formed with each three-person subgroup assuming responsibility for one module. Although the subgroups would be creating instructional strategies and content independent of the main group, other decisions, such as the selection of the philosophical foundation for the curriculum and the web interface design would still be coordinated with all six team members to maintain alignment between the modules.

Analysis

LPI's Education Staff presented the UHCL instructional design team with instructional analysis information that was critical to the development of sound, systematically-design curriculum. This information included the purpose statement for LPI's Mars Millennium curriculum project, which is:

> "To create a curriculum that is suitable for use in 5-12th grade classrooms with the goal of impacting students and teachers at a national level through the Mars Millennium project, our gifted student program, Alpha, and through a variety of outreach endeavors, including Liftoff and Explore (National Educator Training Workshops) by addressing the following goals:
>
> - To address issues relating to the history of the planet Mars and it's current geologic condition through a series of Earth-Mars analogues, hands-on activities, modeling, 3-D imagery, and other presentation materials, and
> - To help support the teaching of the scientific issues facing mission planners designing robotic and manned exploration missions to Mars via a distance learning venue such as the web or CD-ROMs." (Karl & Clifford, 1999)

In addition, the Institute provided the following guidance regarding its preferences for the instructional context and content:

- "We will develop a distance learning venue for the curriculum in order to reach students and teachers nationwide in the Mars Millennium project, by using a web-based format and CD-ROM format. This will include video interviews of a Mars scientist, graphics depicting the possible ocean on Mars, and animated sequences illustrating current missions to Mars that are searching for evidence of water (i.e. the Deep Space Microprobes). The site will also include ways to e-mail with Mars scientists (Ask-a-Mars-scientist), links to Mars activities, images, presentations, posters and resources.
- We will prepare lessons and activities that will address the historical issues of Schiaparelli's 'seas on Mars' and Percival Lowell's 'canals on Mars', and how man's view of the red planet has changed with improvements in technology by using modeling and Earth analogues.
- We will gather NASA (and other) materials suitable for including in this curriculum including, for example, the Surveyor '98 poster which illustrates Mars in the past with oceans and Mars in the present without running water (and also examples of chaotic terrain)." (Karl & Clifford, 1999)

And, lastly, a description of the target learners stated, "We will beta test the activities and materials developed with the pilot Mars Millennium sites this year in Houston and with the Alpha (gifted and talented) students (5th graders) here at the Institute. We will present the material to the teachers at next year's Liftoff 2000, which will focus on Mars, and to the librarians who participate in the Explore Program, Fun with Science." (Karl & Clifford, 1999)

Based on a review of this information, the instructional design team was able to construct goal statements for each of the instructional modules. The *Ocean on Mars* module goal became: "To present an integrated interactive site for distance education serving the Mars Millennium high school students by using chemistry, scientific theory and mission data in order to design new missions to Mars." And, the *Mars of the*

Mind module goal translated into: "Gifted fifth and sixth grade students will hypothesize as to what Mars might look like in 2005 with improved technology. Students will accomplish this by navigating the Mars of the Mind web site to (1) review examples of well-known inventions and discoveries which hold a prominent place in history due to the way mankind's views of reality and truth were altered by them, (2) view historical pictures of Mars from different time periods and study the then available technologies used to form those pictures, (3) use this information to form opinions concerning the accuracy of technology and its effect on man's view of the universe at any given time, and (4) use these opinions to imagine what technology will be available five years from now and what man's view of Mars will be because of it."

With these instructional goals and the instructional analysis data from LPI before them, the team decided to use a constructivist approach as the philosophical foundation for their module and lesson designs. Designers of constructivist learning environments subscribe to instructional methods which provide students with experience in the knowledge construction process and appreciation for multiple perspectives, embed learning in realistic and relevant contexts, encourage ownership and voice in the learning process, embed learning in social experiences, encourage use of multiple modes of representation, and encourage self-awareness of the knowledge construction process (Wilson, 1996, pp. 11-12). Constructivism seemed an excellent approach given the exploration- and discovery-based theme of these instructional goals, the inquisitive nature of the gifted and talented students, and the web-based delivery method.

Design

Each instructional module was broken up into three lessons, with the first lesson supplying an introduction to the unit or some background information that students would need in order to proceed with the instruction. The second lessons provided the heart of the instruction where students engaged in web-based interactivities. Students were then asked to construct new meaning out of their experiences in the last lessons and provide some type of evidence of their new knowledge. Instructional objectives were then written for each of these lessons and are presented in Table 1.

	Instructional Objectives	
Lesson	***Mars of the Mind***	***Ocean on Mars***
1	Students will review examples of well-known inventions and discoveries, which hold a prominent place in history due to the way mankind's views of reality and truth were altered by them.	Students will learn how scientists use mission data in their research in order to develop theories, which will then influence future mission designs in order to help determine the validity of their work.
2	Students will view historical pictures of Mars from different time periods and study the then available technologies used to form those pictures.	Students will learn how the chemistry of Mars drives the future exploration of the planet in terms of sustaining a human presence on Mars.
3	Students will use this information to form opinions concerning the accuracy of technology and its effect on man's view of the universe at any given time and imagine what technology will be available five years from now and what man's view of Mars will be because of it.	Students will develop a rudimentary knowledge of the chemical processes needed to sustain life on Mars using in situ resources.

Table 1: Instructional Objectives for *Mars of the Mind* and *Ocean on Mars*

With the instructional objectives in hand, the design team began to formulate the instructional strategies, which would ensure that learning occurs as students move through the modules. The *Ocean on Mars* group decided to present the scientist's theory that an ocean may have existed on Mars and to provide students with a glimpse of a current mission sent to find this water. Students would engage in an on-line interactive chemistry lab in order to understand what an impact the presence of water on Mars would have for human exploration and colonization. Students would then be encouraged to be a part of this developing exploration program by designing a mission to be published on the site and by interacting with scientists through e-mail.

The *Mars of the Mind* group began by providing students with an example of how the evolution of a different type of technology (other than telescopes) changed man's view of reality and truth throughout history. Students would be taken on a web voyage to explore how the technological improvements in the telescope changed man's view of Mars. Students would then be challenged to hypothesize about the new technology that may be available to them in the year 2030 that would facilitate establishment of a colony on Mars and then write an essay or draw a picture of this technology for an on-line student gallery.

Now that the design was complete, the team set out to develop the web-based modules.

Development

The curriculum interface consists of the module logos and the navigation bars. Module logos, found on each site's home page, were based on the NASA mission patch for the Mars Surveyor '98 mission. PhotoShop was used to create the majority of the logo and then each subgroup customized the three points of the triangle to correspond to the titles of each subgroup's three lessons. After imposing an image map over the customized logos, "launching pads" were established for the students to access the lessons. The navigation bars were constructed in a similar fashion. Generic "Home" and "Lesson" buttons were established and then customized for each module.

Each subgroup flowcharted its sites and then drew up storyboards for each lesson. The next step, identifying and selecting digital enhancements for each web page, was easy given the vast repository of LPI resources. LPI is one of the world's largest Regional Planetary Image Facilities (RPIFs) which catalogues and stores all of the planetary mission imagery on-site, much of it in digital formats. Narrative content was then written and instructional activities detailed.

The *Ocean on Mars* web pages were authored with Dreamweaver, while the *Mars of the Mind* web pages were created with HTML. The team believed that it was important to demonstrate that instructionally sound web-based instruction could be created using both high end and basic web authoring tools.

The result of this work on both web sites can be found in prototype format at http://www.ghg.net/ritakarl/MOMMain.html (*Mars of the Mind*) and http://www.ghg.net/ritakarl/main.html (*Ocean on Mars*).

Assessment

If accepted by the Lunar and Planetary Institute as a prototype web-site, testing will occur via the Institute's involvement with the fourteen Houston beta-testing sites for the Mars Millennium project. Fourteen at-risk, underserved, and low socio-economic schools and youth groups in Houston are piloting the White House Youth Initiative over the course of the next school year. In addition, the Lunar and Planetary Institute teaches a 5th grade gifted and talented program for the Clear Creek Independent School District called 'Exploring the Planets'. Both of these groups would test the actual curriculum and be asked to evaluate the students' experiences. Students will submit questions to the scientists and also submit mission designs, as well as essays and drawings hypothesizing technological advancements that could permit colonization of the planet, to the web sites. Especially with the LPI Alpha students this could be done in conjunction with other Mars Mission planning activities that have previously developed by the institute. With the Mars Millennium sites, the material would be tested in a fashion more closely resembling what the final interactive web-based class

would be like. Student questions and the scientists' answers will be compiled and evaluated along with student submitted missions.

The Institute will also host a summer teachers' workshop, Liftoff, at the LPI. These educators, a selection of master middle and high school astronomy teachers, will be studying the planet Mars for one week at the Institute. They will as a part of their studies be asked to preview and comment on the material. LPI also has a group of former Liftoff teachers who are interesting in evaluating new products, they will be asked to review this curriculum. Hopefully, by next summer, these two web sites will be one part of a larger curriculum including Mars of the Past, Mars of the Present, and Mars of the Future.

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Different Storyboarding Methods in Multimedia Courseware Design

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Abstract: When we use multimedia-authoring tools, such as *ToolBook*, or *Hyperstudio*, to develop courseware or course segment, we usually go through the major phases of systems development. One of the phases is systems design, in which output, inputs, and navigation are determined and blueprinted, which, technically, are detailed in storyboards. Traditionally, storyboards can be 5 by 7 index cards, or certain paper forms. The current paper will present another means of storyboarding—using *PowerPoint* as a storyboarding tool. The components and procedures of storyboarding will be introduced. In six undergraduate and four graduate teacher-education technology classes, students designed multimedia courseware using *HyperStudio*/*ToolBook* with three different storyboarding methods—index cards, paper forms, and *PowerPoint*. The evaluation scores on four criteria—screen display, interaction possibilities, orientation and navigation—were compared. Repeated measures were used for data analysis. Differences were found among the groups with different storyboarding methods.

Background

Multimedia courseware development is a process of system development (Liu, 1999). Yourdon (1988) and Burch (1992) described a traditional system development life cycle (SDLC) that consisted of seven phases and was widely applied in commercial and industrial fields. The seven phases are: (1) systems planning , (2) systems analysis, (3) General (or conceptual) systems design, (4) systems evaluation and selection, (5) detailed (or functional) system design (6) systems implementation, and (7) systems maintenance. In the field of education, especially for the purpose of developing interactive multimedia instructional applications for classroom teaching/learning, Beasley (1998-99) modified the traditional SDLC into four major phases: (1) systems analysis, (2) systems design, (3) systems implementation, and (4) systems maintenance. In the systems analysis phase, the major problems are identified (Grabowski & Droms, 1994; Henderson, Gold & Tindall, 1996; McDeniel & Liu, 1996), the scope of the system is determined (Burch, 1992; Beasley, 1998-99), and task/concept analysis is performed (Fankhauser & Lopaczuk, 1996; Vrasidas & Harris, 1995). In the system design phase, output layouts are designed for all screens, special forms, and printed reports. All inputs are specified and formats, both screen and paper forms, are also approved. Based on the output and input designs, specific processes are designed to convert the input to outputs (Burch, 1992; Henderson, Gold & Tindall, 1996). According to these designs, detailed tasks of the system are implemented. The system is developed and converted to operation (Burch, 1992). Then the system is maintained until next life cycle.

In developing interactive multimedia application, the designers go through all these phases, and accomplish all designed tasks in all the phases. One task in the system design phase of developing a multimedia application is storyboarding (Ivers & Barron, 1998). There are several methods of creating storyboards, this study examined the effectiveness of three storyboarding methods: using index cards, using paper forms, or using *PowerPoint* to create storyboards.

Storyboarding in Multimedia Courseware Design

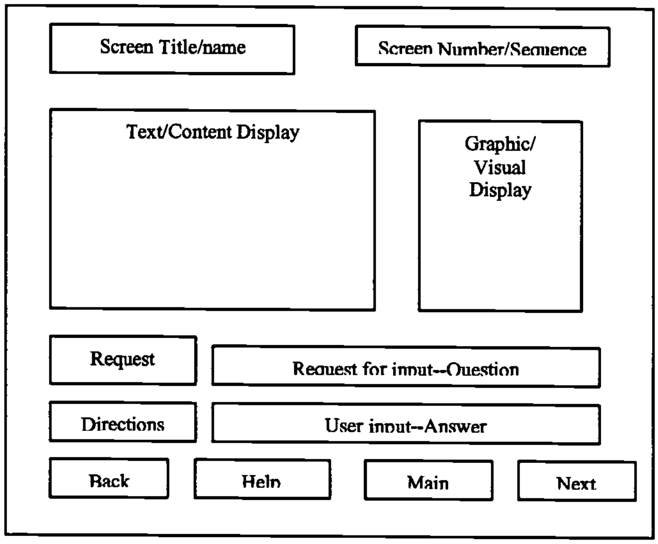
In the system analysis phase, *What To Do* has been determined, and all the requested tasks of the courseware have been listed (Liu, 1999). In the system design phase, *How To Do* will be detailed. For example, screen template and functional areas need to be designed. Multimedia programs, such as *HyperStudio* or *ToolBook*, usually contain at least three screen types: instructional screens, menu screens, and question screens (Ivers & Barron, 1998). The primary functional areas include title, informational/instructional text, graphics, directions,

feedback, icons or navigation options. Screen templates show the exact positions of these functional areas that vary based on the purpose of each screen. The next is to write storyboards.

Storyboards contain all the information that will be placed on the screens (in the screen templates), in addition to information that will assist the programmer and production specialists in development of the media components. Storyboards serve as the blueprint for the program. The detailed storyboards contain all the descriptive information required to produce the text, graphics, animations, audio, and video. Also, the links for each button or interaction are specified.

Traditionally, storyboards are written on 5 by 7 index cards. One card is one screen, all the elements designed for that screen should be on the card. Figure 1 is an example of an index card storyboard before detailed information is put in. In this template, the exact information should be displayed. For example, the screen number, the text content, and questions. The Graphic should be in the right position. The background colors and designs should be specified...

Figure 1. Screen Template Written in an Index Card



Another traditional method of writing storyboards is using some paper forms. This is similar to index card except the size of the paper. In the screen component form/table, all elements are listed and there left the space for detailed explanation. For example, navigation, text and audio can be detailed as:

Figure 2. Paper Form Storyboarding

Navigation:
Button 1:__________ Link to: __________ Action: __________
Button 2: __________ Link to: __________ Action: __________
Text:
Text: Color: __________ Size: __________ Font: __________
Audio:
Source: __________ File: __________ Description: __________

With more and more multimedia applications available for the courseware applications, evidently, neither index-card nor paper-form storyboarding can "tell" all the detailed information to the designer. Therefore, some methods, based on the idea of taking the advantage of technology to solve problems, should be adapted. Considering the format, properties and purposes of storyboarding, we found PowerPoint has the potential to be a useful tool for creating storyboards. PowerPoint slides can contain the same components as in index cards or paper forms, as well as many visual components, such as graphic object, colors, and so on. However, there is no evidence in the literature to show the use of *PowerPoint* as a storyboarding tool. There is no other experience to show either positive or negative of this method. In our technology courses, our students are the designers of multimedia applications. The issues are whether our students could learn multimedia design more effectively with this tool, whether this method

would work well, whether using *PowerPoint* as a storyboarding tool would be better than the traditional storyboarding methods.

Purposes and Research Questions

The purpose of current study was to determine a better storyboarding method among the three methods: index card, paper form, and PowerPoint, so that our students could effectively learn multimedia instructional designs. Considering the different learning experiences, styles, and knowledge background between undergraduate students and graduate students, we examined two research questions in this study:

1. Are there any differences among the evaluation scores of multimedia designs created by undergraduate teacher education students who used different storyboarding methods (index card, paper form, and *PowerPoint*), regarding to the quality of screen design, interaction, orientation, and navigation?
2. Are there any differences between the evaluation scores of multimedia designs created by graduate teacher education students who used different storyboarding methods (index card and *PowerPoint*), regarding to the quality of screen design, interaction, orientation, and navigation?

Methods

Subject and Sampling

This study was undertaken from two dimensions with two groups of students: undergraduate and graduate teacher education students. The subjects were from the College of Education in an eastern state university, including 87 undergraduates from six technology classes, and 72 graduates from four technology classes. The undergraduate classes used *HyperSdudio* to create a multimedia instruction segment, and the graduate classes used *Toolbook* and *HyperStudio.*

Instrument

Instrument used to evaluate students multimedia instructional design was a criteria list consisted of 10 items that have been used in many studies (Ivers & Barron, 1998):

1. Content
2. Language
3. Screen displays
4. Visual images
5. Interactions
6. Orientation
7. Navigation
8. Input, response analysis and feedback
9. Help, evaluation & record keeping
10. Technical consideration

Under each item, there was a detailed checklist. Each quality item was scored from 1 to 10, where the score of 10 was the best. We selected four quality items—screen displays, interactions, orientation and navigation—for the purpose of this study. Because, the quality of storyboarding would directly influence these four design qualities.

Design and Data Analysis

In this study, we used existing classes as the convenient sample. However, in each of the six undergraduate classes, students are randomly assigned into three groups using different methods (Index card, paper forms, and *PowerPoint*); and in each of the four graduate classes, students were randomly assigned into two groups using different methods (Index card and *PowerPoint*). We sorted the undergraduate students' scores of the three groups cross six classes, and the graduate students' scores of the two groups cross the four classes. This was not a completely random design; we only focused on the interested levels of the quality criteria—screen display,

interaction, orientation, and navigation. According the purpose of the study, repeated measures were employed for data analysis. For each group, the four quality criteria were repeatedly measured (see Table 1, and Table 2):

Table 1. Repeated Measures (Undergraduate Groups)

	Screen	Interaction	Orientation	Navigation
Index Card				
Paper Forms				
PowerPoint				

Table 2. Repeated Measures (Graduate Groups)

	Screen	Interaction	Orientation	Navigation
Index Card				
PowerPoint				

SAS system was used for the data analysis, and assumptions for repeated measures were checked. The two sets of data did not violate the assumptions of equal variance, normality, and extreme ourliers. Therefore, we consider that the statistics results of the repeated measures explain the situation of the data well.

Results

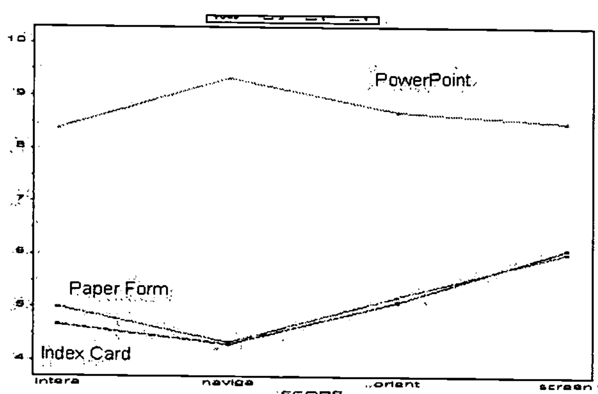
The results of the data analysis shows that significant differences were found among the three groups of undergraduate students' multimedia application design quality scores (see Table 3):

Table 3. Test of Fixed Effects (Undergraduate Groups)

Source	NDF	DDF	Type I F	Pr > F
Method	2	84	452.72	0.0001
Score	3	264	40.94	0.0001
Method* Score	6	264	30.66	0.0001

As shown in Table 3, the differences are significant among the quality scores of multimedia application design created with different storyboarding methods ($F = 452.72$). Figure 3 shows where the differences are:

Figure 3. Interaction Mean Plot (Undergraduate Groups)



As shown in figure 3, quality scores of PowerPoint method group is significantly higher than that of paper forms group ($t = 25.70, p < 0.0001$), and that of index card group ($t = 26.41, p < 0.0001$). There is no difference between

the paper form group and index card group ($t = 0.71$, $p < 0.4784$). From the mean score plot, we can see the quality scores of the four criteria in PowerPoint group are higher than those in paper form group and index card group.

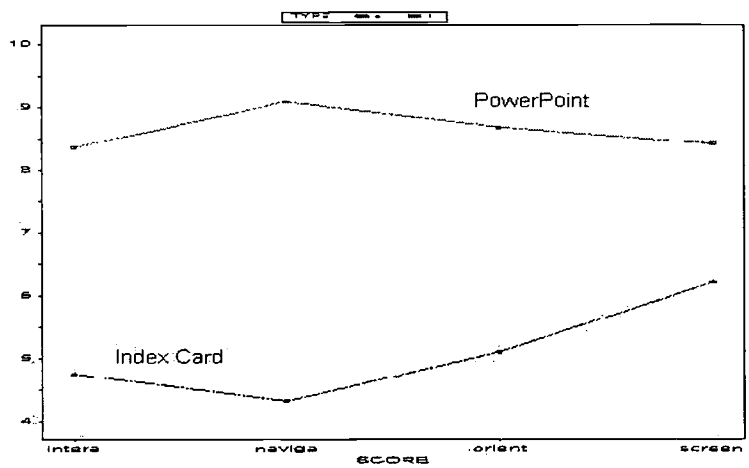
The results of the data analysis shows that significant differences were found among the two groups of graduate students' multimedia application design quality scores (see Table 4):

Table 4. Test of Fixed Effects (Graduate Groups)

Source	NDF	DDF	Type I F	Pr > F
Method	1	70	607.07	0.0001
Score	3	218	22.09	0.0001
Method* Score	3	218	56.65	0.0001

As shown in Table 4, the differences are significant among the quality scores of multimedia application design created with different storyboarding methods ($F = 607.07$). Figure 4 shows where the differences are:

Figure 3. Interaction Mean Plot (Graduate Groups)



As shown in figure 4, quality scores of PowerPoint method group is significantly higher than that of index card group ($t = 24.64$, $p < 0.0001$). From the mean score plot, we can see the quality scores of the four criteria in PowerPoint group are higher than those in index card group. Other detailed results comparing the four criteria will be presented as SITE.

Conclusions and Discussions

In conclusion, as the answers to the two research questions, for both undergraduate and graduate teacher education students, using PowerPoint as the storyboarding tool will produce better design in a multimedia application. The screen display, interaction, orientation, and navigation designs were significantly different (higher scores) from the designs using index card or paper forms in storyboarding. The PowerPoint group showed the high quality of design in the for area: (1) The screen frames were properly designed to achieve balance, harmony and simplicity; color and text styles were used appropriately; and special effects were used properly. (2) Interaction possibilities were maximized and properly designed. (3) A natural sense of dialogue was created with the user; users could control the pace or sequence; screens were properly labeled so users could easily find out where they were—orientation. And (4) Users could easily get where they wanted to go—navigation.

The findings of this study also suggested that although undergraduate and graduate students are different in their learning experience, knowledge background, and thinking skills, the results of the two groups are similar. Figure 3 and 4 showed the same pattern of the differences. This indicated that this method worded well for both groups, and could be used in the technology courses for both groups.

One interesting question was why this method made the differences. When students used index card or paper forms, they only could imagine and put in something that was to be created. However, when using PowerPoint, the storyboarding process is a pre-design process. They could visually arrange the screen, for example, they could put the exact object (buttons, cliparts, or pictures) on the right position. This made the implementation process much easier and they could sense visually. The author of this paper ever conducted a study (Liu, 1999), using a visual tool—*Inspiration*—to structure multimedia application that enabled students to create flowchart that visually showed the structure of the courseware. That study found out it was more effective using *Inspiration* than using paper flowchart in designing the interactions cross several layers of the structure.

The findings from the two studies alerted the idea that technology can be used as a tool not only for improving our daily work but also for developing other technology applications. More and more new technologies are available now. We would not only think about how to use them to solve old problems, but also think how to use them to create new applications.

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LEARNING THROUGH DIGNITY: PARTICIPATORY COMMUNICATION THEORY

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Abstract: This paper describes an alternative approach to traditional instructional design models by suggesting that participatory communication theory (PCT) creates a process which values the learner's voice. As a student develops a critical awareness of his/her environment, participatory media becomes a catalyst for cognition. Learners use media tools to influence their own lives. PCT suggests that learning is political as well as psychological and that dignity is a fundamental component of learning.

Introduction

Education and dignity should not be mutually exclusive phenomena. Dignity involves taking control over one's own life. As an educational process, participatory communication theory (PCT) holds as its cornerstone everyone's fundamental right to self-volition. PCT values the learner's knowledge and perspective. PCT allows the leaner to fully participate in educational decisions. PCT offers a rich educational framework within which instructional design issues can be addressed with and through dignity.

This paper will first define participatory communication and its theoretical constructs. Second, an explanation of how it works will be given. Third, several examples of participatory communication projects will be presented. Fourth, a rationale for employing PCT will be suggested, a rationale anchored in self-efficacy research as well as socio-constructivist approaches to learning theory. Finally, this paper will explore the uses and ramifications of participatory communication theory in an instructional design model. Education should be about liberation and humanness and dignity. Our teaching and instructional design processes should support such an approach.

What is Meant by Participatory Communication?

Participatory Communication is a field of communications theory that focuses on the political aspect of the communication process (Servaes, 1996) by combining critical analysis with an understanding of the structure of media. Much of the theory is involved with communities who struggle to become democratic entities; however, many attributes of participatory communications provide guidelines for all communities including established first world nations such as the United States.

Two working philosophies helped create and shape participatory communications: emancipatory pedagogy and communication structure. Paulo Freire's work in emancipatory pedagogy (Freire, 1978, 1995) provides a rich philosophical approach as to how education should be imagined. Education is not, as he calls it, based on the banking principle with a teacher depositing knowledge into a student account. Rather, education is the right of all people to have a voice, a voice not filtered through another. To a certain degree, equating voice with education establishes the precious link between communication and learning that is both different from and akin to many of the socio-constructivist theories of learning. Development of voice with respect for the voice of others is one of the key components within Freire's emancipatory pedagogy.

Another theoretical construct of participatory communication is the concept of dual communication channels within a society. On one hand there are official communication channels. These generally support the power structure and quite often are controlled by them (UNESCO, 1980). "Uniform, high-cost, highly professionalized, state-controlled media" (Servaes, 1996 p. 34) are found in most societies. A second channel is generally local, multi-viewpointed and lower cost, and blurs the actor/audience roles. Both communication channels are responsible for the dissemination, development and sustenance of cultural, social and political goals. But is has been suggested that the highly centralized communication channels dominate all communication (Cherryholmes, 1988).

Much of pedagogical critique has revolved around the conflict between these two communication channels, the hegemony of the dominant channel and the dependency of alternative viewpoints. Domination of the center by economic, cultural, and political elements results in control over minority ideas on the outskirts. Minority viewpoints become marginalized. The critical theorists of the 1950s (Marcuse, et al) decried the role of mass culture and its ability to drown out the voices of dissent. Mass culture was ubiquitous and omniscient. Mass culture was the tool of the ruling elite to legitimize its position; mass culture was the tool of the ruling elite to sustain and increase its power. However, during the 1980s critical studies began to look at popular culture (the name change establishes the paradigm shift) as a liberating communication channel because of its ironic elements (Giroux & McLaren, 1986). As a new medium replaces an older one, the content of the old medium becomes the new (McLuhan, 1964). Popular culture may still have been ubiquitous but through self-reference and irony, the difference between *what is* and *what is said* becomes the medium through which minority voices can be heard again.

Participatory Communications recognizes the power of the official communication channels to co-opt all viewpoints; but unlike critical theory and critical pedagogy which primarily contribute to a critique of society and culture, it provides a positive, action-oriented method in which minority viewpoints have a place in discourse and it recognizes minority modes of communication, minority media, as alternative yet valued voices. Minority viewpoints become both a frame of reference for official viewpoints and provide "texts" for discussion, discussions which have the potential to seed change.

How Does it Work?

Fundamental to the understanding of Participatory Communications is its deep, underlying belief in the fundamental dignity of men and women. Freire (1970, 1995) suggests that in order to be participatory all communication must follow a dialogic model. Individuals must seriously consider the perspectives and viewpoints of others (similar to Habermas' ideal speech situation). Freire also puts forth his concept of conscientizaçao and problem posing, whereby people learn "to perceive social, political, and economic contradictions, and to take action" (Freire, 1970, p. 19). Finally, Freire's idea of praxis combines theory building and theory testing, action and reflection as a key component in the understanding and reading of the world (Wink, 1997).

Participatory communication creates a process which:

a) promotes community identification of needs and problems,
b) develops cogniscence of the skills and talents within the community allowing self-direction in acting in its best interests,
c) develops decision-making skills,
d) creates a climate in which a community can make decisions,
e) values and strengthens local knowledge systems,
f) develops group process skills which bring consensus through negotiation and conflict resolution,
g) creates a direct channel of communication between the community citizens and the decision-makers, and
h) molds a vision of the future through commitment and ownership by the community (Rajasunderam, 1998).

It is with the blend of emancipatory pedagogy and the study and employment of media that PCT finds its voice.

Examples of Participatory Communication

In Bangladesh grassroots women's organizations such as Banchte Shirkha and Proshika have used video projects to combat exploitation (Stuart and Bery, 1995). Interviewing politicians as they made promises and documenting their statements through video recordings provided the pressure needed to have leaders fulfill the promises heretofore broken. Video projects also raised awareness of women's rights issues and spousal abuse.

Popular theatre in India by such groups as the Association for the Rural Poor (ARP) used popular theatre as a single component of larger scale development (Thomas, 1995). In dealing with a fishing crisis between large mechanized trawling operations and smaller fishermen, ARP used local fisher folk as actors in their play. The play was stopped several times during its staging as the audience clarified the social reality as portrayed. The play became the catalyst for the people's political action against the mechanized trawling forces.

Folk songs, skits, and tape recorders, citizen-band radio, public-access television and copiers compete with state controlled large media for the hearts and minds of each country's citizens. A recent Boston Globe article (October 30, 1999) describes the use of electronic communication via e-mail and the Internet as a tool by the Falun Gong movement in the People's Republic of China. Small, participatory media struggles but is not subsumed by the larger, state-owned mass media.

Why Does it Work?.

The link between political empowerment and learning is the basis of participatory communications. Situated cognition and self-efficacy are not mere psychological buzzwords but become the mechanisms by which participatory communications theory functions.

A student's belief about his/her own abilities, or self-efficacy (Bandura 1997), influences students' motivation and goals for academic work. Freire has shown that an approach to learning that stimulates awareness of a student's social conscience and that promotes an awareness of possibilities for social transformation through action improves learning (Freire and Faundez, 1989).

Duguid and Brown (1992) suggest that learning takes place at the intersection of task and cognition. Realizing that teaching and learning are not one and the same thing (they quote Rabindrath Tagore about stealing knowledge from his teacher--after not being taught anything by his teacher), they provide a new context within which to think about how students learn. First and foremost, a student must be engaged within an authentic situation in order to learn. Problem posing and problem solving focus on what the situation is really like. It's as authentic as one can conceive.

Vygotsky suggests that students first learn through their relationship with others and only later internalize knowledge. In participatory communication research the rich relationship between participants and researcher becomes part of the research process (White, 1995). Jointly, researcher and participant, define the nature of their shared reality. Jointly, their knowledge base converges.

Implications for Instructional Design

In traditional ISD approaches three phases define curriculum development: 1) A front-end analysis defines the learner, the context, and the task. The task is then operationalized through a performance objective. 2) Material is developed to support the performance objective(s). 3) Assessment provides the feedback with which the materials are reevaluated and/or the front-end analysis is redefined.

To a certain extent the concept of an instructional systems design (ISD) model, any ISD model, might seem outside the frame of reference of participatory communication theory. Indeed, the very idea of knowledge transmission, objective (versus subjective) analysis, and a structural (context-free) design system is antithetical to the

participatory model. But PCT can offer a framework wherein education can be developed albeit with the twin caveats of *no dogma, no system* (Sullivan and Harper, 1996). It begins with Friere's *problem posing.*

A problem posing design model begins by asking the learner to define a) the problem, b) the context, and c) the learner and his/her strengths and potentials. A major difference between the traditional and the PCT model is that within the PCT model the learner identifies the problem. What is to be learned, the skills, the media used, and the curriculum are all products of the problem posing process which is defined by the participants, not by an external instructor. The role of the instructor is that of consultant providing only those resources that are requested. The instructor is a co-learner yet he/she must avoid at all times the inclination to dominate the learning process. And during the course of the process the instructor's role is reduced until he/she is no longer needed.

Historically, both in communication theory and in ISD models, the role of the expert overseer cultivated and inevitably developed the model of what was to be leaned. The teacher's perspective defined the process. The teacher knew best. The learner was marginalized, becoming the object of the process rather than the subject. Participatory Communications, however, values the learner's knowledge.

Tilakaratna (1991) provides a two-step process that moves between reflection and action and back again. Beginning with critical awareness of societal forces, a problem is defined. The group determines a strategy that will solve the problem. Self-assessment and action plans move the group towards the solution. Freire (1995) was adamant that a reflection on the action must take place that asked how the action addressed, solved, or changed the problem. This reflection on the action is important to renew the group's efforts, to revitalize the approach and to avoid the creation of a single viewpoint, the creation of a structure that co-opts the problem posing/problem solving process.

The instructor or ISD designer may better be thought of as an animator (Tilakaratna, 1989). The teacher's first role is to enable the students to become aware of the problem (animator). Secondly, the teacher is vital to group formation (facilitator). His/her responsibilities include group identification of the strengths and weaknesses of its members as well as the mobilization of resources within the confines of the problem. Finally, the teacher must leave the students to carry out their own learning. Tilakaratna calls this the *progressively redundant phase*, insuring that the students can continue to learn, to assess, define, and develop their skills.

Participatory Communications Theory also focuses on the media of communication, using the interplay between mass media and small media in both the problem posing and problem solving aspects of the learning model. Mass Media perpetuates and/or develops values and social structures of the power elite. Small Media develops new social structures and new values. The interaction of the media becomes the text to be read.

It is important that the Mass Media not be painted as being diabolical nor to either deify or belittle Small Media. Each is a cultural phenomenon. Mass Media is not omnipotent. While Small Media is not a substitute for Mass Media, it can fill information gaps that Mass Media cannot. And above all Small Media and Mass Media provide the questions, the problems, and the tools to read the world.

Conclusion

I have been concerned that educational intervention, teaching or curriculum development, has focused on the teacher rather than the learner. I have also been concerned with an almost patronizing attitude that comes with such a focus. Dignity involves taking control over one's own life. Ahmed Kathrada (1999) wrote that a life "without dignity is not worth living." By valuing the learner's knowledge and perspective, by allowing him or her to fully participate in educational decisions, and to employ minority media as both a text and a tool, participatory communication theory provides an educational framework for liberation, humanness and dignity.

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Teachers Under Construction—Incorporating Principles of Engaged and Brain Based Learning into a Constructivist "Technology in Education" Program

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Abstract: This paper is a report on the findings of an action research project conducted during an undergraduate "Technology in Education" class for preservice teachers. The course was structured using a Constructivist approach and designed to incorporate principles of brain based and engaged learning. Technology competencies of students participating in the course were accessed using quantitative and qualitative analysis techniques. Findings indicate that students in the Constructivist course acquired proficiency in the use of technology and developed knowledge structures essential to the successful integration of technology into classroom practice.

Rationale and Problem Statement

Trends in pedagogy and technology are converging to significantly alter the learning environment of the coming millennium. Shifts in theory brought about by findings of cognitive psychology and brain based learning research challenge the traditional lecture-exam model of learning and indicate that learning is best facilitated by activities that actively engage learners in the creation of knowledge. The emerging paradigm supports the theory that learning is best achieved by interaction between learners and teachers and between learners and their peers.

Traditionally, educators have attempted to employ technologies to teach students directly. In the lecture/direct instruction model so common in higher education, technologies may be used to deliver and communicate messages to students who, it is assumed, will comprehend these messages and learn from them. The underlying assumption of this old paradigm is that students learn from technology in much the same way they learn from teachers: through the transmission of information. Thus, for many years, technology savvy educators have sought to embed information in technology-based lessons to be transmitted to the learner who becomes little more than a passive recipient of that information. In this fashion, students learn from technology what the technology "knows" just as they learn from the teacher what the teacher knows.

Constructivists, on the other hand, argue that students cannot directly learn from either teachers or technologies. Rather, they maintain, students learn from

thinking, and thinking, not teachers or technologies, mediates learning. To the Constructivist, thinking can be engaged only through activity. Teachers and technologies can present and support thinking activities, but they cannot directly cause thinking, just as they cannot directly cause learning. Since students learn from thinking about what they are doing, both teachers and technologies can support learning only if they are used as intellectual partners and tools that help learners to think (Jonassen, 1997).

A Constructivist approach to teacher education is essential if the next generation of teachers are to encourage students in their classrooms to apply, analyze, synthesize evaluate and construct knowledge from the massive flow of information available in today's society. White (1996) and other teacher educators have long recognized the importance of engaging preservice teachers in these processes throughout the teacher education program. But in spite of a growing body of research supporting the benefits of Constructivist pedagogy, most technology in education courses continue to follow the transmission model of instruction.

The "Technology in Education" course required of preservice teachers at many institutions typically follows a direct instruction model which emphasizes rote learning of computing skills rather than the integration of those skills in meaningful instructional contexts. Consequently, students often emerge from traditional programs knowing how to perform basic tasks such as using the Internet or constructing a database but lacking the conceptual understanding necessary to know how, when and where to integrate these technologies into their own professional practice. The dilemma facing educators charged with providing technology education to future teachers is how to restructure traditional skills-based courses so that students not only acquire the requisite skills but also construct the knowledge base necessary to apply those skills to support engaged learning in their own classrooms with their own students.

Program Description

In response to this dilemma, Montgomery and Whiting, both professors of teacher education at Southern Utah University, have attempted to develop a technology in education program informed by Constructivist principles and grounded in brain based and engaged learning theory. In developing a pilot program for undergraduate and graduate students, the researchers adopted a framework suggested by Brooks and Brooks (1993) which incorporates a set of twelve Constructivist teaching behaviors. This set of descriptors outlined below presents teachers as mediators of students and environments rather than as providers of information and managers of behavior.

1. Constructivist teachers encourage and accept student autonomy and initiative.

2. Constructivist teachers use raw data and primary sources, along with manipulative, interactive and physical materials.

3. When framing tasks, Constructivist teachers use cognitive terminology such as "classify," "analyze," "predict," and "create."

4. Constructivist teachers allow student responses to drive lessons, shift instructional strategies, and alter content.

5. Constructivist teachers inquire about students' understanding of concepts before sharing their own understandings of those concepts.

6. Constructivist teachers encourage students to engage in dialogue, both with the teacher and with one another.

7. Constructivist teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other.

8. Constructivist teachers seek elaboration of students' initial responses.

9. Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.

10. Constructivist teachers allow wait time after posing questions.

11. Constructivist teachers provide time for students to construct relationships and create metaphors.

12. Constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model.

Atkin and Karplus (1962) described the process of curriculum development and instruction as a three step cycle. First, the instructor provides an open-ended opportunity for students to interact with purposefully selected materials. The primary goal of this initial "discovery" lesson is for students to generate questions and hypotheses from working with the materials. Next, the teacher provides the "concept introduction" lesson aimed at focusing the students' questions, providing related new vocabulary, framing with students their proposed laboratory experiences, and so forth. The third step, "concept application," completes the cycle. During this phase, students work on new problems with the potential for evoking a fresh look at the concepts previously studied.

The learning cycle represents a significant departure from the ways in which most teachers are taught to teach. In the traditional model, emphasized in traditional approaches to curriculum and instruction, concept introduction comes first, followed by concept application activities. Discovery, if addressed at all, usually occurs after introduction and application activities , and includes only the more capable students who finish their application tasks before the rest of the class.

To facilitate a learning environment consistent with the principles outlined above, Montgomery and Whiting developed a series of experiences which emphasize collaborative and project based learning. To provide an authentic context for learning, students work collaboratively in small groups to develop a detailed plan for a technology rich charter school. Students employ a variety of "mind tools" (Jonassen, 1996) including modeling and interactive multimedia software to develop plans which emphasize engaged learning and the appropriate integration of instructional technologies. In the course of completing the project, learners utilize the Internet and other resources to explore the literature of educational reform and the effectiveness of instructional technologies and to expand their knowledge of curriculum and instruction. The groups use spreadsheets and databases to analyze information and produce model curriculum materials using multimedia and desktop publishing tools. During the last two weeks of class, each group presents its plan using appropriate technologies and participates in a self and peer assessment process. Conclusions and reflections on experiences are published on a student produced web site.

Because knowledge construction is facilitated by collaboration, the formation of collaborative "pods" or groups was an important dimension of the restructured program. To create a learning environment which emphasizes multiple perspectives, peer support and cognitive apprenticeship, the researchers adapted a model of collaborative learning suggested by Kagan (1990). A five step sequence of activities was employed to facilitate the successful operation of the collaborative pods.

1. **Formation of the groups.** Students were asked to group themselves into pods of three to five on the basis of a shared vision for the proposed charter school. Since the school was to represent an integrated approach to curriculum the composition of each group was interdisciplinary. In addition to developing a charter school proposal, student subject area specialists were given the task of working together to plan cross-discipline instructional units which would facilitate engaged learning through the appropriate use of various instructional technologies.

2. **Clarification of the group goal.** The common thread of the content to be explored was the creation of a hypothetical charter school based on the principles of Constructivism, and consistent with the latest research findings on brain based and engaged learning. Each pod was given the task of utilizing various mind tools to create a portfolio representing their school and its curriculum. An integral part of the portfolio was a Unit of Practice and a model lesson based on Constructivist principles. Each group was also assigned the responsibility of conducting a whole group learning experience near the end of the course designed to bring closure to the research process and to share constructed knowledge.

3. Negotiation of tasks and sub tasks to be completed. Students were asked to break down the required tasks and to delegate them to various pod members. An important dimension of this process was the determination by the group of which tasks should be delegated to individuals and which should be accomplished in group brainstorming and problem-solving settings. In addition, each group member was asked to master one of the "mind tools" (Inspiration, Avid Cinema, ClarisWorks, Claris Home page, Powerpoint and Hyperstudio) and assume responsibility for teaching others in the pod to use it.

4. Monitoring of individual and group performance. Individual and group progress was monitored using process rubrics and periodic reports. Each pod was asked to share research findings and works in progress on a weekly basis with members of other groups and with the instructor. Pod members were also asked to complete weekly self-assessments designed to track mastery of technology competencies related to the use of the various mind tools. These assessments were compared to benchmarks established in individual skills development plans completed by each pod member at the beginning of the course.

5. Reconciliation of differences in approaches to the goal. Disagreements in approaches to and interpretations of group tasks and goals sometimes arose, giving pod members opportunities to articulate their unique perspectives and to negotiate differences in understanding. Interpersonal communication skills including providing and receiving feedback, paraphrasing without evaluating, negotiating meaning, and accepting the needs of others were introduced by the instructors and presented as an integral part of the cooperative process.

Findings and Conclusions

Qualitative and quantitative data were gathered during and at the conclusion of the course. These measures included concept maps of content knowledge, self-assessment forms related to skills acquisition, group process forms and self and peer ratings of final presentations. In addition, a course evaluation was completed by all students participating in the program.

Analysis of the various measures yielded a number of positive results. All students participating in the course demonstrated mastery of the various "mind tools" and responded positively to the processes of collaborative, project-based learning. A significant number of students indicated that participation in the course helped them to develop problem solving and critical thinking skills. In addition, they reported gains in understanding of the collaborative research process and in their perceived ability to facilitate and teach in a constructivist environment.

On the basis of these results, the researchers conclude that students in constructivist environments can effectively learn the same technical skills emphasized in transmissive approaches to technology education. Further, the introduction of collaborative learning and an inquiry driven curriculum can greatly enhance and

accelerate the acquisition of these technical skills while increasing student interest and motivation.

The new paradigm brings with it an innovative model of teaching and learning that emphasizes the construction rather than the transmission of knowledge.The use of technology and collaboration needs to be encouraged more than ever in higher education in order to prepare teachers for the paradigm shift they will experience as more and more schools embrace the principles of brain based and engaged learning. Consequently, educators at the college and university level must model new approaches which emphasize the role of teacher as facilitator of learning rather than dispenser of information. Only through this approach will prospective teachers acquire the competencies which will be the mainstay of the educator in the new millennium.

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PCA - A Digitally Manipulative Software Development Environment for Physically Challenged Participatory Design

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Abstract: This research involves creating a context for design and a support environment to create applications for the physically challenged (PC). This research explores direct manipulative user interfaces that are specially enhanced for the PC. PCA (The Physically Challenged Assistant) focuses on the modeling of computer processes and the facilitating support environment that will allow the physically challenged individual to engage in time-dependent activities which need coordination with other tasks, other computers, other individuals, and even other physically challenged individuals. PC and non-PC persons working in coordination with each other do the applications produced from PCA.

The Americans with Disabilities Act of 1990

The Americans with Disabilities Act (ADA) of 1990 stipulates that employers must make reasonable accommodations for those with disabilities(ADA 1990)[1]. Reasonable accommodation is any modification or adjustment to a job or work environment that will enable a qualified applicant or employee with a disability to participate in the application process or to perform essential job functions. Examples of reasonable accommodation include making existing facilities used by employees readily accessible to and usable by an individual with a disability; restructuring a job; modifying work schedules; acquiring or modifying equipment; providing qualified readers or interpreters; or appropriately modifying examinations, training, or other programs.

It is not easy to determine just how a physically challenged person will interact with an environment, and hence employers have focused their attention to jobs that require only one person to accomplish, and usually ones that are not time critical. It is the purpose of PCA to expand the capability of the employer to cover situations that are time-dependent, and ones that include user interaction and task coordination. The PCA context allows employers to more readily conform to the ADA, and to mainstream valuable assets.

Challenges for the PC

The computer is now, and will continue to be an essential part of the toolkit for the physically challenged. It offers New Hope of extended independence to those who previously had little hope. These rapid technological advances translate to increases in system complexity. The ability to study and to manipulate complex computing environments is critical to the creation of working and meaningful environments for the physically challenged. An important part of the cooperative environment is the communication devices for the PC individual. Using these devices as a means to a solution creates a distributed application because these interface devices are in themselves powerful and complex computers with very sophisticated application software, some of these already operate as distributed systems. Following are some of the devices that make PCA a reality.

The Liberator

The Liberator is a specially modified computer adapted to the needs of the PC. The extended demands for multi-user coordination in PCA make it necessary to encapsulate the functionality of the Liberator into a larger distributed computational model. Liberator's capabilities can be extended to contain powerful programming tools to augment the communication capability of the PC.

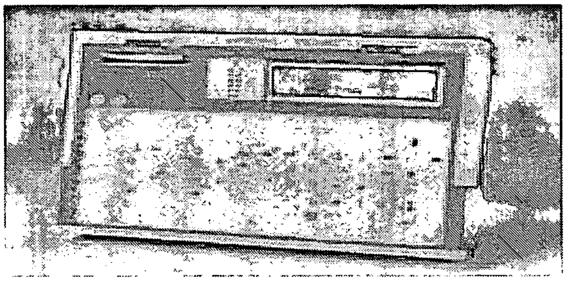


Figure 1 - The Liberator

Liberator's clock and calendar serve as organizers that are particularly useful in the software development process and in research associated with the development process. In this study we used this device as one of the interfaces to the software test environment. But of greater significance a slight modification provides a non-intrusive monitoring and data acquisition mechanism to help determine just exactly what the PC person was doing. In the initial findings time was a factor that impacted the overall software development, and hinders the PC participant from being an immediate asset to the development team.

Though it is possible to derive some of the cognitive task data from the Liberator interface, we found it limited when trying to track exactly what the participant was doing at a fine-grained micro level. For instance we could tell that the person was working on debugging a segment of code, but it was difficult to determine just what cognitive activity was activated. Coordination of chronological elements with other parts of the environment produced task sequences at a coarse grain level. Often a shift of attention to an associated document, diagram, or piece of test equipment alluded the Liberator. The Liberator allows for other assisting devices to be added to enhance and monitor the software development interface.

The Eye Tracker

The ION™ Eye Controlled Cursor Control System is an access device that operates completely through head and eye motion giving the PC person total access to the computing environment.

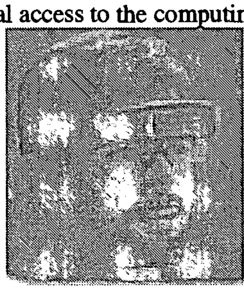


Figure 5 - The ION™ Eye Tracking Mechanism

Software adds eye control to basic software for head control, and allows full control of a computer with only the eyes. Two tiny cameras in the headset observe both the user's eye and the beacon on your monitor, allowing the computer and the ION™ Eye Control Software to determine where the PC Person is looking on or off the screen. The ION™ can also sense intentional blinking, and uses that for clicking and dragging. Eye tracking mechanisms give us insight into the cognitive tasks for PCA. This will provide a focal point for future studies into the cognitive aspects of the software testing process.

Computational Construction Kits

The MIT Media Lab developed a new generation of "computational construction kits" to enable people to express themselves in ever-more complex ways, deepening their relationships with new domains of knowledge. To guide the development of these computational construction kits, a theory of constructional design evolved. Whereas the traditional field of instructional design focuses on strategies and materials to help teachers instruct, constructional design theory focuses on strategies and materials to help students construct and learn.

Essentially there has been much of a parallel effort in the area of the construction efforts for distributed object systems. The architectural foundation provided by the OMG in the CORBA 2.0 specification and the toolkits such as ORBIX, Visibroker, etc. have given rise to a constructional approach to designing complex distributed object systems.

Software architecture serves as a framework for understanding system components and their interrelationships, especially those attributes that are consistent across time and implementations. This understanding is necessary for the analysis of existing systems and the synthesis of future systems. In support of

analysis, architectures capture domain knowledge and community consensus, facilitate evaluation of design and implementation of components, and ease simulation and prototyping. In support of synthesis, architectures provide a basis for establishing product lines and using domain knowledge to construct and maintain modules, subsystems, and systems in a predictable manner. As systems grow in complexity reuse becomes more critical.

Constructional design is a type of meta-design much like the concepts found in building today's software frameworks such as SEMATECH Computer Integrated Manufacturing (CIM) Framework Architecture(Sematech Report 1995)[2] built at SEMATECH in Austin, Texas. Constructional design involves the design of new tools and activities to support students in their own design activities. In short, constructional design involves designing for designers.(Resnick 1996)[3] This is the cognitive foundation for the construction of PCA.

Digital Manipulatives for the PC Person

In many educational settings, manipulative materials (such as Cuisenaire Rods and Pattern Blocks) play an important role in learning and enabling the exploration of mathematical and scientific concepts through direct manipulation of physical objects. A new generation of "digital manipulatives" -- computationally enhanced versions of traditional children's toys have been developed by the Media Lab at MIT. These new manipulatives enable exploration of design concepts. PCA uses digital manipulatives such as computationally augmented versions of blocks and a tube to help create a construction environment that is mentally challenging and physically useful to those who are physically challenged.

Resnick(Resnick 1996)[4] sees the use of digital manipulatives as part of a broader trend within the computer interface research community. Objects to manipulate have traditionally been virtual objects. An example would be object-oriented languages and direct-manipulation graphical interfaces. PCA builds on these virtual objects with the introduction of physical objects. In research efforts variously described as "ubiquitous computing," "computer-augmented environments," and "things that think," (Resnick 1996) [5] researchers are now exploring ways of adding computational capabilities to everyday objects ranging from notepads, desktops, and eyeglasses, to a new version of an ION™ Eye Controlled Cursor Control System 2000.

Resnick and the MIT Media Lab researcher have by choice focused attention to direct manipulative learning aspects, and in particular the use of the physical devices as a part of the learning environment for young children. PCA switches the focus of their attention to the use of directive manipulatives as a means of adding functionality to the participatory software development environment.

Programmable LEGO© Bricks

The MIT Programmable Brick is a tiny, portable computer embedded inside a LEGO© brick, capable of Interacting with the physical world through sensors and motors. The Programmable Brick extends the child's construction kit, enabling students to build not only structures and mechanisms, but also to add behaviors to these structures. With Programmable Bricks, students can spread computation throughout their worlds. They can build distributed systems, and even autonomous distributed systems (real-time embedded systems). They can use Programmable Bricks to build autonomous robots and "creatures"; to create "active rooms" (for example, making the lights turn on whenever anyone enters the room); and to organize "personal science experiments" (for example, counting the number of steps they take in a day).

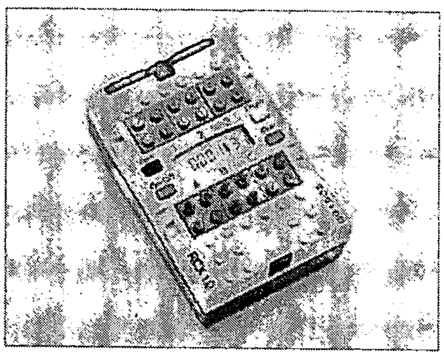
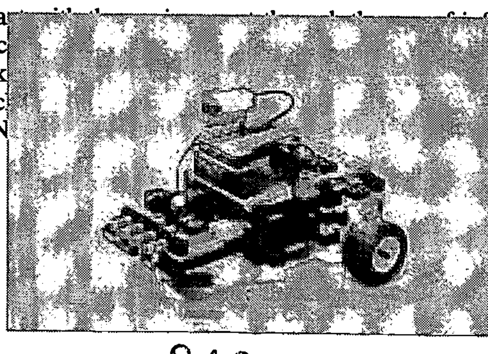


Figure 5 the LEGO© RCX Brick from PCA

The physically challenged intera ... rared sensors that are attached to a special computer interface whic ... en. By manipulating the analog through the use of the eye-track ... ie environment without use of any psychomotor skills from the nec ... e Programmable Bricks respond to commands directly from the ION ... re were usually several RCX bricks



and other interface apparatus that allowed computer controlled operation. The project we chose to test PCA was a light sensing robot built with the Mindstorms Robotic Invention Kit.

Figure 6 - Light seeking Robot with attached RCX Lego™ Bricks

We attached the infrared sensors and transmitters to designated portions of the light seeking robot and likewise modified the user interface devices to use the infrared sensors and transmitters of the LEGO™ Brick. In addition we modified the user interface to the computer to be operated by screen representation of the physical devices from computer interface, but also from embedded processors in devices such the ION™.

The Software Development Processes

A quality product depends on a quality process (Humphrey 1989)[6]. This is a tried and tested premise of mature manufacturing and engineering quality circles for years However it is just beginning to become a trait of a mature software development process. A software process can best be defined as a set of activities, methods, practices, and transformations that people use to develop and maintain software and the associated artifacts (i.e. project plans, design documents, code, test cases, and user manuals). As an organization matures, the software process becomes better defined and more consistently implemented throughout the organization. As the process matures, it will be passed between projects, project personnel, and project managers. It is important to consider the impact to the software development process that comes from having a PC participant. It should in no way alter the defined process, but can easily impact the process enactment when going from one person to another.

There is the need to represent as a first class object. The object coordination is first class object. These objects can be fragments of a software product under development or a fragment of the development process to generate that software product. Jacobsen[7] introduced the concept of Object Interaction Diagrams (OID). The problem with Object Interaction Diagrams is the lack of a formal representation, and in the PCA instance the lack of a formal representation for the coordination of process, whether product processes, or development processes.

Figure 6 represents a simple message trace diagram of messages between objects in an object application represented as an Object Interaction Diagram. This could represent steps in a development process, or a sequence of steps in a manufacturing process, or a sequence of tasks in a message-passing program. Message diagrams revolve around the main threads of execution and there is a lack of any synchronization mechanism that enables coordination of concurrent execution interactions. To adequately include the PC into the software development process, the process must be able to represent multi-user, multi-process coordinated interactions.

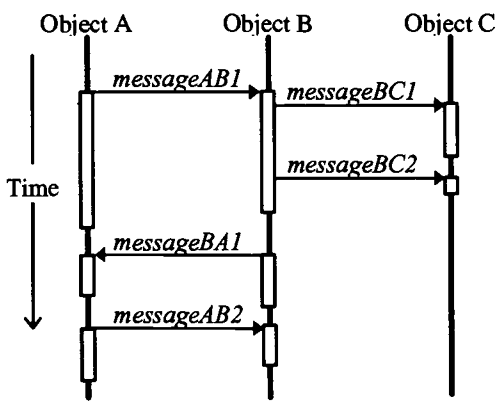


Figure 6: Message Trace Diagram

Vondrak introduced Interaction Coordination Nets[8](Vondrak 1995) (IC-Nets) to represent a tool that provides for concurrent threads for coordinated process management and control. He originally used these to represent steps in the development process, but has since extended these to include process interactions and coordination in actual programs. IC-Nets are an extended form of Petri Net. The processes modeled using IC Nets are inherently concurrent and often distributed. Synchronization of object interactions is simplified by the visual nature of IC-Nets.

[9]Summary

In addition to the exploration of digital manipulatives, PCA provides a solid theoretical foundation for the construction of software products and software processes. Not only did PCA provide a means for the PC person to participate in the design of distributed object systems; it also provided a new way of thinking about distributed problem spaces. In retrospect it was also a lot of fun. Playing with LEGO© Blocks is a lot more fun than programming a distributed test environment.

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[1] http://www.usdoj.gov/crt/ada/adahom1.htm
[2] http://www.sematech.org/public/docubase/abstract/3214aeng.htm
[3] http://el.www.media.mit.edu/groups/el/papers/mres/black-box/proposal.html
[4] http://el.www.media.mit.edu/groups/el/papers/mres/black-box/proposal.html
[5] http://el.www.media.mit.edu/groups/el/papers/mres/black-box/proposal.html
[6] Humphrey, Watts, Managing the Software Process, Addison Wesley, New York 1989.
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Graphic Design Software and Creativity Development

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AbstractThis paper explores the possibilities to develop the creativity skills originality, flexibility and elaboration of graphic ideas through the use of a locally developd software applied in a sample of 112 Mexican high school male students. The software consists of three main parts theoretical information on graphic design techniques, links to different web sites related with graphic design and a locally developd software for drawing and graphic desing and its tutorial. The results were obtained comparing the works in two control and experimental groups. A group of experts evaluated the works by their originality, flexibility and elaboration of ideas, and the experimental groups works were more creative than the control groups.

Creativity in the Design

Creativity is the ability to produce work that is both novel and appropriate (Lubart, 1994; Ochsae, 1990; Sternberg, 1988; Sternberg & Lubart,1991,1995) Creativity in design can be developed using specific software. The present paper explores creativity development in graphic design in Mexican high school students who had no previous experience in drawing and graphic design. The creative criteria evaluated in the works of the students were elaboration, flexibility, color composition and generation of multiple ideas. The subjects were assigned to control or experimental groups randomly. The works from each student were evaluated for a group of design experts by the creative criteria established. The main purpose of this paper is to show that the creative potential in graphic design can be developed by using appropiate objectives, tools and evaluation criteria.

The possibilities of using software for different human activities have been not completely explored. The computer and the software for graphic design can demonstrate their usefulness in the development of creative works in graphic design.

Method

Subjects

Mexican males from the first year high school at La Salle University, Mexico City Campus. (N=112) from 14-15 years old, without previous knowledge in design.

Experimental Design

The students belonged to four different groups, assigned randomly in two control and two experimental groups. In the experimental groups the software was applied.

In the design course II, with 72 sessions,in the experimental groups was used a locally developed design software. Students were asked to develop special design works in both groups. The only difference was that the students in the control groups did not use the software, and the experimental groups did use it. The works were evaluated by design experts, after a special selection of the more creative works. The experts agreed on the criteria to evaluate the works elaboration, color and creative design.

The works developed in the experimental groups were more creative than the works developed in the control groups. This was explained by the following reasons

Students in the control groups only worked with the traditional possibilities in design (limited colors, limited tools, limited skills), usually in two hours session they can work one or two design simple concepts and ideas.

In the experimental groups, the time was completely dedicated to practice with the software two hours in each session. Students in the experimental group could work two or three ideas at the same time.

Results

From the first sessions the quality of the works was better in the experimental groups. Specially by elaboration, originality and creative design.

The final designs in the control group were better in the quality of the techniques. It was explained by the possiblitiy these students had to use each session to practice different techniques. Experts evaluated by elaboration,more works from the control group than from the experimental groups. In the experimental groups, students were focused on developing ideas in the software, than developing their own designs by hand.

Implications of the results

The desing software demonstrated to be a useful tool in accelerating the creative process in the conceptualization of desing ideas.

The software improved the edition and the final design. At the same time improved the creative skills in the students in the experimental group.

According with the results, the creative students in the xperimental groups performed increassingly better in each session. At the end of the course, they showed an excellent performance by the creative criteria.

The potential showed by the students was more evident in the experimental groups. The software helped them to demonstrate and arrived to more creative ideas, and at the same time they improved the process of conceptualization of creative design ideas .

Creative students developed more creative ideas in less time than the students in the control groups. The experimental students used more resources to developed more elaborated, original and complex design ideas.

Cognitive processes involved in Creative Design

The use of the softwar let the students to design with more freedom their own ideas, which at the end of the process were more creative, according with the opinion of the experts in design.

Concentration of the attention process

The students in the control groups, gave less time to the development of their design ideas. In the experimental groups, the students were completely focused, some times for almost two hours, each session , working and reworking new designs.

Elaboration of ideas

Students in the experimental group dedicated more time and effort to edit different alternatives in their designs. The software was very useful to elaborate more ideas, and more complex designs than in the control groups works.

Part-Whole interaction

In the works, the relation and interaction between the part- and the whole was an importan element to consider the originality in the designs. The students in the control groups showed limited possibilities in the originality of their designs compared with the results obtained in the experimental groups. The most creative compositions were found in the experiemntal groups, where students decided a more original and unexpected creative designs.

Working with simultaneous design concepts

In the experimental groups, the students used the software to generate and explore different concepts, two, three o more design concepts were worked by almost all the students in the experimental groups.The experiemntal grupos worked simoultaneously by hand and with the software. This condition improved the process of generation and elaboration of concept designs.

Work in two environments

Students in the experimental groups worked simoultaneously with the software or without it. At the end of the course, these students demonstrated more creative designs than the control students.

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Approaches for Generating Animations for Lectures

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Abstract: Many software tools try to address the growing interest in supplementing course materials with animations. In this paper, we give a short review of the basic approaches for generating animations. Thus, teachers can determine the way best suited for them and are then better prepared to select a tool addressing their needs. For each basic approach, several example tools are cited. All selected tools are available for free use or download, so that interested teachers can test them.

Introduction

The number of teachers who want to integrate animations into their lectures to illustrate dynamic behavior has grown over the last few years. By now, a large selection of tools for generating or presenting animations are available. However, these tools differ in how animations are generated or edited, the offered animation features, portability and cost factors. Many people interested in using animations may find themselves confused by the profusion of different offers. This situation may lead to deciding on a tool not well suited to the intended animation content, resulting in increased time spent on animation generation and possibly frustration on the teacher's part.

In this paper, we try to help teachers wanting to use animations for supplementing their courses by outlining the general approaches of how animations can be generated. We give some examples of how generation efforts may typically look like, and contrast strengths and weaknesses of the approaches. For each general approach described, we also mention some of the tools supporting this approach.

Our interpretation of the very broad term animation is focused on instructional usage for computer science. Thus, typical animation areas contain the dynamic display of the effect commands or operations have on algorithms or data structures. We are not concerned with animations as seen in movies, like *"Antz"* or *"A Bug's Life"*. However, we include animations taken from other fields, such as physics, mathematics or economics.

The paper is organized as follows. In the next section, we mention some of the basic restrictions placed on animations tools. The following section discusses the presented basic approaches for generating animations and gives short examples for each approach. The last section concludes the paper and outlines areas for future research.

General Considerations and Restrictions

Apart from the generation process itself, some other issues should be taken into account before deciding on a tool. These issues are of a general nature and not directly linked to a given tool or generation approach. However, they can have a large impact on the usability of the tool and the generated animations, and should therefore be considered first.

The foremost issue from our point of view is platform independence. While the majority of students may own a PC and are most likely using Windows 95/98, this may not be the case for a significant portion of potentially interested clients. This is most especially true for universities, where Unix operating systems are very popular, as well as for the increasing number of Linux users. Furthermore, not everybody uses Intel-

compatible hardware – think, for example, of the *iMac* platform. Thus, using a proprietary tool based on Windows 95/98 may limit the number of potential clients for your software. Furthermore, the visibility and accessibility of the animations when propagated over the World-Wide Web may be reduced due to security concerns regarding ActiveX controls and JavaScript.

The same is true for formats that "only" require a plugin for Web browsers. Teachers should be aware that while the plugin download itself is usually free, plugins are not necessarily available for all platforms! Unix-based platforms and Linux are not supported by many tools. For maximum platform independence and the greatest possible audience, the chosen tool should provide a Java applet for displaying generated animations, as most modern Web browsers come with built-in Java support.

Furthermore, several of the commonly used tools are commercial software. Teachers should make sure that a player or viewer component is also included and may be freely passed along, so that students can study the animation at home whenever they want.

Basic Approaches for Animation Generation

The following basic approaches for animation generation are discussed in this paper:

- Using "classical" presentation tools such as PowerPoint®,
- Visual editing using drag and drop or selection of options,
- Direct animation of source code,
- Generating animations by function calls implemented in a function library (API),
- Animations generated by a scripting language or text commands.

Some of the tools available support more than a single way of generating animations, or use a special combination of the basic approaches. In the following, we discuss the individual approaches, mention some of the tools concerned and outline typical strengths and weaknesses.

Using "Classical" Presentation Tools

Some classical presentation tools like PowerPoint have lately been enhanced to support animation effects to a certain extent. Classically, many animation effects are concerned with modifying the appearance of new elements or the repositioning of visible components. The programs are not intended to be used for animating dynamic structures, like sorting algorithms or molecular movements. Thus, presentation tools are well suited for making presentations on slides more lively, but also restrict the teacher's creativity in generating animations.

The strengths of using presentation tools for animations include the comparative ease of using the presentation tools, as they typically offer visual editing and thus directly show the effects of a given action. Furthermore, they allow the integration of animations in lectures without having to switch media or presentation programs, as several courses are already presented in PowerPoint. However, the extent of possible animation effects supported by the tool limits their usage. Before spending a lot of time on trying to generate an animation, it is therefore reasonable to determine whether the effects offered are sufficient for the intended animation. If this is not the case, one can better spend the time otherwise wasted on trying out animation effects by using a tool better suited for the targeted animation.

Visual Editing Using Drag and Drop or Selection of Options

Probably the easiest way to generate animations is visual editing, where the teacher can directly see what the animation looks like at a given point in time. This approach is very similar to the way presentations are

generated in presentation tools such as PowerPoint. However, most animation tools offer special object types for certain contexts, such as arrays or list elements (Rößling & Freisleben 1999).

Object drawing is usually accomplished by one of the following approaches:

- dragging predefined objects on a drawing area, where they can be rotated or scaled,
- or by placement of individual points of a given object by a simple series of clicks.

Tools supporting this approach include *Macromedia Dreamweaver* (Macromedia 1999), *Flash* (Flash 1999) and *Animal* (Rößling & Freisleben 1999). The main advantage of this approach includes the direct visualization of effects already mentioned. Teachers can also learn much about animation generation by experimenting, as this can be accomplished by simply drawing objects to see whether they "fit" into the animation. Finally, only very modest computer experience and no programming experience is required for either animation generation or editing.

The main drawback of the approach is that, due to being forced to do everything manually, animation generation is very time-consuming. This becomes most obvious when more than a single animation for a given topic is wanted. Furthermore, there may be differences in what a given algorithm does and what is shown in the animation, as the animation depends on the author's understanding and interpretation of the algorithm, which may differ from the actual algorithm's behavior.

Direct Animation of Source Code

In some cases, teachers may have source code for the topic to be animated. In this case, an approach that can directly generate an animation from the source code would be highly helpful.

Tools such as *Jeliot* (Haajanen et al. 1999) and *AlgAE* (Zeil 1999) support direct source code animation. With these tools, the teacher is completely freed from having to define animation commands or doing extra work to generate the animation. The animation is also automatically kept consistent with the underlying source code. By being based directly on the source code, new animations can usually be generated by simply exchanging algorithm parameters and restarting the algorithm.

However, there are also some drawbacks. First of all, teachers must have access to source code for their problem in the programming language supported by the animation tool. The tools cited above support Java, while other tools others support Modula-2, Pascal, C or C++ code. If the teachers wish to use a programming language not supported by the chosen tool, the tool becomes unusable. Furthermore, some topics which may profit very much from animation can not easily be specified in source code. This may be due to the long running time of the problem, as for NP hard problems, or the lack of clarity and brevity of the code. In these cases, teachers need a way to directly jump to a given point in the animation, as well as a way to use pseudo code or a textual description replacing the actual source code. However, tools based on source code animation do not provide these features. Obviously, the teacher also needs to be a rather good programmer in the underlying language in order to generate animations. Thus, this approach is limited to rather special circumstances. Finally, the teacher often has no way to determine the way the code is presented, as the animation effects themselves are usually hard-coded into the underlying source code interpreter. Thus, teachers are prevented from choosing a different view of a given topic that they consider more interesting or beneficial.

Using Functions Calls Implemented in a Function Library

In order to alleviate the problems resulting from having a direct match between source code and animation, several tools support the generation of animations by function calls. These tools include *Animal* (Rößling & Freisleben 1999) and *JAL* (Silicon Graphics 1998). In this approach, animations are generated within a collection of functions provided in a function library for a specific output tool. The approaches can be

subdivided in two categories: tools which generate and directly display the animation, and tools that generate and store animation files that may be loaded and run at the teacher's discretion. JAL belongs to the first category, while Animal is part of the second category.

The functions are usually assembled in function libraries commonly called *APIs* (Application Programmers Interfaces). The API is responsible for providing functions that generate animations or animation files used by the underlying animation tool.

The main strength of this approach lies in the ease of generating animations "on the fly": once a given source code has been enriched with the corresponding API calls, it can be used to generate an arbitrary number of animations by simple substitution of the algorithm's parameters. The same is true for generated animations resulting from direct source code animation. However, API calls also allow teachers to define how the animation should look. Thus, the teacher need only decide *once* on a suitable way to present the animation of a given topic, and can then use this approach for generating animations of the topic whenever they are needed. Furthermore, the API calls can also be used for skipping "irrelevant" algorithm parts, allowing the teacher to focus on the main part of the presentation.

The main drawback of this approach lies in the need for teachers to be comfortable with programming. The API calls are usually embedded directly in the source code, or collected in a special animation generation class. This may prevent teachers with little or no programming knowledge in the underlying programming language from using the approach. Furthermore, the approach is only helpful if the teacher uses the same programming language for the course as used by the API, as calling functions in a library written in a different programming language remains difficult. Adapting the animation to other requirements or a slightly different display can become very time-consuming due to having to decide on how to change the API calls.

Animations Generated by a Scripting Language or Text Commands

Animation tools working with scripting languages try to combine the flexibility of API calls with a modest amount of programming knowledge. The scripting language may be a proper but "easy" language, or it may simply be restricted to specific text commands without programming structures such as conditional statements or loops. Tools supporting animation generation by a scripting language or text commands include *JAWAA* (Rodger 1997), *JSamba* (Stasko 1998) and *Animal* (Rößling & Freisleben 1999). Usually, the commands can be generated and edited with any text editor and contain a single command per line. Commands are usually defined in an "intuitive" way, making the animation definition (almost) self-explanatory. Thus, most teachers will find it very easy to read animation files defined by this approach even without having programming knowledge.

The main strength of the approach lies in the fact that the process of generating the animation definition can also be automated. Doing so yields results similar to the effect of using API calls, but without being forced to use a certain programming language. Furthermore, due to the normally good readability of the animation code lines, many teachers may find this approach easier to use than API calls.

However, while each single line of the generated animation may be easily readable, it is often rather difficult to get a feeling for what the animation might look like. While experimenting with the code lines is easy, generalizing the desired effects and putting them into algorithm's source code can be difficult. This is necessary, however, for allowing the generation of animations "on the fly" by adapting algorithm parameters.

Conclusions

In this paper, we have outlined several possible general approaches for generating animations. Apart from the basic considerations such as platform independence and free availability, the approaches mainly differ in three aspects: (I) the way animations are generated, (II) the extent to which the actual display can be

adapted to the teacher's wishes, and (III) how easily multiple animations of the same topic can be generated.

Due to limitations inherent in the target use of *presentation programs*, we can not recommend them for arbitrary animations. *Visual editing* offers a very easy way of generating animations and highly flexible display depending on the underlying tool's abilities, but does not allow for easy adaptation of a given animation to modified input values. *Direct animation of source code* offers the easiest animation generation, as this is done by the animation system. Generating multiple animations of the same topic is also done without effort. However, the teacher is usually not able to adapt the default display to his or her preferences. Furthermore, the programming language to be used for all examples is determined by the animation tool, and "irrelevant" passages of the code cannot easily be skipped. *Function calls* in a special animation generation function library, on the other hand, allow teachers to adapt the display and easily generate multiple animation, but also puts demands on their programming ability as well as the underlying programming language. *Scripting languages or text commands* offer a middle way, combining easy generation and high. However, trying to automate the generation can become difficult, especially for teachers with little programming knowledge.

In general, we want to stress that tailoring the animations to the specific needs is usually a very time-consuming process. Thus, it is of great interest to be able to automate parts of the process, so that the same steps need only be performed once for a given topic, and can then easily be reused with changed parameter values. Most approaches offer some way to automate this process; however, this is not true for the most "intuitive" approaches taken by *presentation tools* and *visual editing*.

In the end, it is up to the teacher to decide which type of tool is best suited for the current task, possibly changing the tool used from one week to the next. All major approaches have their specific strengths and weaknesses, so that teachers should study the effects of the tool's approach before deciding on a given tool. This may well result in the teacher using a different tool each week, though this has severe drawbacks in the form of the preparation time for getting familiar with the tool. Therefore, teachers should select tools supporting more than a single technique of generating or editing animations.

The animation tool *Animal* (Rößling & Freisleben, 1999) developed by us supports animation generation by *visual editing, API calls* and a *scripting language*. It can thus be used by teachers of any background and easily adapted to the current requirements by simply switching the way animations are generated. The basic graphic elements point, polyline, arc, text and list element are supported and can easily be adapted to more specific structures such as circle segments. All objects can be rotated, moved, shown/hidden or change color using a duration and/or offset defined by the teacher. For presentations, snapshots of the current animation state can be generated by the animation player and are stored in a variety of popular graphics formats such as JPEG or PNG. *Animal* is implemented completely in Java and freely available for all platforms supporting Java at the URL http://www.informatik.uni-siegen.de/~inf/Software/Animal.

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Web-Based Curriculum: An Instructionally Sound Solution for Universal Design Issues?

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Abstract: This paper focuses on the challenge for classroom teachers to design instructionally sound curriculum materials for diverse learners that utilizes effective technology. Web-based curriculum that incorporates instructional design principles and universal design principles may be one solution to creating a classroom in which technology can enhance the learning and account for student diversity. In the current educational structure, teachers often adapt materials to meet the needs of the diverse learners by using the principles of universal design. Teachers create materials that can meet the educational needs of diverse learners without noticeably targeting specific students. Since research indicates that while students with disabilities greatly appreciate adaptations of materials, they also desire receiving the same materials as their general education peers. The process we are going to describe in this paper suggests ways teachers can develop an awareness of universal design principles in creating web-based .

Introduction

As education moves into the 21st century, the instructional goals and methods of teaching are adapting to the massive changes in our society based on technology growth and development (Roblyer, 2000). At the same time, education's mission is to provide access to all students the ability to achieve in the classroom. Schools have been adding computers to their classrooms at a vigorous rate. According to an ABC News report, "in the past 10 years, American schools have spent more than $5 billion on new technology that was designed to improve student performance. But during that same period of time, student test scores for reading and math have remained relatively flat" (Norris, September 29, 1999, p. 2). The challenge of using technology in these classrooms is not having access but rather teachers' development skills in designing instructionally sound curriculum incorporating technology. The integration of technology calls for new thinking in the way we teach.

Within these same classrooms, teachers are being challenged to provide instructionally sound education for a diversity of learners. Teachers are creating materials for students with disabilities in response to a mandate from the *1997 Reauthorization of Individuals with Disabilities Education Act* (IDEA). Thus, teachers, in response to the ever-increasing demands of providing universal designed materials, must be proactive in their curriculum development.

To design curriculum alone regardless of diversity and technology can be a daunting task as both are considered as reactive rather than proactive. Web-based curriculum that incorporates instructional design principles and universal design principles may be one solution to creating a classroom in which technology can enhance the learning while accounting for student diversity. In this paper we will be discussing the universal design principles, the creation of web-based curriculum materials based on these principles and the future impact on teacher education.

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Universal Design Principles

"As general education classrooms become more inclusive, strategies for providing access to the general education curriculum are needed so that students with disabilities are actively involved and progress within the curriculum of these classrooms," according to Lou Danielson, director of the Research to Practice Division in the Office of Special Education Programs (U.S. Office of Special Education Programs, 1999). It has been long recognized that the general curriculum may need to provide various accommodations to enable access by these students. In the past, the typical solution has been for teachers to customize already prepared materials and presentations to meet individual learning needs. This process has not always been satisfactory for either the teacher or the student.

First, teachers often do not have sufficient time or specific knowledge to redesign these materials or presentations. As the general student population now includes an increasing number of students with diverse learning needs the task of making effective accommodations and modifications can be overwhelming. Today's teachers will encounter students with different developmental levels, learning styles, special needs, motivation to learn, as well as students learning English as a second language (Newby, 2000).

Second, research indicates that while students with disabilities greatly appreciate adaptations of materials, they also desire receiving the same materials as their general education counterparts. In addition, many teachers are uncertain of how to implement assistive technology in their instruction without jeopardizing educational quality. Klinger and Vaugh in their research found that parents, educators and students realized the importance of quality in their educational process because of the impact it plays in their academic and social success.

Web-based curriculum that incorporates instructional design principles and universal design principles may be one solution to creating a classroom in which learners, regardless of diversity, can succeed and technology utilized to its fullest potential. While no one product or method will ever be always applicable for all students, these principles can guide an educator in the initial design of curricular materials so that further customization will be more manageable and provide effective instruction.

Universal design means the design of instructional materials and activities that allows the learning goals to be achievable by individuals with wide differences in their abilities to see, hear, speak, move, read, write understand English attend, organize, engage and remember (Orkwis & McLane, 1998). There has been a growing body of knowledge concerning the potential and actual use of materials using the principles of universal design. While the first four principles originated from the guidelines for accessible design delineated by the Telecommunications Act of 1996, the fifth enhances cognitive access. These principles include:

- Provide all text in digital format,
- Provide captions for all audio,
- Provide educationally relevant descriptions for images and graphical layouts,
- Provide captions and educationally relevant descriptions for video,
- Provide cognitive supports and activities:
    - Summarize big ideas
    - Provide scaffolding for learning and generalization
    - Build fluency through practice
    - Provide assessments for background knowledge
    - Include explicit strategies to make clear the goals and methods of instruction (Orkwis & McLane, 1998).

Universal design implies the use of technology in curriculum materials. Technology allows teachers the ability to meet the universal design principles by providing various mediums to stimulate differences in student's abilities. However, technology should be included only as a media selection – a tool to deliver the planned instruction. Therefore, in terms of instructional design of universal use, teachers need to determine the instructional goals, conduct a need assessment, and design instruction that meets the gaps between the goal and the current status of the students. Technology comes into play during the design, development, and implementation stages of instructional delivery

Web-based Materials

The integration of technology has provided a change in the educational paradigm. "Because of the diversity in both learners and information, a single approach to all instruction will not work: a number of different methods and media exist for designing and developing learning experiences and the roles of learner and teacher shift based on the situation, the content, and the special needs of the individuals involved." (Newby, Stepich, Lehman, & Russell, 2000, p. 7). With the advent of technology, teachers may need to reexamine the way they construct classroom materials. Perhaps it is time to consider an universal design approach to teaching and learning in our classrooms.

Web-based materials in the classroom is beginning to gain popularity in both higher education and K-12 education. Web-base materials may provide additional access to students because they would be able to access their classroom materials both in the classroom and at home. An additional advantage of web-based materials, if designed correctly, is that students could advance through the materials at their own pace thus allowing teachers the opportunity to work individually with those students who have not yet mastered the relevant concepts.

Web-based materials that incorporate the principles of universal design may be advantageous for teachers to use as a way to provide embedded accommodations for students with disabilities. For example, teachers may design their web-based materials using high contrast backgrounds and text to provide an easier screen to read. Another suggestion provided by Edward Blackhurst is to avoid the use of frames. "Frames pose problems for individuals who use screen readers because the reader reads across the entire page, from left to right." Additionally, text that is chunked using shorter paragraphs, subheads, bullets and block indented paragraphs can assist the reading process and avoid visual fatigue, (U.S. Office of Special Education Programs, 1999). These are already common designing principles in web page development and general educators need to realize how valuable these principles can be in assisting the learning and reading processes.

Future Impact

Teachers need to have staff development opportunities that focus not so much on the basic skills of technology, but the use of technology in their curriculum. The important factor of integration is the recognition that technology may provide an effective medium to provide learning opportunities to their students. According to Jane L. David, the director of the Bay Area Research Group, "Teachers are the key to whether technology is used appropriately and effectively, and technology increases conversation, sharing, and learning among students and between students and teachers." (Trotter, 1999, p. 4).

As more and more children with special needs are being expected to learn and meet standards in their regular curriculum, teacher education must meet the challenge of providing both preservice and inservice instruction. Current and future teachers need to fully understand the implications and practices of both universal design and technology integration to become proactive in providing quality materials to their students. To achieve this goal, current and future teachers need to be exposed to the principles of universal design and effective web-building within their educational curriculum.

Currently the educational community focuses on the general curriculum development. Information regarding accommodations for diverse learners is typically taught separately. The goals of the authors are to strongly encourage incorporating universal design principles in initial general education curriculum development. We as educators of preservice students should encourage universal design considerations to be embedded into the curriculum process from the very beginning. There have been numerous examples from research and practice that demonstrate how modifications developed for students with special needs have a broader application in the general education classroom. As the examples cited previously, web pages that are developed for the students with special needs actually are beneficial for the general classroom student to use as well.

One possible solution would be to develop a web-based instructional design course that addresses the principles of universal design in the development of curriculum materials. The authors propose to teach such a course during the summer of 2000 targeted toward inservice teachers. The basic concepts and principles will be incorporated into a one-day session along with instruction in the use of our web-based course. Our course will model the principles of universal design embedded in the physical and conceptual

framework of our web pages. Through guidelines and additional information presented via the Internet, students will have the opportunity to develop web-based instructional materials and will present their work in a final in-class session where feedback will be provided.

Conclusion

Using the universal design principles to guide the web-based material design process has the potential to open the accessibility of all students with special needs to course materials. The web environment offers an endless opportunity for all students to learn regardless of their developmental levels, learning styles, or other special needs. As we venture into this new horizon of educational change, we must remember that "materials are only as good as the pedagogy on which they are based and the way they are used by teachers and students," (Office of Special Education Programs, 1999).

The bottom line is that all of our students must learn the skills, knowledge, and abilities that will help them succeed as they live out their lives in an increasingly changing society. Technology integration and universal design are two issues that will continue to impact education as educators design curriculum to help students succeed. Focusing on these issues as considerations of curriculum design – not add-ons – may be the first step to ensuring the integration of technology, not as the answer to all curriculum problems, but as a useful way to deliver learning based on the diverse needs of the learner.

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How to create a Learning Environment on the Internet, based on constructivism and sociocoultural approaches?

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Abstract: This paper is about designing learning environments based on the Internet seen from a constuctivistic-/situated learning point of view. First, we'll take a look at some of the main principles of learning theory before we move on to the structuring of virtual learning environments and integrated use of services on the Internet. We will also present tools for developing entirely netbased learning environments, where the resources in the network work together to support the learning process. Last, we'll take a closer look at some models for integrating network-based learning environments and learning organizations/social context. The network-based concept that we're working on does also include administrative tasks, such as student registration, course-base, salary, exam, etc. This will not be further dealt with here.

Background

The universities are being criticized for creating passive students and for teacher managed methods, based on old behavioristic learning theories. When Information- and Communication Technology (ICT) now makes it's entry, there is a risk that teacher managed models will be copied into network-based learning.

The last few years, The Norwegian University of Technology and Science (NTNU) in collaboration with other universities/colleges and companies, both nationally and internationally, has been working actively towards the development of a more flexible, problem- and project-based learning, in which network-based learning creates the foundation. Constructivistic learning-theory and situated learning, have formed the pedagogical background, not least in order to be capable of offering flexible learning possibilities when it comes to lifelong learning and the need for continuing vocational training in trade and industry.

Constructivistic learning theory/situated learning

From a historical perspective the design of the first computer-based training programs was based on behavioristic learning theory, where learning is thought of as passive acquirement, or absorption, of an already existing and often rigidly defined amount of information. The main role of the teacher is to gather formal knowledge, to find efficient ways of distributing this knowledge, and to control that the students have acquired the taught material. Then cognitive learning theory followed, focusing on how the material is presented, and development of computer-based ways of teaching which emphasized the presentational form and intelligent guidance systems.

Even though we can't find the same enthusiasm within learning theory today when it comes to the effect of

such managed and organized teaching, we witness the international education market explode with offers concerning manage-based teaching, especially when these are directed towards continuing vocational training. From our own schooldays we carry with us the knowledge that learning means to be quite, to watch and listen, and then, finally, a test of what we remembered. Thus, it doesn't seem too strange that this model is copied into network-based learning environments, especially not when the Internet as a medium is extremely suitable for fast and comprehensive management and distribution of information, and flexible both in terms of time and place.

However, research on learning theory has for the last few years been increasingly focusing on the fact that learning comes through active participation and collaboration in entire social-/cultural environments. Constructivism was rooted in the perspective that knowledge is acquired through personal construction of knowledge and arose in connection with Piaget's research on developmental psychology. Piaget introduced a theory on learning where new information act together with old knowledge through a process of assimilation and accommodation (Piaget, 1985). Papert (1980) further claims that the activity of programming computers could play an important role in constructivistic learning and related this to his work on the programming language, Logo. Here, the learner plays the role as "teacher" in relation to the computer.

In the 1970s, based on Piaget's theories, a group of psychologists, the so-called Genevan School, carried on research on how social interaction affects each individual's cognitive development. The main-thesis claims that each individual is capable of handling new knowledge by interacting with others. Individual cognition is seen as a spiral of causal connection.

The other theoretical main influence was the research carried on by Russian psychologists who were interested in the cultural basis for human intellect and researchers from the social-cultural perspective. The best known of these Russian researchers is Vygotsky (1978) who formulated the theory on cultural historical psychology. Vygotsky general genetic law of cultural development stipulates that learning always is a two-level process: first as an interpersonal act in a social community and then as an internal/personal process. Internalization refers to the genetic link between the social and the internal plans. Social speech is used for interacting with others, inner speech is used for talking to oneself, for reflection and thought. The social-cultural approach focuses on causal connection and connection between social interaction and individual cognitive change. Vygotsky's theory on "The Zone of Proxymal Development" (ZDP) has been interpretated in various directions. One interpretation claims that ZDP is the difference between a person's ability to solve a problem on his/her own, and what the same person is capable of when collaborating with others. Another interpretation of Vygotsky's ZDP is the distance between an individual's personal knowledge and the knowledge that exists in social situations. In both these interpretations learning happens through social interaction which inspires to individual acquisition and internalization of knowledge.

A related school represented by the Russian researcher Leont'ev (1974) et al., focuses on the role of active participation for human development, the so-called "Activity theory". The basis for analysis is social activity, from which individual mental functions are developed. This one focuses on signs, symbols, rules, methods, instruments and other artifacts which serves to mediate this activity. Vygoysky's cultural-historical psychology, and later on the work of the activity theorists have again developed successors both in relation to educational research and in the specialized area of computer science directed towards human/machine interaction.

In theories on situated learning is seen as a process for entering a practical society. "To learn to use tools as practitioners use them, a student, like an apprentice must enter that community and its culture. Thus in a significant way, learning is, we believe, a process of enculturation" (Brown, Collins, & Duguid, 1989). Within this perspective, the learning context (both social and cultural) is under heavy investigation, from a view which states "that agent, activity, and the world mutually constitute each other" and that knowledge must be presented in an authentic context, in which this knowledge normally is integrated (Lave & Wenger, 1991). For these researchers the environment is a complete part of cognitive activity, and not just a set of relation through which context-dependent cognitive processes are expressed. Collaboration is seen as the process in which a common understanding of a problem is created and maintained. While the earlier approaches focused on the inter-individual levels, common-cognition and situated learning are now focusing on the social level where new concepts are being analyzed as a group-product.

From constructivistic-/situated learning theory we have decided to emphasize three main principles of learning and to look upon these in relation to design of internet-based learning environments:

1. Focus on active actors with intentions and creativity, searching for knowledge and collaborators.

2. Focus on collaboration and communication between the actors

3. Focus on learning in a total context/environment

So, how is it possible to design internet-based learning environments on these main principles?

Structuring a virtual competence environment

Based on these learning theoretical principles, we have tried to find out how available services on the Internet can be structured and used in order to promote a learning environment with active actors genuinely collaborating in a total context. The resources/services that are available in a virtual competence network can be structured in relation to tasks and activities to be emphasized. We have chosen to structure the services into five areas, according to which tasks/theories that are to be dealt with: A presentation-arena for presenting and receiving scientific literature/theories, a knowledge arena for accessing library services/on-line services and other accumulated knowledge, a working arena to manage collected material/information and produce new material, a private arena to make personal notes and reflections, and last a communication arena which, together with the working arena, make up the main core of a learning process based on constructivism and situated learning.

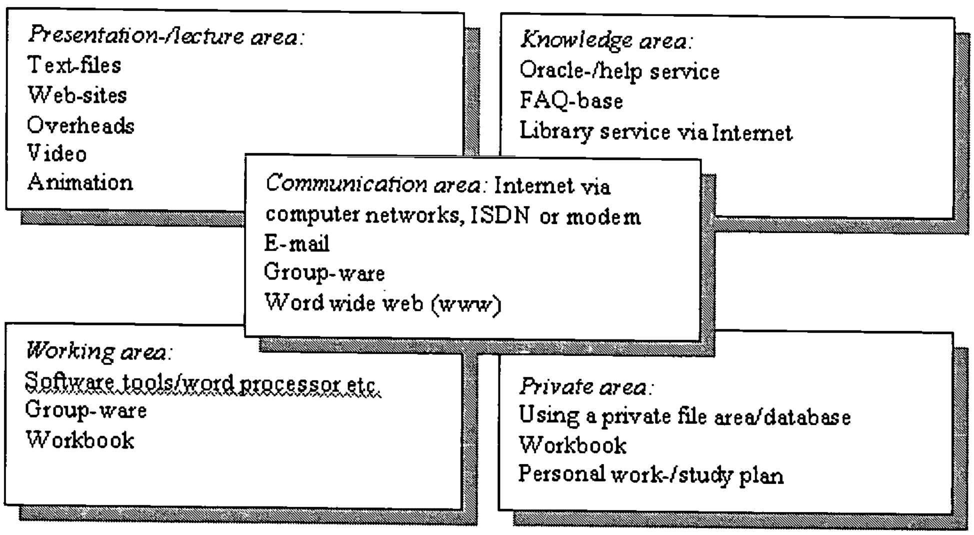

Figure 1: Electronic Learning Environment in Internet

Presentation-/lecture area

The criticism against behavioristic learning theory is especially directed towards the belief that "someone can teach someone something" and that learning can be managed by the teacher. Thus, the possibility of spreading huge amounts of science material in a simple and flexible way by using network-based systems, shouldn't be confused with learning. Science material can be presented and mixed together via network-based systems through different kinds of media, such as text, drawings, pictures, animation, video, and audio. It all depends on the one(s) having the knowledge how this knowledge can be made available to others. The activities related to this arena are on one side to present information and on the other side to receive information. And, vice versa, if the communicating parts are equal. Based on cognitivistic principles, this arena will be important if the material is organized properly.

How great the activity related to this arena will be, depends on the amount of information to be mediated. For example, there will be relatively much more activity on this arena if the system is being used in relation to a defined

material/course (reproducive learning), than in relation to creation, e.g related to learning organizations.

Competence area for accessing library services and other accumulated knowledge

This area is also an information area. However, it's main emphasis is to actively search for information/answers for the topical questions. Thus, accessing databases and libraries will be in the form of searching in relation to accumulated and stored information, while requests made to an oracle service may either be contact with resource persons and/or with accumulated information, e.g. stored answers in "Frequently Asked Questions" (FAQ). The services in both the presentation area and the knowledge area must first of all be seen as resources in relation to the actors learning process.

Working area for organizing and producing science material

Area for personal organizing of material. This is the real learning area, if based on constructivistic learning theory. The learning take place through the actors treatment of information and production of new material. The tools available in this arena are the same as those in the presentation/lecture arena, but now as tools for organizing and producing your own material. Group-ware tools are included also here in relation to personal work but communication with others is done in the communication arena. The workbook is also here when working with personal material but the storage of this one is in the private arena.

Private area for personal notes and reflections

Basically, the private arena is supposed to be used for storing personal material. The private workbook is stored here.

Communication area for interaction and collaboration

Area for communication and organizing in relation to others. Together with the working arena, this is the most important learning arena if based on situated learning. Here, together with group-ware tools, e-mail and the World Wide Web (WWW) create the communicative foundation.

Tools and help services to realize Learning Environments in Internet - Interactive learning system, (ILS)

In order to realize this new network-based learning environment it has been necessary to develop a number of tools and help services in order to increase the smoothness of the layout and the production of network-based scientific literature, and support for the learning co-operation. This tools consist of an infrastructure tool based on the Internet and includes tools for hyper-/multimedia-systems, video on demand, animation, object-orientated design based on constructivistic learning principles, info-search in free text, a knowledge test based on free text, an oracle-/help service, a workbook, and a plan for student administration. We have also developed specifications for necessary services in group-ware, but this tool is not realized yet.

The Infrastructure tool creates the complete frame for the learning area and ties the areas/functions together. Consequently, the areas are able to communicate and use the resources across the borders.

The tool for creating *Hyper-/multimediasystem on Internet* make it possible to use media such as video, navigation, lecture-paths, personal paths, lectures on video synchronized with information in the hyper-system, and the possibility of making personal notes for each node, personal working arena, choosing language, fonts, colors,

background, etc.

The Video on demand tool edits video (e.g. a lecture) and makes it possible to synchronize events in order to find the desired picture/sequence. By using this tool it also becomes possible to edit overheads and animations in relation to a video sequence. This is useful if one wants to use several media in order to strengthen a message. Video on demand is available from 28.8 kb and up to a few hundred, or a few mb if needed. We have chosen to connect the main service for video to Video On Demand instead of Multi Cast. The reason for this is i.a. to be able to reuse already produced material without conflicting the law, copyright. Multi Cast is to be considered as broadcasting and thus it doesn't allow for such an opportunity.

The Animation tool makes it possible to create animations which doesn't demand much band-with. It is also possible to control the animations step-by-step from a video-lecture. For example, this may be desirable if one wants to illustrate a process and explain what's going on simultaneously.

The Object-oriented design tool makes it possible for a teacher or a student to build a set of objects by using their own knowledge about a subject. Based on the objects one may easily construct systems in which the system and the work progress are visualized and animated during the execution.

By use of *the tool for Info-search in free text* one may search for information in free text; the information and the search are compared by use of vectors. Nonsense-answers can be rejected, answers with a touch of reason can be guided. Here, the teacher can decide where to draw the line between nonsense and reason.

The Oracle service/help service tool structures and creates a connection with an on-line help service. Questions and answers are stored for later use in an automatic service for "Frequently Asked Questions".

The Digital workbook structure tool gives possibility to make sure that learning is done through one's own activity and production, activities in an electronic workbook are very important. The workbook is a frame into which the users are supposed to put their own product, and not a book where you fill in the correct answers, or where you practice defined tasks. This workbook is also available to course administrators/tutors in the period of study, so that course-related discussions are connected to the work of the learner and which they show through the product that the workbook will become. It is also possible to share and develop a workbook in collaboration with other students/partners. Connected to the workbook, there are tools for editing, asking for help and possibilities for tutor/colleges to add comments. It is possible to divide the workbook into chapters. Which tasks that are connected to each chapter will depend on whether there is a special course to be completed or whether the workbook is being used as a public domain for documenting the work in progress. If the workbook is to be used in connection to a specific course content, it is up to the course administrator and those participating how to proceed. One example of how to structure the workbook:

- Preface, where the participant presents himself/herself.

- A chapter where a group of persons, single or together, creates an overhead series in order to present a part of the material to each other. That is, the participants function as "teachers" for the rest of the group. They do this in turn so that everyone gets the opportunity to present course material to the others in the group.
- A chapter for writing a summary of lectures/presented material.
- A chapter for practicing exercises. These are solved through discussions and by working in groups.
- A chapter for a project assignment.
- A chapter for miscellaneous.

From a learning theoretical perspective, based on active creative actors in genuine collaboration, we think that the working area and the collaboration area, can create the foundation for such an active collaborative learning process, while the presentation area and the knowledge area can be considered more as resources for the actors work and production. A well-designed network-based learning environment can, as we see it, create the foundation for

active, creative collaborative learning.

Network-based learning environments and learning organizations/social context

According to the principle that learning takes place, and is closely connected to social context/environment, the network-based environment may either be seen as the total learning environment, separated from the social reality where people belongs, or as an integrated part of a bigger social context. When collaborating with companies, municipal services, regions, we have tried to see virtual competence networks as integrated parts of an organizational context representation. However, such an integration demands focusing on internal learning processes and organizational development at the collaborative parts. That is, at both the knowledge institution/university and the company/service. From our point of view, it is through the possibility of collaborating and communicating through network-based environments we enable the possibility of collaboration between environments that genuinely seek each other's competence without considering time and place. However, this requires good effort and a conscious mind, if not, the network-based environment will operate outside the institutions, both from the universities and the companies, and will not be an integrated part of the context.

The Rørvik-model

As an example of such an integrated collaboration-model for developing a total learning environment we want to mention the Rørvik-model (OECD, 1999). The model is based on a close Internet-based collaboration between a small coast society (Rørvik), four universities/colleges (NITOL – Norwegian net with IT for Open and distance Learning) and a local upper secondary school (Ytre Namdal Upper Secondary School - YNVS). The local high school plays the role as the worlds best mediator to Internet-based university education and training for the local population in this area. This due to the close collaboration between the local upper secondary school and local industry.

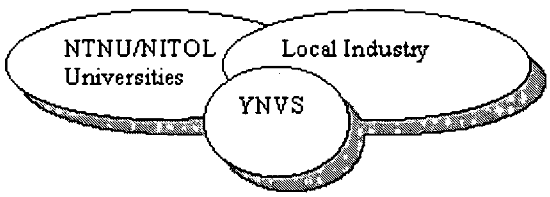

Figure 2: The Rørvik-model

The background to this project was that one of the companies in Rørvik (Telenor Mobil) needed higher education for their employees, and therefore they contacted the local high school (YNVS) to ask for help for such education. YNVS then contacted NTNU/NITOL, which has for the last few years been arranging off- and on-campus learning based on Internet solutions. Later on, this collaboration has grown to concise several companies in the Rørvik area, municipal authorities has joined the project, i.a. many of the teachers in the area have attended continuing vocational training at university level through this collaboration. The results are very good. In 1998, of those who had started a locally mediated Internet-based university-/college course, 96% graduated. There were only 4 out of 350 who failed the exam, and the average grade was 0.2 above the average for other students who took the same courses at universities/colleges.

Conclusion

Based on constructivism and sociocultural approaches we have tried to arrange for a network-based learning

environment that supports active, creative actors in a genuine collaboration within a total context. From our point of view, there is a great challenge in seeing the context as the foundation for integrating network-based learning, this applies not least to lifelong learning and continuing vocational training related to working place/environment. We have up gained some experience in this interesting area by developing tools so that people with competence in one or several specialist areas could be able to express this knowledge in an internet-based competence-network, and to collaborate with others. There is still a lot of work to be done, both with learning theory, methodology and tool development.

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Taking ID On-line: Developing an On-line Instructional Design Course

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Abstract: Educators in higher education are increasingly being called upon to design, develop and deliver courses via the World Wide Web. Although reasons for the strong push to develop on-line courses are varied, it is clear that the perceived need for such courses is steadily increasing. Also needed are prescriptions for creating courses that are dynamic, interactive and timely. The purpose of this article was to explain, in detail, the process of developing a Masters-level instructional design course for delivery on-line. Rationale behind the need for such a course, development procedures, successes/failures, and prescriptions for future developers will be discussed.

Introduction

Increasingly, higher educators may find themselves in a new situation. They may be asked to design and develop courses for delivery via the World Wide Web. The reasons for increased pressure to develop these courses are varied. However, in an article by Gubernick and Ebeling, (1997) the authors suggest that quite possibly, universities will have to change as we know them. According to the authors, in 1994, Peterson's Guide listed only 93 schools that delivered instruction via the web. Just five years later, there are literally thousands of courses offered via the World Wide Web.

In order for universities to compete for students, administrators recognize the need for change. For example, Cagney (1997) suggests that no type of college or university will be spared from this trend. Even private universities could be threatened if their students can take a significant portion of their courses on-line.

In an article in the Chronicle of Higher Education, the author discusses the fact that even the "more elite" universities may be jumping on the bandwagon. Universities such as Yale, Rice, and Duke are considering offering distance courses ranging from continuing education courses for alumni to distance-based graduate courses to general courses to the public (Blumenstyk, 1997).

Background Information

The state from which the on-line course was delivered is in the top ten in terms of total area yet the population centers are scattered throughout the state. In addition, in order to meet the changing needs of

students, the administration at the university has placed increase importance on the development of courses for delivery via the web. Faculty members who design and develop web-based courses have received grant money, may be able to receive release time in the future and it may have a positive influence on the process of tenure and promotion.

This author used the ADDIE model of Instructional Design to design and develop an Instructional Design course for on-line delivery beginning in the Summer of 1998. This is the first of the core courses in the Masters program to be delivered on-line. The dean of the college as well as the chair of the department were extremely supportive of the design of this course.

Analysis

The students who take courses Instructional Design are usually Masters students in an Instructional Technology program located in the mid-west. The course is also a requirement for certification in a Library and Information Systems program and an increasing number of those students have enrolled in the class. They are usually in-service or former K-12 teachers and have a range of technical expertise. This is a required course yet most students are self-motivated and enjoy learning about the systematic design of instruction. Specific technology to be used by students is not emphasized—students have designed instruction using print-based media, projected media and hypermedia.

This course presents a systematic method for the planning and development of instructional programs. In addition to examining the research supporting contemporary methods of instructional design, students will apply instructional design principles to the development of an instructional lesson.

Upon completion of this course, students will be able to demonstrate skills, which will assist them in becoming professionals who, are critical thinkers, creative planners, and effective practitioners. Each student will be expected to:

- Describe the basic components of instructional design.
- Summarize the research supporting the various elements of systematic instructional design principles.
- Develop an instructional plan that includes learner and task analysis, instructional design, instructional materials development, a strategic plan for the implementation, and a plan for formative analysis (Summer '98)
- Produce an instructional lesson according to the systematic plan developed (Summer '98)

- Analyze and develop cases in Instructional Design (Fall '98)

Design

The design of this course took several months. This author began the conceptualization process of creating a web-based course in the fall of 1997. The biggest obstacle to this course was having enough material available on-line without running the risk of violating copyright laws. Fortunately, there were many sources available on-line. It is extremely important to stress that this author also believes it is important to ask permission to use these sites as a part of the class. The URL's for sources are available through the following website: http://www.emporia.edu/idt/id/design.htm.

This course was offered as a traditional class in the fall of 1997. It was important to this author to keep the content in the distance class as close as possible to the content in the traditional class. Although the class used the ADDIE model as the basic model of Instructional Design, many other models were discussed in class. Much of the class time was used to discuss the "pro's and con's" of several traditional and non-traditional methods of designing instruction. Thus, it was important to set up a listserv for the purpose of class discussion. Examples of questions and responses will be included in the presentation and available through the following website: http://www.emporia.edu/idt/id/design.htm.

Development

This author used Adobe Pagemill 3.0 to create the web-site for class. The site itself consists of three frames: a "contact" frame (with e-mail and street address information plus phone numbers), a "menu" frame (with course syllabus, questions of the day, on-line resources, and directions for subscribing to the listserv), and a "main" frame which contains information loaded from the menu

A listserv was also created to handle the class discussions. These discussions took place on a regular, almost daily basis during both summer and fall semesters (deadlines were emphasized) and were based on the essential elements in Instructional Design, models of Instructional Design, and outside readings.

The students were required to submit projects via e-mail during the summer '98 semester. There were a total of seven small projects due during the course of the summer session. These projects were designed to represent each of the phases of instructional design from Analysis to Evaluation. "Analysis" was broken down into three separate projects: Needs Assessment, Learner Analysis and Task Analysis.

During the fall semester, in lieu of projects, students were required to analyze cases in small, pre-assigned groups. Students were directed to read the cases posted to the website, develop their own conclusions, and then submit them to the group. From there, the group would try to reach a consensus of opinion regarding the questions posed.

Implementation and Evaluation

This course was delivered in the summer and fall of 1998. Evaluations as a whole were favorable for the summer semester, but it was evident that the process of submitting projects via e-mail was quite frustrating, both for the instructor and the students. Due to the difficulty in sending and receiving projects via attachment, the course was changed to a case-based course for the fall '98 semester.

Using cases for analysis has proven to be quite rewarding. This author chose to create new cases due to the fact that the case study textbook of choice, "The ID casebook" (Ertmer & Quinn, 1999) was not available for review until just prior to the start of the fall semester. There were a few problems with the clarity of directions in the cases; missed links, making assumptions, not asking questions, etc. However, the problems did not seem to interfere with the students' knowledge of the case. The problems will be corrected in time for the summer '99 class.

Results of the evaluations during the fall '99 class were favorable, far exceeding this author's expectations. However, the summer class evaluations were not as good--students cited that there was too much work and not enough time. By the time the summer evaluations were received by this author, it was too late to make the changes necessary to create a better course.

This author elicited feedback on an ongoing basis from the students enrolled in the fall '99 course. The students were extremely helpful and provided feedback on an ongoing basis which will help in the design of the summer 2000 course. Students requested a less formal chapter write-up (choosing personal reflections instead of summaries), more lead time on cases, a better way to know where they stand in terms of their grades, and a more reliable method for contacting group members than e-mail.

In light of this feedback, this author has decided to use a webcourse template system called WebCT. This program will allow for instant grading (as the gradebook can be accessed from any computer), chat rooms (for group work), instant reflection posting, and better methods for self-assessment of progress. As everything is contained on the site and chat room conversations can be recorded, it will be

easier for this author to make certain that students have submitted all of their work in a timely fashion and that group work has been equally shared among members.

Conclusion

The importance of designing web-based instruction is clear. University personnel must prepare for the inevitability that courses delivered traditionally may need to be delivered via the World Wide Web in order for the college or university to remain competitive. What the exact process of conversion looks like for courses such as Instructional Design remains to be seen.

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WebSite Address: The URL for this class is: www.emporia.edu/teach/id/design.htm
Our server is case sensitive.

Real-time courseware design : the LAVAC Video Sequencer®

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Abstract: Teachers have already acknowledged the richer learning environment and interactivity of multimedia teaching, its flexibility to different learning styles and a learner's control that allows him or her to engage fully in the learning process.
But they still have problems in courseware design because their work is mainly centered on exercises and not on what the machine can do best. This is why a new device has been designed to allow them to use their videos. The video sequencer can complete real-time automatic segmenting of sound and images and automatically insert an answering time span after each sequence.
Coupled to IBM ViaVoice, the teacher can speak during this time span to create the transcript from which the necessary textual help will be derived for an easier aural comprehension. A 5-minute video will then require no more than a few minutes' work from the teacher to produce a two-hour student session.

Introduction

The aim of IT for a language teacher is to provide interactive simulations of language use through individual virtual learning environments. This highlights an important issue: the need for a particular multimedia learning system and courseware that will actually respond to specific user requirements.
Therefore when the first teacher-controlled multimedia computerized language laboratories appeared six years ago, the challenge was to enable teachers to use the built-in authoring system without any previous computer experience. Several easy-to-use programs with user-friendly interface have been developed to help them to digitize and edit sound, attach pictures and sounds to gap-filling or multiple-choice exercises, and achieve a multimedia integration that diminishes the weaknesses of each media used separately.
Such systems allow the design and development of a multimedia-based tutoring through embedded training packages and networked communication applications. They should offer learners' support, assessment tools and the maximum interactivity between teachers and students whether the teacher is present or not.
But if it is essential to know the possibilities of the system, it is even more important to define as accurately as possible the types of learning procedures that need to be implemented to help the teacher produce his own customized courseware and eventually a powerful interface for learning.

Objective

The building-up of knowledge representation and learning will occur through some proposed tasks but these tasks should be appropriate to a maximum number of cognitive learner types (analytic, synthetic, kinesic, etc.). The problem is then to implement the metalinguistic learning activities that will suit these different cognitive types knowing that each learner more or less belongs to most or all of these types.
Several solutions can be proposed among which a hierarchized list of different deduction techniques for sound recognition and understanding, i.e. wave spectrograms, phonetic transcription, lexical hints, written form of words and translation. Etymology, knowledge of the discourse situation, contextual logic will be put into use to enable the learner to find the meaning of the words or the group of words by him or herself.
Everything should be designed to help and encourage the learner to carry out his or her tasks alone, with imposed hints if necessary for all of them and proposed ones only for those who need them.
Keywords in multimedia teaching are learner's control, hypernavigation, interactivity, and multimodality. But learner's control does not certainly mean no-time limit to answer nor an easy access to the solution. The problem

is that most courseware programs leave the learner free to read the solution just after a mouse click or to read the transcript on an aural comprehension task[1].

As a cognitive scientist and a linguist, I have therefore designed the implementation of ten fundamental prerequisites for a multimedia language authoring system:

1. multimediatizing or the use of the multimedia language directly from a didactized content of information the teacher will have in **mind**. Detailed design will be achieved through doing
2. multimedia expression through a coherent semiological code and a multimedia language still to improve and stabilize
3. easy-to-use authoring system for non-programming teachers
4. adaptation of the produced software to different cognitive types
5. adaptation of the produced software to different personality types
6. set of hints that will implement metalinguistic activities based on deduction techniques, so that the mental processes involved can be reused in other linguistic contexts
7. automatic segmenting with answering time and segment visualization
8. personalized access to the solution decided by the teacher in relation with the learner's metacognitive performance
9. presence of the teacher in the room for personalized tutoring while the learners work on the machines and communication activities in small groups still in the same room
10. possibility of real-time modifications for answering time, textual hints, questions or even mistakes ... on the part of the teacher.

Methodology

The implementation of these pre-requisites began in 1992 when I designed the LAVAC® (Toma, 1993). This acronym stands for *"Laboratoire Audio-Visuel Actif-Comparatif"*, i.e. Audio-Visual Active-Comparative Laboratory. Its development is still under way with an html version, but the decided objectives are now reached with the latest version (4.03.i).

LAVAC has become one of the most popular computerized language laboratories in France since 1993, with around 5 000 software programs used in more than 150 university departments and high schools in France and abroad.

The system consists of a complete network of student terminals, plus a courseware-design workstation, all linked to a server. It was the first to use a teacher's console for presential or distance tutoring, which avoids the well-known 'wandering' and twisted paths of a learner lost in a traditional Resource Center.

A LAVAC courseware is in fact a set of segments or sequences with an automatically-given number plus a possible name or wording of your choice, linked to sound, images, videos, texts and tutor zones (for proposed hints or exercises), making it up to **six** different media altogether.

This has mainly been designed for oral comprehension and production, i.e. for listening (with 24 listening modes) and recording, but the student can also type in his answers, either in a learning or testing mode, and will be guided by hypertext or hypermedia links in case of mistakes.

The problem is that this tool may have been designed too early. Teachers were not ready yet. As Carlson (1998) puts it: "A technology-enabled curriculum should be conceptualized as a dynamic partnership among three agents: the student, the teacher, and the computer-mediated tools". Six years ago, few students knew how to use a computer and a lot of training was needed. Furthermore, the expensive machines (PC 386) were slow in playing the wave files which had to be short especially because these files were provided by a distant server through a Novell network. The network nevertheless was the only solution to overcome the low capacity of disks (540 Mb) and enable discrete or active tutoring.

The three agents were not present at that time, but now the situation has changed. Students have become familiar with cheap machines powerful enough to play real-time full-screen videos in a 100 Mbit Windows NT network.

Are teachers a problem? Most observers see them as conservative and technophobic. But this so-called negative attitude and the difficulty to educate teachers who, as educators themselves are sometimes the last persons to accept to be educated, should not be overemphasized, simply because teachers, and not the industry, are at the heart of the system.

The main problem with teachers is that they see multimedia as a "combination of texts, audio, and pictures on a single platform. At its best, it should recombine the benefits of 'conventional' Computer-Assisted Language Learning (text reconstruction exercises, tests games, etc.) with those of videos, together with the advantage of

[1] See Toma, T. (2000).*Cognition and Courseware Design by Teachers: the Concept of Multimediatizing*. SITE 2000, San Diego, Ca, for a more complete description of the present situation.

being able to jump instantly to the desired frame rather than having to rely on the rewind or fast-forward keys" (Eastment, 1999). Eastment synthesizes the problem and its solution in this comment.
The problem is to believe that multimedia courseware design just consists in digitizing different media already edited in a discrete way and in integrating them with an authoring system, even if as with LAVAC no programming is required (for at least 99% of the functions). The question for the teachers is *how* to integrate the different media. A complete rethinking of their pedagogical practices has to be undertaken. Some are ready for it, some are not. The need for bringing "conventional" teachers into computer-literate ones has well been developed in Nierderhauser (1996), but few training courses integrate an epistemological thinking on the changes involved in the didactic practices (Toma, 1997).
Few training courses explain as well that integration should not be carried out in the "ancient" way (still in use however) which consisted in giving scripts, audio and video cassettes, exercises on paper to team of developers that usually, because they are not teachers, have difficulties in understanding the specific teachers' requirements and produce a result often far from the one expected.
This is why I imagined the concept of multimediatizing[2] which consists in the *direct* expression of a didactized content into a multimedia form. No storyboard is needed with the LAVAC system since for language teaching the privileged medium is SOUND. The automatic segmenting of the sound track will produce numbered sequences where text, image, exercises can be attached to if needed.
That is why the solution is in the use of what the machine can do best. Sound processing in LAVAC is real-time and the minimum pedagogical work on behalf of the teacher is to write the transcript and analyze the lexical and syntactic difficulties for his or her specific students. Help will be given in the corresponding text zones and images will be linked to the right sound segment as a prop to the discourse situation. Links are created by a simple mouse click.
Exercises are often difficult to implement with an authoring system. Ironically enough the most profitable ones are not the easiest to complete. The first one is note-taking that can be done on a simple sheet of paper or in a text zone very easy to create. This phase can be labeled "content appropriation" phase.
Then in the testing phase exercises will have to be taken and done with the notes (with possible comebacks to the informational content).
The first exercise is a written question one with open answers. An answering text zone has just to be linked to the sequence labeled "Exercise 1" and this zone will open when the student will select "Exercise 1" and click on "Record". The written answers are immediately recorded on the server for an instant retrieval in case of modifications or analysis by the teacher.
The second exercise is a transcription of a passage of the sound track. It is just the same as note-taking but all the words have to be written. A gap filling-exercise could then be easily set up with a blank for all the words or just for some that need to be tested but a transcript on papers that can be given to the teacher proved as effective since the point is not to know that a word has been badly understood, but to understand why. Students really demand the teacher's opinion on their problems just because they can see the teacher has more time for themselves.
The third exercise is a so-called "simple" exercise since it is a repetition of a part of the sound track. It is automatically implemented by LAVAC since a recordable answering time span is set by default after each segment. But this task is not so easy for the learner since he has to discriminate the words, understand them, remember them and pronounce them in a limited time
The fourth exercise consists in oral questions that have to be answered orally. Here the sequences are manually created by a mouse click, the question is recorded by the teacher and he decides upon the length of the answering time span by entering a number of seconds.
The fifth is a translation exercise, which is from a computer point of view exactly the same as the first. The teacher types the sentence to be translated and creates an answering zone. The students' written answers will then be automatically saved in their respective files.
Most teachers use this model even if gap-filling or multiple-choice questions are also possible.
However the majority of teachers who discover multimedia teaching, who agree to use multimedia on the condition that they produce their own educational software because the available programs on the market are too general and will not satisfy their didactic needs, still do not know what to do since they think they will not have time to learn how to use even simple tools.
For this reason, I designed a new system derived from LAVAC that presents a new student interface of the LAVAC audio-segmenting device that will avoid teachers to link text or images to the sound segment.
This device, called *"Virtual Recorder"*®, is an audio-sequencer and appeared in 1998. The problem was even more complex with videos.

[2] See again Toma, T. (2000).*Cognition and Courseware Design by Teachers: the Concept of Multimediatizing*. SITE 2000, San Diego, Ca.

Automatic segmenting of the sound AND the images was not easy to achieve for synchronization reasons between these two media. Moreover the sound volume is sometimes kept constant due to music background on some videos. Since automatic segmenting works by the detection of blanks or volume drops in the sound signal, this problem of background music had to be overcome. This video-segmenting device or "*Video Sequencer* "® appeared then in March 1999.
Training for teachers is thus shorter. An exercise sheet can even be given to each student at the end of their lab session. Exercises can be done at home and the correction will take place in a normal classroom. If students spend less time in the language lab a greater number of them will be able to use it.
The methodology described here can therefore fit different didactic contexts. Three software tools can thus be used: the complete LAVAC software (authoring system, student interface, teacher interface (for distance tutoring), networking tool program for complete multimedia courseware, the audio-sequencer and the video-sequencer both compatible with the LAVAC student interface.

Results

Many teachers have produced several educational programs with this methodology by using the complete LAVAC toolkit (Toma, 1996). Tests have occurred for six years now with an average of 300 students a year.
Students appreciate the possibility of retrieving their recordings (text or sound) more than attractive exercises that are mainly complex to build. They sometimes consider the teacher as a tool when they urgently need him or her in case of a problem, but most of the time as a guide and a confident for their own particular problems.
Experiments are still in progress with the audio and the video sequencer, so I would like to limit the results to the use of the audio segmenting device, the use of the video sequencer alone, and the use of this tool with IBM ViaVoice and the LAVAC courseware station.

The LAVAC segmenting device

The segmenting device needs first to make a distinction between what is language sound and what is not. This can be set on 1-127 scale. A high level will be used if the background noise is important. At a value of 30 segmenting still takes place but the words have to be pronounced loud, if not they might be interpreted as noise. A value of 5 is used in a quiet environment. Under 5 it has to be very quiet. The computer noise may then be interpreted as language and therefore no segmenting will occur since it is continuous!
The normal values will then vary between 5 (quiet) and 15 (rather loud).
The next setting will concern the value of the blanks to be detected. This setting can vary from 0.2 second to 8 seconds. A "hard" segmenting rate of the sound track at a value of 0.2 second will give a large number of short sound segments (one word or more) to suit weak levels of students whereas a medium rate of 0.5 second will give a smaller number of longer sound segments for average-level students. Values above 1 second will be used to segment a sound track in large paragraphs.
Another setting concerns the value of the answering time span created after each segment during the segmentation process. The length of this span will be proportional to the length of each created segment. The proportional value can then be parameterized in a 10 to 999 % range. I usually use a 150 % value for repetitions, which means for instance that there is a 3-second answering time after a created sound segment of 2 seconds. But if this answering time is used as an automatic pause in aural comprehension for a better understanding process (because slower) and for note taking, the value should preferably be set at 3 to 400%.
The digitizing of the audiocassettes of the old cassette labs has also been planned. At a 100% value, the duration of the recorded blanks of the cassettes (corresponding to the answering time spans) are respected. But teachers find it necessary to diminish the values of the blanks simply because the student language level has raised. A complete recording of the cassette would be necessary with a traditional recording system either analog or digital. With this system, the recording of the cassette can be done in real-time in the server with a different value of the time spans. On top of that if the new value proved unsatisfactory, it can be changed while the students are working on the network[3].
The video segmenting device uses these LAVAC parameters except for the audio cassette settings.

The student videosequencer interface[4]

[3] A screen image could have explained more than words these different settings. They cannot be inserted here in a 6 page article. Neverthelesse these explanations are available with images on my ftp site: ftp://130.120.112.2/Tony/San_Diego
[4] For more details on the system see http://www.alizes.fr/cp3i

The *Video Sequencer* uses the whole set of didactic prerequisites this time applied to an analog VHS recording a an analog or digital camcorder recording or a live satellite program.
When the video starts to be digitized, it can immediately be seen on each student monitor. Sound is heard but no student control is possible. Nevertheless, if a student comes late, he will see and hear the video from the beginning and not from the part that is being digitized when he arrives. Or if a weak level student thinks he will not have enough time to understand more than 3 minutes of video, he can stop the visualization for a while and resume it after, when the first part has been completed.
For a better data transfer through the network, the AVI file sent to each student PC is MJPEG compressed (about 7 times).
The interest of the system is that segmenting occurs during this data transfer but is not visible when the video is played for the first time. As soon as digitizing is finished, the system automatically turns itself into the segmenting mode.
The segmented video immediately starts on the recording mode. Experience has shown that a learner will tend to watch the video intuitively as on television, which may induce a passive attitude. On the contrary, the recording mode shows that the machine waits for an action on the part of the learner. The first segment is played with sound waves in green on the "teacher" track, and after the first segment a red line appears which is the sound track of the student when s/he does not speak. As soon as the student speaks, waves appear in red. But if he does not, the video goes on and the second sequence is played. The video will thus be automatically paused, which will favor a better understanding and note taking.
Unexpectedly, most students stop the video after three or four sequences have been played, just to see the "menu" of their work. Each segment is numbered and represented by a square on a line. It is then possible, using the direction keys, to move rightward or leftward on this line, or to go straight to the end or the beginning by pressing the appropriate keys. In fact they want to be aware of the average length of each segment since 60 segments for a 3-minute video will be much easier to listen than 10.
In each square small lines appear in different colors according to the status of the segment: yellow for non-played segment, green for a played segment, red for a recorded one and green under the red when the listening of a recording has been made.
One of the most used trick is to click inside the sound wave to insert an index from which the video starts immediately and tirelessly. After each click of the mouse a vertical black line will come up in the yellow line. These indexes set by the students will help him find back the segments which posed comprehension problems to him. He will not need then to jot their number down for an easier retrieval. A recap key will help him play the segment at the place of the index when necessary.
The pedagogical interest of sound waves were questioned at the beginning. Some teachers even saw them as a gadget. I even had this dubious attitude. But English pronunciation is so stressed compared to French that this first forced students to speak louder in their microphones to make their spectrograms as accentuated as the master track's, and second, their could visualize sounds that they would have noticed otherwise. Even when they still do not understand it, they can make the difference between what is understood and what is not.
Three "working" modes have then been implemented to increase the range of learning tasks: teacher then student (sequential mode) for recording, teacher and student simultaneously (but in the recording mode, this would mean that the student knows the transcript by heart), and role play (in that case, the student can answer freely to questions asked if s/he takes the role of the interviewee, or know them by heart if s/he takes the role of the interviewer. Role play is the favorite activity of the students because they suddenly have the feeling of becoming part of the video (at least their voice)!
Another surprising result concerns the listening of students' recordings in the sequential listening mode. The LAVAC setting reproduces the classical model of the language lab: teacher listening, student recording, teacher's correction, student's repetition of correction. I chose a different option for the video sequencer. After the recording phase, the listening phase starts with the student's recording and not the teacher's one. Tests proved that students were much more attentive to the teacher's production (the master track in that instance) after they have heard their production than in the opposite way. The reason for that still needs further checking, but it seems that the student is first eager to hear his or her recording. If he hears the teacher's track first, he will not listen to all since he is awaiting his production. When he has heard him or herself, he is more prone to listening to the right pronunciation, so that s/he will become more conscious of the distance between both productions and will immediately try to diminish it.

The teacher videosequencer with IBM ViaVoice and the LAVAC courseware station.

After a real time segmenting, the teacher has just to repeat each segmented part of the sound track in the following blank created by the system. Words are then written by Via Voice in a special window with a 90% accuracy but the silence in the recording room must be total.

A LAVAC lesson has first been prepared and copied as a model. Hints can then easily be made from the transcript and pasted in a window of the corresponding LAVAC sequences.
Students will therefore be able to type their own transcript using the aids. This transcript can be visualized by the teacher through the network and when sufficient work has been accomplished by the student, the correction can be sent to him or her.
All links to a database for vocabulary, grammar, or civilisation purposes can eventually be made, with the necessary connections to the Net.

Conclusion

More than 5 000 LAVAC software programs are being used in French universities. A number of experimental protocols are still in progress mainly carried out by cognitive scientists. The video sequencer seems to be the easier and more efficient tool to use for non-programming teachers.
At least this is perhaps the solution to engage them later in a full courseware design process.

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Leaner-centered WBI Tutorials

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Abstract: Current online tutorials were limited to one-way distribution. The learner was unable to negotiate what they wanted to learn and how they wanted to learn. A database-driven tutorial was designed to implement learner-centered pedagogy. A web-based database-driven tutorial was used to support pre/in-service teacher education in learning of web page creation. Pros, cons, and revisions are reported in this paper.

Current Problems

Current computer-based tutorials have been constructed with a linear approach; learners go through a long list to select one, or more, tutorial(s). Contrary to the learner-center instruction theory, current tutorial design does not provide an opportunity for the learners to negotiate and reflect on what they need and want to learn. The tutorial "feeds" learners information that is unnecessary mingled with information they need. The tutorial instruction is not individually customized. The current schemas require time-consuming efforts to select the desired tutorial. These maneuvers neither provide the opportunity for learning nor encourage critical thinking during the learning process.

Database-driven Instruction

Database-driven web-based tutorials engage more critical thinking and interaction in the learning process and are proposed to solve the deficits discussed above. This new design for a web based instruction (WBI) tutorial was applied to a graduate level course, EMC 598 Internet for Teachers, to support the creation of web pages. In this class, students learned how to integrate Internet technology into their classrooms. The content of the tutorial is creation of a web page utilizing three different HTML editing applications. Each time tutorial support for web page creation is accessed, a search function is required (Fig. 1) and performed that displays a duplicate of the current tutorial design (Fig. 2). The learner is required to negotiate, specify, and analyze their needs, then conduct a search on the database by specifying different field search criteria. The learner is able to specify the search criteria, subjects, and levels of skills, applications, and search parameters to negotiate the learning process. After the search is conducted, the database will generate the results with multimedia components, text, still images, and an animated demonstration with audio. The learner is not forced to accept all of the components rather the learner can customize their preferred components to engage this learning process. This design demonstrates a true learner-centered instruction.

Querying the tutorial database is the first phase of the Database Instructional Project, while filling in the database and designing the database structure are the second and third phases of the project. This paper focuses its discussion upon querying the tutorial database.

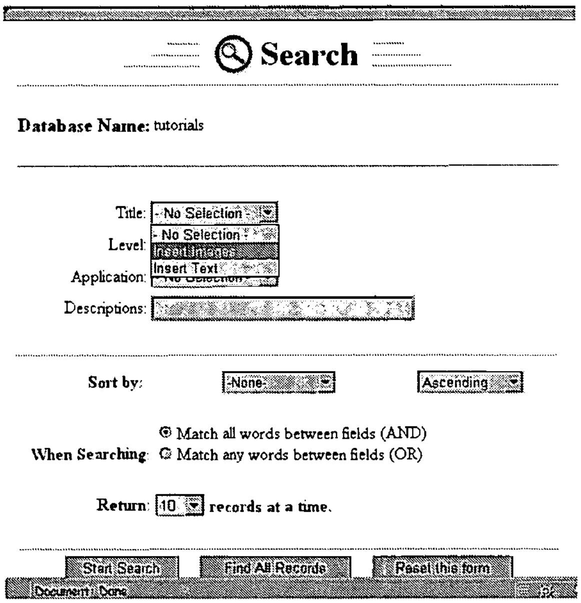

Figure 1: Search

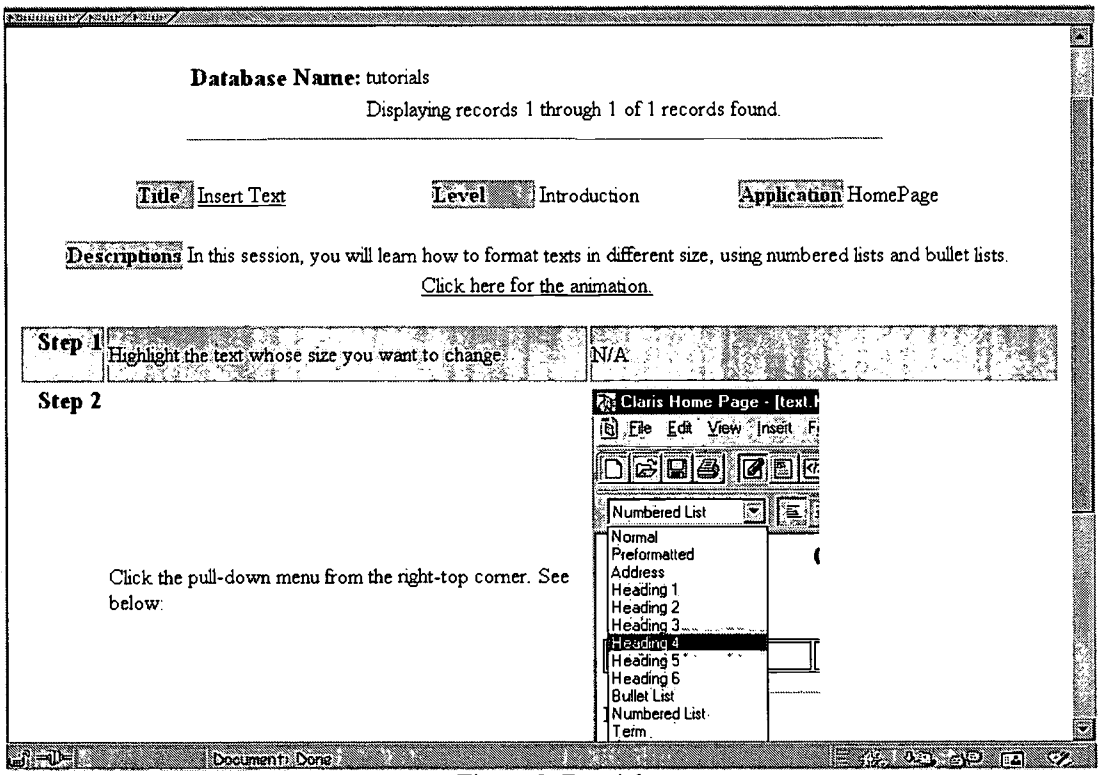

Figure 2: Tutorial

Rationale

Students are engaged in critical, creative, and complex thinking through utilization of learner-centered WBI tutorials. Querying a database requires that learners evaluate the questions and determine a strategy of searching

and sorting to answer their query. For example, to learn how to insert texts, learners need to search the field of subjects, identify their HTML levels, and evaluate the media format field. Thereby, learners are required to recognize fallacies, verify information, recognize patterns, and identify assumptions, ideas, and sequences of information, while comparing and contrasting information, using logical deductive thinking, and identifying causal relationships.

Fewer creative thinking skills are involved in querying a database. Querying a database requires learners to predict, speculate, visualize, and intuit responses. Answering queries effectively requires that learners develop a "feel" for the database and its contents.

A number of complex thinking skills are required for querying a database. Learners need to sense and formulate problems and apply problem-solving skills. Decision-making requires that learners make a selection and evaluate their choices when the search results are available. If the search results are not satisfactory the learners are required to find alternatives as an element of the problem solving process. These designing, problem solving and decision-making processes engage learners in developing complex thinking skills.

Literature Review

Literature reporting the use of a database to support instruction is scant. A few articles regarding knowledge-oriented database designs and designs producing thinking skills were identified. Rooze (1988-1989) observed that preparing and searching a database would help students analyze, synthesize, and evaluate data, but stressed the need to distinguish between teaching how to process information and how to think. Further, Rooze (1988-1989) appreciates the database as a tool in teaching social studies but maintains that the primary goal is to teach thinking skills. Watson and Strudler (1988-1989) designed a lesson based on Taba's Inductive Thinking Model that provided a set of strategies to enhance the teaching of higher order thinking skills with the use of databases. Students were expected to analyze, synthesize, and evaluate information to engage in higher order thinking.

Knight and Timmons (1986) discussed the advantages and limitations of database software in meeting the educational objectives of history instruction. Many studies on utilization of databases were conducted in the field of history education. They all concluded that the database helped students to appreciate the content, strengthen critical thinking skills (Little, 1995; Mernit, 1991; Miller, 1995), and produce a higher order of thinking (Pon, 1984).

Database instruction on the Internet is a giant step forward. Student publishing and peer evaluation were used to enhance learning by graduate students on a web-based database-driven system of instruction (Tu, 1999). Tu (1999) concluded that web-based database-driven instruction enhanced students' critical thinking, and knowledge construction, and provided learner-center environments. More interactions were identified as well. In this class, students post their assignment to the proper web fields, such as the title field, the body text field, keyword fields for the title and the target audience, and submit it. The assignments were converted into an HTML format and a searchable database upon submission because the keyword fields are created at the same time. Students are asked to evaluate each other's assignments by using an online evaluation form. Evaluations were available immediately after they had been submitted. It was concluded that web-based database-driven student publishing and peer evaluation increase the level of interactions.

Database is used to support instruction in problem solving. Foyle and Yates (1993) supported the use of databases in problem-solving activities. They concluded that when students developed their own databases they acquired significant social study skills and history skills.

Databases can also be used in computer-mediated communication (CMC) and in multimedia and hypermedia knowledge base instructions (Jonassen, 1996). Using a database to support CMC allows information retrieval and manipulation. One who has experience with manipulating data structure will be able to transfer to information-retrieval processes. This transfer will enhance their ability to search for information in any kind of knowledge base on CMC. Databases also provide a structure for developing multimedia and hypermedia knowledge bases. Database creation permits learners an opportunity to structure and manipulate information in a format that positively affects the use of information processes.

Advantages

The process of creating and manipulating a database is inherently constructive, meaning that learners are actively, mentally engaged in learning rather than merely reading or responding to questions. Knowledge construction is fostered through the intentional searching process and by linking information to the learner's own schema. Critical to the knowledge construction process is the articulation of the learner's behavior while performing a database search. This search facilitates and strengthens connections between elements of information and results in higher-order thinking and meaningful learning. This tutorial database, a learning environment that requires learners to reflect upon personal knowledge, and state their learning intentions, produces cumulative, progressive results for the group.

Another advantage of these database-learning strategies lies in the powerful searching and sorting capabilities of the database. The process of comparing concepts and relationships in the database is greatly facilitated by the speed and reporting capabilities of the tutorial database. Learners can search their databases in any number of ways, e.g. to provide an overview of all the subjects in certain HTML editing applications or to compare particular skills between or among different HTML editing applications, to arrange information to make more sense to them, to query all intermediate skills in certain applications or to use logical parameters, and/or to produce customized tutorials. This powerful querying ability allows learners to engage in different approaches to learn different web page creation skills.

WBI tutorial database, unlike other database designs, allows learners to access the Internet where browser access exists. The proprietary application is not required to access the tutorial database. The convenience of accessibility provides more opportunity for learners to engage in critical, creative, and complex thinking.

Disadvantages

The downside for the learner-centered WBI tutorial database was that the animated component required a plug-in for the client web browser. This caused several problems. The plug-in required for LotusCam was not installed on most web browsers. Therefore, it required the students to download and install the plug-in on their web browser. Many of students had difficulties installing the plug-in on their web browsers. Second, the AVI files require a great deal of server memory. With the tutorial growing, it fills the server memory quickly. Third, the web-based database-driven tutorials require a tremendous amount of time from the instructor or the instructional designer.

Software and Hardware

Various computer applications, FileMaker Pro, Claris HomePage, and Lotus ScreenCam, were used to create this tutorial database. FileMaker Pro 4.0 by FileMaker is used to create the database while HomePage by Claris is applied with use of CDML (Claris Dynamic Hypertext Language), a proprietary HTML, to create HTML pages. Collage Capture 1.0 and Lotus ScreenCam are used to create graphical tutorials and multimedia tutorials. The entire program is run on a PowerMac 7300/200 with 32 MB RAM installed as a web server.

Hardware requirement for installation of FileMaker Pro 4.0 is:

MAC
A Macintosh or Mac OS computer with at least 8 MB of RAM (16 MB or more recommended)
A CD-ROM drive
System 7.1 or later, or Mac OS 8 or later

PC
An Intel-compatible 486/33 PC or higher with 8 MB of RAM (16 MB or more recommended)
A CD-ROM drive
Windows 95 or Windows 98, Windows NT 3.51 or later, Windows for Workgroups 3.11, or Windows 3.1

Hardware requirement for installation of LotusCam for Windows 95 is:

PC
PCs 386 or higher
Windows 95
CD ROM media
VGA 16-color or higher graphics adapter and monitor
Parallel port or sound card-enabled device support by Windows 95
10 MB free recommended for recording

Hardware requirement for installation of Collage Capture is:

MS Windows version 3.1 or higher, MS Windows 95/98, or MS Windows NT, hard disk recommended
An IBM compatible 3-1/" high density floppy drive (for installation only)
2 MB of disk space to hold programs and files. Additional disk space is required to save your own images.
4 MB of available memory.

Hardware requirement for installation of Collage Capture is:

PC
Windows compatible computer with a 486 processor or better
Windows 95 or NT 4.0 or later
12 MB RAM (16MB for NT)
CD-ROM drive (for installation)

Mac
Mac OS compatible computer with 68020 processor or higher
System 7.1 or later
12 MB RAM
CD-ROM drive (for installation)

Revisions

Several revisions are to be made after the student trials. First, the server is not robust enough. When a high demand occurs, the server was unable to process queries fast enough. This database is to be moved to a Microsoft Windows NT 4.0 server with a faster processor. Second, the plug-in required to run animated tutorials created downloading and installation difficulties. The file format for animated tutorials should be converted to a non-plug-in required file format or a common plug-in. Third, although FileMaker Pro 4.0 is able to process the tutorial database, it is not an efficient scalable database. During the publishing time, a plan moving from FileMaker Pro 4.0 to ColdFusion with Microsoft Access is planned.

Conclusions

Learner-centered WBI tutorial database empowers and engages learners in higher-order thinking, which results in better understanding. In this learning environment, learners are able to engage in interactivity with more independence, greater competency, and increased support. Querying the database in this tutorial database is the first phase of learning database instruction. The next two phases will engage in contributing, and designing the tutorial database. These two processes will advance learners' individual critical, creative, and complex thinking skills and engage them in constructive learning environments with collaborative learning and problem solving strategies.

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Designing a "Best Practice" Online Course

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Abstract: This paper is a summary of a "how to" workshop, focusing on design guidelines when moving from an onsite course to an online course. Three most basic considerations are content knowledge, pedagogical skill, and higher-order thinking dispositions. Transferring content to an online environment requires technological expertise. Insuring learning in an online environment requires pedagogical expertise, and facilitating growth in a student's knowledge base through interaction of literacies requires mindfulness. This workshop is intended for teachers of adult learners who are truly concerned with building thinking persons. We will present a model to guide teachers in designing online courses to increase learning through improved teaching.

Introduction

Teachers who are critically literate have explored their own "ways of knowing" through the interaction of all their literacies. Believing that technology is a literacy, as necessary to a teaching and learning life as reading, writing, listening, speaking, thinking and viewing, led to the design of an online model incorporating "best practice" and "higher-order thinking." Adding technology to the curriculum or teaching it as a skill, is a very different process than integrating technology for lesson enhancement. Beginning with what we know about "Best Practice" and what the audience knows about "Best Practice," we would like to create some new designs for online courses developed from a model with the intentional integration of *all* our literacies. Teachers who have had the opportunity to explore and understand the power of writing their own literacy histories, will be better models of critical literacy for adult students.

The model introduced in this workshop depends on strong dispositions toward teaching (modeling) critical and reflective thinking strategies. Guidelines for incorporating critical and reflective thinking strategies are adaptations from Bloom's Taxonomy of educational objectives (1956). A content rich syllabus is the driving force for a good onsite or online course, but what makes a course exceptional is the concept of "integrating literacies." This idea comes from whole language and constructivist philosophy where students make their own meaning and deepen their understandings through reading, writing, listening, speaking, viewing, and thinking. Strengthening reading will strengthen writing, strengthening writing will strengthen thinking. Interaction online requires emphasis on communication skills and critical thinking.

From a movement by national curriculum specialty organizations, such as the National Council of Teachers of English, the National Council of Teachers of Mathematics, and the International Reading Association, and many others who recognize the importance of emphasizing standards, the concept of "best practice" was defined. Certain educational activities stood out as most effective methods for teaching, learning, and assessing. In Methods that Matter: Six Structures for Best Practice Classrooms (1998), Daniels and Bizar write, "...there are six basic structures that help to create Best Practice classrooms" (p.5). These six structures are integrative units, small group activities, representing-to-learn, classroom workshop, authentic experiences, and reflective assessment. Daniels and Bizar go on to explain that we "need all six ingredients in order to describe the Best Practice paradigm" (p. 7). In a recent publication, Best Practice:

New Standards for Teaching and Learning in America's Schools, the authors list 13 Principles of Best Practice Learning (Zemelman, Daniels, and Hyde, 1998, p.8).

Principles of Best Practice Learning

Student-Centered. The best starting point for schooling is young people's interests; all across the curriculum investigating students' own questions should always take precedence over studying arbitrarily and distantly selected "content."

Experiential. Active, hands-on, concrete experience is the most powerful and natural form of learning. Students should be immersed in the most direct possible experience of the content of every subject.

Holistic. Children learn best when they encounter whole ideas, events, and materials in purposeful contexts, not by studying subparts isolated from actual use.

Authentic. Real, rich, complex ideas and materials are at the heart of the curriculum. Lessons or textbooks that water-down, control, or oversimplify content ultimately disempower students.

Expressive. To fully engage ideas, construct meaning, and remember information, students must regularly employ the whole range of communicative media-speech, writing, drawing, poetry, dance, drama, music, movement, and visual arts.

Reflective. Balancing the immersion in experience and expression must be opportunities for learners to reflect, debrief, abstract from their experiences what they have felt and thought and learned.

Social. Learning is always socially constructed and often interactional; teachers need to create classroom interactions that "scaffold" learning.

Collaborative. Cooperative learning activities tap the social power of learning better than competitive and individualistic approaches.

Democratic. The classroom is a model community; students learn what they live as citizens of the school.

Cognitive. The most powerful learning comes when children develop true understandings of concepts through higher-order thinking associated with various fields of inquiry and through self-monitoring of their thinking.

Developmental. Children grow through a series of definable but not rigid stages, and schooling should fit its activities to the developmental level of students.

Constructivist. Children do not just receive content; in a very real sense, they re-create and reinvent every cognitive system they encounter, including language, literacy, and mathematics.

Challenging. Students learn best when faced with genuine challenges, choices, and responsibility in their own learning.

Our concern with the "pedagogical potential" of an online course comes from the ease of moving information to a technological landscape and calling it "distance learning." White and Weight claim that "...effective online instruction requires an interpersonal approach" (2000, p.vii). In their new book, The Online Teaching Guide, these authors and other contributors, write about the human side of teaching and

learning online. Content seems to be a given, but concern for active learning, student engagement, ongoing assessment, reflective and critical thinking, student-centeredness, and an outcomes-based approach are central issues. The book incorporates the Principles of Best Practice without specifically referencing them. Those who think of distance learning as a way to increase student-teacher ratios from 1:12 to 1:800, should consider that teaching and learning online demands one-to-one student-teacher instruction, prompt feedback, significant collaborative interaction, authentic assignments, and a comfortable learning community. Extra time for preparing and delivering assignments for teachers and students is dramatically increased online, and increasing the number of students per instructor drastically reduces the quality on online teaching and learning.

Background

The main differences in moving from an online classroom to and onsite classroom are the use of technology and the non-traditional way the students and teachers communicate, interaction without the use of verbal and nonverbal responses, and the mechanics of receiving and sending assignments and feedback. All communication is electronic, including lectures, chats, tasks, assignments, projects, videos, and the portfolio. Gestures and body language in the classroom translates to reading between the lines online.
In addition to technological troubleshooting when transferring messages and assignments, the online instructor must be specific regarding acceptable equipment and software.

Status of the class

Whether through written biographies, questionnaires, journal prompts, philosophies, or discussion, it is important to know the backgrounds and prior knowledge of learners when deciding what to teach , how to teach, and to what depth. Teachers who ask students what their goals and objectives are can use this information to make assignments more meaningful. This makes learning more personalized because the teacher values their input.

Objectives

Thinking and sharing in small groups, participants will design their own online courses. Groups will explore possibilities for creating alternative assessments and a community of learners online. Participants will examine their own literacy histories (ways of knowing) in order to understand how authentic experiences can happen in a virtual classroom. Participants will articulate and defend completed projects.

Mini-Lesson

Step one is to set goals, state objectives, and determine outcomes/assessments.

What do you want the students to know and be able to do? What evidence will be required to show knowledge and skill? How will you assess?	Goals: Objectives: Outcomes/Assessments:

Step two is to consider your audience.

Learning about the assumptions students have coming into class and their current content knowledge relating to the subject matter is essential in developing tasks and assignments. Following are several strategies for audience analysis. • Questionnaires • Biography • Guided discussion • Oral quiz • Journal prompt	Audience analysis strategy:

Step three is to adjust the content.

Having the expertise to decide what content is essential and most beneficial is the instructor's most important responsibility. What is really important for the students to know? What is the most effective way to deliver content?	Lists, texts, articles, web sites, lecture topics, or other resources. List activities, projects, tasks, prompts.

Step four is to plan for assessment.

Although there are many terms, for different kinds of assessments, the important thing to know is that assessment is a tool for learning. How will you know if your objectives were met? How will you judge what your students are able to do or how well they can do it? • Responding in writing • Assessments with rubrics • Standardized evaluation • Rank ordering grading	Alternative assessments:

Step five is to consider the tasks and activities needed for exploration, application, or practice.

While most traditional teachers think of themselves as dispensers of knowledge, they must understand that this is not learning. Students have a more important part to play in learning than memorizing and duplicating information on tests. What authentic experiences can be arranged so students could apply new concepts to scaffold deeper understandings?

- Decision making
- Problem solving
- Investigating
- Projects

Authentic experiences:

Step six is finding ways to enhance assignments to engage students.

When the teaching role changes from *teller* to *facilitator*, students accept the lead. Teaching students to monitor and manage their own learning increases autonomy and ensures engagement.

- Reflective self assessment
- Student choice
- Student empowerment
- Peer assessment
- Knowledge construction

Learning enhancements:

Share Time

Participants demonstrate evidence of learning by articulating what they have learned. A final poster presentation offers all an opportunity to defend their work and respond to others. Organizing one's work into a visual display gives way to common themes and meaningful connections.

Conclusion

The following documents support this workshop approach: Initial Design of Instructional Techniques – Model 1, Best Practice of Online Teaching and Learning- W-W Model 2, Ways to Include Best Practice Principles in Lessons, Technology Standards, Using Bloom's Taxonomy in Assignment Design (http://www.umuc.edu/ugp/ewp/bloomtax.html), and a research summary of evidence of best practice and higher order thinking in student work from an online course.

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Technology Assists to Create a Structured Learning Environment for Discovery Learning

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Abstract: This paper intends to report how a group of inservice teachers who were involved in designing interdisciplinary units of instruction used a systems approach in fulfilling the requirement of a graduate course. The paper will also report on the initial resistance to applying the SDI model on the part of several group members, and those changes that took place in the process of understanding the designing principles. After months of guided practice and engagement in active group interaction, all the participants successfully produced their final projects, interdisciplinary instructional units including several technology tools and the web as the delivery tool, thereby contributing to the pool of knowledge for other professionals to use as resources.

Introduction

One of the main purposes of implementing instructional technology is to create a learning environment in which our students can discover, explore and construct their own knowledge with the help of this technology. The classroom teachers should not only have a strong command of basic technological skills, but should also understand how to make the curriculum come alive in their classrooms. "Making the curriculum come alive" means that teachers should have control of the content and the pedagogy, and thereby be able to create the best possible learning environment to enhance the most effective learning. In order to achieve this goal, it is necessary for teachers to perceive themselves as instructional designers. Because of the enrichments made possible by modern technology, interdisciplinary learning can provide the students great opportunities to make connections among all the subjects they are learning, to gain multiple aspects of understanding, therefore to widen their perspectives of the world.

Instructional design is a process that is creative and active, iterative and complex. Dick and Carey (1990) in their book of "The Systematic Design of Instruction" provide detailed steps for designers to follow. Diagrams are used in the designing of instructions, which is a common practice among the designers. However, many teachers are not embraced this model for a variety of reasons. First, classroom teachers usually are given the chosen curriculum, and hence do not view themselves as instructional designers. Secondly, classroom teachers are given more and more daily responsibilities, from the delivering of the instructions to managing classes. In addition, they are expected to deal with all the social problems typical in a given school environment. As a result, there is little to no time for them to dedicate to designing their own instruction. Thus, we see that many forces are present that conspire against the teachers being involved in the instructional design process.

In addition, the complicated and complex process of instructional design is very confusing to new and novice designers, and the many diagrams of SDI (Systematic Design of Instruction) are interpreted as stiff, passive, and too complicated, with a plethora of visual elements, such as rectangles, circles, ovals, lines and arrows, used to model the process. The purpose of applying SDI is to use a systems approach model for the design, development, implementation and evaluation of instruction. In turn, this helps to lay a foundation for the creation of a technology-enriched learning environment for learners to construct their own knowledge and to provide opportunities for authentic learning in the classroom.

Application of SDI

How does SDI fits into the enriched learning environment? With today's technology, it is possible to provide a "guided" discovery learning experience to individual learners or groups of learners (Rice; Rice; & Lovell,

1996). It is possible to create a technology-based learning environment built loosely on constructivist views augmented with such cognitive tools as modeling, sequencing and corrective feedback (Schwen; Goodrum; & Dorsey, 1993). The goal is to provide an accessible, open environment that challenges each learner to "discover" a predetermined outcome. Although the method is referred to as being based on "discovery," this is not to suggest an unfocused, disjointed exploration with no instructional goal. As Bruner (1973) states, "as so frequently happens, the concept of discovery ...(has) become detached from its context and made into an end in itself. Discovery (is) being treated by some educators as it were valuable in and of itself, no matter what it was a discovery of or in whose service" (p. Xv).

Teachers as Designers

This paper intends to report how a group of inservice teachers enrolled in a graduate course, "Integrating Instructional Technology in Curriculum," designed interdisciplinary units of instruction using a systems approach. After spending some time in becoming familiarized with the concept, small groups were formed to work to use SDI in creating a unit of instruction with interdisciplinary content and technology as delivery tools. While these inservice teachers did not find the theory difficult to comprehend, they felt that the detailed steps according to Dick and Carey were too complicated and unnecessary, especially since most of them had been classroom teachers for several years and felt confident in their understanding of curriculum and instruction. They openly professed having very little confidence that they would find the SDI model useful or that what they were learning to do would add any valuable experiences to their professional growth.

Nonetheless, the project began, with the inservice teachers forming groups and jointly exploring the components of the SDI model. One particular group of three teachers, representing history, industrial technology (formerly called "shop"), and science at the same middle school all initially shared the same prejudice toward SDI, but found that as time passed, they began to realize some of its validity and applicability, even for seasoned teachers. The core components of SDI involve the meticulous, even painstaking process of defining instructional goals and meaningful performance objectives, which stratify into several layers of achievable smaller goals. In the final analysis, however, these teachers were able to overcome the prejudices formed through their own experiences and began to realize that while the articulation of the expected outcomes may require a certain degree of "massaging" so as not to pollute a desired discovery process, one should always use performance objectives as a unifying principle of instruction. After a period of fairly intense collaboration, they produced a complete unit, "The Wright Stuff" (after the famous aviators, the Wright brothers), which integrated a historical background, scientific experiments and development, as well as components of industrial technology. So designed, this unit provided learners with the opportunity to explore, to make choices along the way, and finally to discover the information needed to construct their own knowledge on this particular topic. The project utilized the Internet as a delivery tool providing middle school students with structured learning. In so doing, not only was relevant information presented, but also the tools needed to solve a particular problem were given to the learner. The learner was to decide which tool to use, and what information to apply in solving a particular problem in the instructional unit.

Other groups produced units emphasizing music and history, art and social studies, mathematics skills and reading comprehension. The most valuable lesson they learned through the practice of the SDI model was that they started to see the relationships among the steps. The steps involving the conducting of instructional goals provide a conceptual roadmap for any instructional activity. Even in a discovery-learning environment, an instructional goal should be clearly stated to tailor all the possible events of instruction toward meaningful learning outcomes. The steps of writing performance objectives can facilitate the learning process and provide clear directions of the learning activities toward desirable outcomes.

The End of the Process

After months of guided practice and engagement in active group interaction, all the participants successfully produced final projects, interdisciplinary instructional units including several technology tools and the web as the delivery tool, therefore contributing to the pool of knowledge for other professionals to use as resources. Through this process, they learned a great deal of designing principles and practice strategies. The clarity with which the instructional goals could be stated and the specificity with which the performance objectives could be

identified, made them better able to create an enriched environment within which to better produce predetermined learning outcomes for their students. Thus, these graduate students were afforded an opportunity explore how using SDI can significantly assist them in the development of instruction (even for the experienced inservice teachers) and to discover more efficient ways of implementing instructional technology.

In conclusion, "While some may argue that such tedious and careful design takes the "discovery" out of discovery learning, one should never lose sight of the importance of solidly designed instruction." (Rice; Rice; & Lovell, 1996, p. 45.) Discovery learning can provide students interaction with enriched environments and active learning experience, but it should not be seen as an all-encompassing approach to all instruction. Based on the experiences of the above-mentioned project, the SDI model certainly appears to validate this assertion.

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Collaborative Inquiries into the Networked Classroom

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Abstract: This paper points to the teacher professional development practices in a networked classroom that become reality with the use of advanced telecollaboration tools such as Virtual-U and KnowledgeForum. Those tools support, extend, and strengthen the establishment of teacher learning communities and their collaborative inquiries. Those inquiries are part of larger design experiments aiming at studying teacher learning when deep understanding is the goal of the knowledge-building activities that pre-service, in-service, and teacher educators engage in. The practices at two of the TL-NCE sites illustrate the transformative processes underway in teacher education when collaborative use of information and communication technology is made in networked classrooms.

Introduction

The practice of Internet-based activities is transforming teaching and learning in the classroom as well as it is transforming learning to teach. Interactive learning materials and activities are being developed, and computer-mediated communication tools support the classroom conversation beyond usual limits. Educators of educators are faced with a new challenge, one which is at once risky and compelling given the window of opportunity that is now opened: at the one end of the spectrum, network-based learning is viewed as a means to increase choice (modules and courses) and, sometimes, academic results or performance, and at the other end, as the essential activity for maintaining our scholastic cultures through knowledge-building communities. And then again, teachers are engaged in learning about the technology even as they are to help their students work with it.

Teacher educators involved in the TeleLearning Network of Centres of Excellence (TL-NCE) share the belief that educators must have a say in the orientation and the conduct of emerging on-line learning and teaching practices. The TeleLearning research program, funded under Canada's National Centres of Excellence, contains an important teacher education component that seeks to develop a model of integrating technology into teacher education. The model identifies a) under what conditions teachers can become thoughtful and reflective utilizers of educational technologies that support, extend, and strengthen their work as educators, b) how those conditions are achieved in a variety of situations and c) the consequences of such achievements. The research program is aimed at assisting pre-service and in-service teachers as well as teacher educators while gaining knowledge and skills of a practical or intellectual nature which they are called upon to master, in order to accomplish the tasks and functions expected of them now or in the not too distant future.

The objectives of this paper are 1) to describe the on-line information and communication practices of teacher learning communities that are emerging at two of the TL-NCE sites, and 2) to point to the early converging results of collaborative inquiries that have been carried out into both Anglophone and Francophone networked classrooms.

The changing parameters of learning

There is ample evidence that important determinants of learning are time-on-task and active learning strategies (Ewell & Jones, 1996). Cooperative and collaborative learning strategies engage students in constructive, reacculturative conversations with one another, helping them achieve better academic grades (Springer, Stanne, and Donovan, 1999). Computer-mediated communication research (Fjermedal, 1986; Cooper & Selfy, 1990; Hiltz, 1992; Harasim, 1993; Lévy, 1994) points to the potentials of on-line communication for collaborative and emancipative learning. What is learned is not only about what students read but what is said to one another about what they read (Pence, 1993).

However, the most adequate ways of educating educators not for instruction per se, but for every student to learn by whatever means work best are not always applicable on campus. The lecture-discussion classroom format remains, including in schools of Education, the primary means of producing instruction in North American colleges and universities today because it does in fact produce a lower cost of instruction than the use of individualized active and or collaborative learning strategies. Schools of Education are criticized by preservice and inservice teachers for their lack of coherence between what they espoused theoretically, and what they practice on campus.

Many schools of Education in North America have redesigned their curricula over the last decade, most especially their practice curricula (the Professional Development School Model), to be amenable to research on learning and teacher education research. Many teacher educators have adopted the constructivist view of learning. But campus-based learning coupled with field experience in school setting continues to be the primary mode in professional teacher education. Changes in educational paradigms and the evolving nature of an ever growing information society, create new opportunities and challenges for educators in all sectors and at all levels. And the emergence of networked communities of learners is leading the way toward the development of viable alternative educational models.

The emerging practice of computer-supported collaborative inquiry

On-line resources and tools are usually understood to mean the information and communications technology (ICT) applied to teaching and learning for the purpose of providing: 1) the flexible delivery of educational material (technology for the instructor), 2) the guidance and facilitation of the experience of the student (technology for the learner), and 3) the support of communities of learners (collaborative learning). Thoughtful and effective use of on-line resources and tools is understood to encompass those pedagogies that take advantage of "applications that engage students with the material, illustrate complex systems or relationships, and encourage interaction with other individuals or teams. Ultimately, the technology tools should become transparent as they integrate the user in the process, enabling immersion in the learning level, and that, on an individual or community basis." (NSF, 1998, p. V)

The virtual community of communication and support for teachers working in networked classrooms, established in Phase I of the research program (TL-NCE), is now moving toward curriculum-oriented collaborative knowledge building activities. Participants are encouraged to co-construct their knowledge of thoughtful and effective use of online resources and tools in a networked classroom. Collaborative inquiry is central to the knowledge-building process, and participants are enabling one another as they seek to understand how information and communication technologies can best support student learning. One strand of collaborative inquiries is dealing with the contribution of new information technologies to learning and teaching in elementary, secondary, and post-secondary classrooms, and involves school teachers, university researchers and graduate students from McGill University (Montreal, Canada) and Laval University (Quebec, Canada). The "community of practice" model is applied (Lave & Wenger 1991), and participants share a common set of purposes, practices, and perspectives. The networked classroom generate a whole new set of problems for novice as well as for expert teachers. Collaborative inquiries on specific questions, issues and challenges are conducted, for instance, in VGroups (a key component of the Virtual-U platform) at local sites or between sites. Access to and appropriation of valid and relevant knowledge for teaching in the networked classroom somewhat depend on their success to learn with one another. Key themes being discussed are the following ones: 1) learning and teaching for understanding, 2) cooperative learning and telecollaboration tools, 3) collaborative learning activities and projects using online resources and tools, and 4) the changing role of the teacher and of the learner. Novice teachers and expert teachers co-construct valid understandings of the thoughtful and effective use of on-line

resources and tools in face-to-face and on-line discussions. As they negotiate the meaning of their emerging practices, they develop identity relationships that enable them to increasingly think of themselves as true members of interconnected communities of learners (teachers-as-learners). This strand of collaborative inquiry has led to documentary reviews (1996, 1998, 1999) that condense for practitioners and policy makers articles, reports, papers and book chapters addressing the question of the contribution of ICT to learning and teaching (see Bracewell, Laferrière, Breuleux, Benoit, and Abdous, 1998). Some of the trends identified are the following ones: 1) the emergence of a mixed mode of learning: face-to-face and on-line learning activities; 2) the unresolved debate over the nature of information access as being or not more direct, interactive, and flexible; 3) the renewed interest in classroom social interaction.

Another strand of collaborative inquiries focuses on the nature of the activities and processes that on-line discussion forums (or dynamic databases) may support when it comes to teacher professional development. Pre-service, in-service teachers, and teacher educators are involved, at times jointly, at times in distinct forums. Depending on the circumstances, pre-service teachers may engage in either collaborative journal writing, collaborative inquiry projects or other forms of knowledge-building activities using Virtual-U VGroups, eGroups, or FirstClass. The V-Groups are, for instance, supporting pre-service teachers' collaborative journal writing, an activity commonly known for its private nature: a conversation occurring between the student teacher and the university supervisor, one sometimes inclusive of the school cooperative teacher. What a student teacher is interested in and what he or she is willing to share becomes visible to all other student teachers and, at times, to those of another cohort (same-year cohort or next-year cohort). Those discussion forums provide views into learning and teaching for those engaging in early field experiences, or preparing for their student teaching. Permissions are granted on a reciprocity basis. Some messages may be deleted in order to respect confidentiality. The platform used becomes an on-line collaborative space, that is, a place for teacher knowledge exchange. It is an evolving space, as incoming student teachers not only benefit from previous online discussions, but add to the content of what is being shared. Reflective teaching activities such as problem setting and problem solving are found to be enhanced, and Laval University student teachers are nearly unanimous in recognizing the value of using a telecollaboration tool such as Virtual-U VGroups to these ends (Legault, in press). As they graduate, they keep their identification code and password to this virtual community.

In-service teachers who use telecollaboration tools such as VGroups, eGroups or Knowledge Forum to gain, or advance, their understanding of effective use of on-line resources and tools, make transparent their engagement in on-line practice for themselves and for the school learners they work with. They deal with dilemmas and problems, create artefacts (templates for use in the classroom, links with the curriculum through concept maps, lists of suitable websites, on-line problem-solving activities, etc.), and share ways of doing things, and creative products. They are inclined to create their own school or personal webpage. Given the opportunity, they link those to a message in a discussion forum (VGroup or eGroup). Many-to-many communication for collaborative inquiry purposes are found to be an advanced use of information and communication technologies. A few inquiries of that sort have been conducted using WebKnowledge Forum, and most resulted in educational materials being created for classroom use (dynamic databases). Some of those inquiries involved only teachers, and others elementary or secondary school learners.

The above findings are part of larger design experiments. At the Laval University / Quebec City Site, the attempt is to enable a large network of associated schools to make adequate use of ICT through the building of a capacity for collaborative teacher learning and teaching in the networked classroom. It is in this context that discussion forums and dynamic databases are emphasized. This is to say that face-to-face and on-line activities are being combined. The collaborative on-line places are analyzed on an ongoing basis in order to identify recurring and evolving thematic content and patterns of communication. At the McGill Network of Professional Development Schools (PDSs), researchers are attentive to the socio-cognitive discourse that is being displayed in on-line conversations (see Breuleux, Bracewell, and Renaud, 1995). Their focus is on the different sources of knowledge required of participants to engage in successful knowledge-building communities. What knowledge results from participation in networked communities of learners remains the central question under investigation in the research project as a whole. Educators in the McGill TL•PDS Net are developing a practical understanding of on-line discussion and information tools. For example, 70 student-teachers and practicing teachers in the McGill TL•PDS Net have used actively the web-based eGroup environment during, and following, the 1999 Summer Institute: they have exchanged close to 500 messages starting in August and up to November 1999 . The messages served a variety of purposes such as information sharing, interpersonal support, team building, and knowledge

building. These educators also are learning in practical and experiential ways how on-line knowledge-building communities are formed, and what purposes can be achieved by such communities. For example, teachers in three schools of the McGill TL•PDS Net have formed, and are monitoring, their own on-line groups for students and/or colleagues. Therefore, there is an emerging practice of on-line collaboration that extends learning in powerful ways, but most importantly there is a growing ownership of the tools, with an associated sense of efficacy on the part of the teachers.

Early converging results

As elementary, secondary, and university classrooms get networked, teachers are grasping the potentials of telecollaboration tools. The many-to-many communication patterns enable by tools such as VGroups and KnowledgeForum are seen as ways to enrich, extend, expand, and deepen the conversation in the classroom, be it at the elementary, secondary, or post-secondary level. However, in order for those tools to lead to successful collaborative inquiries in the networked classroom, a reframing of one's understanding of what learning and teaching are all about is often found to be necessary. The implications of the socio-constructivist perspective on learning requires not only a shift of thinking, but in doing as well. Tools that catalyze, support and enable such a change are found to be necessary.

After experiencing an initial shock when being presented with the possibility of using VGroups (Virtual-U), Laval pre-service teachers use of this tool confirms their interest in collaborative learning and teaching. As demonstrated by their readings of the writings of more advance pre-service teachers, they manifest openness and respect for, and recognize the relevance of the writings of more advanced pre-service teachers that have gained expertise in the use of online resources and tools. Their trust in the value of such materials is key to the development of a collaborative knowledge-building capacity in the whole Quebec City Region since 80% of the graduates are likely to teach in that area. They also manifest a positive attitude in looking into in-service teachers collaboratively built data bases (Web Knowledge Forum). However, only a few demonstrate confidence in their capacity to successfully use that tool in their own upcoming classrooms.

The design of the McGill Institute confirms that developing a thoughtful and reflective practice of educational technologies that supports learning can be achieved under conditions that include the following: a) a willingness and a capacity on the part of the practicing teacher to mentor student-teachers, and in doing so to open her practice as a model for inspection by someone else (an essential capacity to be reflective). This capacity is found to be a pre-requisite for successful on-line discussions to include substantial discourse about practice and about its development; b) a school climate that supports (or is conducive to) collaborative knowledge building among the teaching staff; c) guided discovery activities for teachers allowing them to develop technology practices and tools that have two attributes: they are connected to the practice as it currently exist, or to the practice that is aimed by the group, and allow connections between the two practices.

The consequences of an emerging, thoughtful, and reflective practice of educational technologies that support and extend learning include the establishment of new relationships between the members of the teaching staff within a school, the establishment of relations between teachers in different locations, and increased connections between student teachers and teachers.

This design experiment is now entering a phase where issues of leadership are crucial. We are examining leadership practices that support the participation of teachers in on-line learning communities, how leaders can develop their own learning communities, and how teachers can become leaders in their school or school board about the use of ICT to support advanced pedagogies such as collaborative knowledge-building.

Forms of support and communication among the participants may vary while learning takes place in learning networks pertaining to teacher professional development. The different range of learning outcomes entailed in teaching and working with these new technologies, is found to be highly dependent of the level of access to online resources and tools, the support of the local context, the nature of the curriculum, and the teacher's pedagogy. Those process-related converging findings are found to support the cohabitation of educators at different levels of technology practice, and to promote collaboration in design, implementation, and inquiry.

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11th International Conference

Proceedings of SITE 2000–

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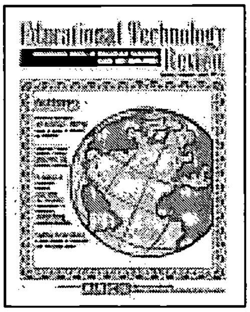

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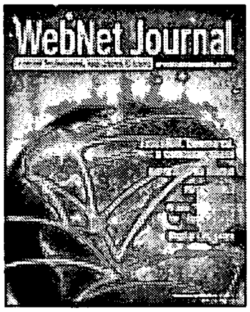

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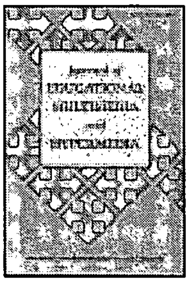

Designed to provide a multidisciplinary forum to present and discuss research, development and applications of multimedia and hypermedia in education. The main goal of the *Journal* is to contribute to the advancement of the theory and practice of learning and teaching using these powerful and promising technological tools that allow the integration of images, sound, text, and data.

Journal of Computers in Mathematics & Science Teaching
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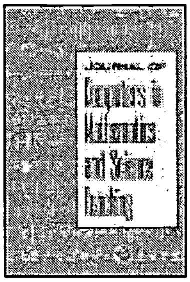

JCMST is the only periodical devoted specifically to using information technology in the teaching of mathematics and science. The *Journal* offers an in-depth forum for the exchange of information in the fields of science, mathematics, and computer science.

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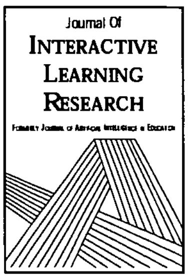
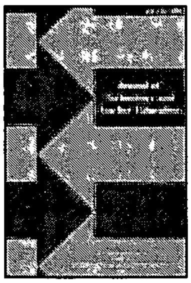


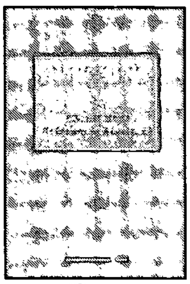
The *Journal's* published papers relate to the underlying theory, design, implementation, effectiveness, and impact on education and training of the following interactive learning environments: authoring systems, CALL, assessment systems, CBT, computer-mediated communications, collaborative learning, distributed learning environments, performance support systems, multimedia systems, simulations and games, intelligent agents on the Internet, intelligent tutoring systems, micro-worlds, and virtual reality based learning systems.

Journal of Technology and Teacher Education
(JTATE) ISSN# 1059-7069 *Quarterly*



A forum for the exchange of knowledge about the use of information technology in teacher education. *Journal* content covers preservice and inservice teacher education, graduate programs in areas such as curriculum and instruction, educational administration, staff development, instructional technology, and educational computing.

International Journal of Educational Telecommunications
(IJET) ISSN# 1077-9124 *Quarterly*



IJET serves as a forum to facilitate the international exchange of information on the current theory, research, development, and practice of telecommunications in education and training. This journal is designed for researchers, developers and practitioners in schools, colleges, and universities, administrators, policy decision-makers, professional trainers, adult educators, and other specialists in education, industry, and government.

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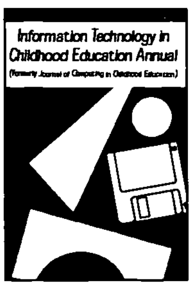

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The exchange of ideas and experiences is essential to the advancement of the field and the professional growth of AACE members. AACE sponsors conferences each year where members learn about research, developments, and applications in their fields, have an opportunity to participate in papers, panels, poster/demonstrations and workshops, and meet invited speakers.

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This conference, held annually, offers opportunities to share ideas and expertise on all topics related to the use of information technology in teacher education and instruction about information technology for all disciplines in preservice, inservice, and graduate teacher education.

Co-Sponsored Conferences

ICCE/ICCAI—International Conference on Computers in Education/International Conference on Computer-Assisted Instruction

ICCE/ICCAI is an annual event focusing on a broad spectrum of interdisciplinary research topics concerned with theories, technologies and practices of applying computers in education. It provides a forum for interchange among educators, cognitive and computer scientists, and practitioners throughout the world, especially from the Asia-Pacific region.

NOVEMBER 21-24, 2000 • TAIPEI, TAIWAN

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Preface to the Millennium Edition!

Now that we have had our celebrations about the coming of a new century and a new millennium, purists are pointing out that we are not really in the first year of the new millennium but in the last year of the old one! "What?", you say. I vacationed in Turkey this Christmas (thanks to Dee Anna Willis being willing to shoulder most of the load for getting the section leaders' comments in and organized) and the English language paper in Turkey ran an article about the way the monk who organized the calendar we use today started it. Instead of making the first year, 0, he made it year 1. Thus, the year 2000 is actually not the two thousandth year, it is the 1999th year. So, if we want to do the whole thing over again next year, we can.

What about the Annual? Is this the 9th or the 10th year of the Annual? That too is a bit complicated. The first conference was held in 1990 which means this is the 11th conference. (We did not think far enough ahead to hold the first conference in 1991 instead of 1990 so it would be easy to keep up with.) Everything being equal this should be the 11th Annual, right? Well, not quite. The papers presented at the first conference were not published in an Annual. Instead, they were Issues 1, 2, and 3 of the 1990 volume of the journal, Computers in the Schools. So, when it comes to Annuals, the year and the number of the Annual is consistent. This is the tenth Annual.

Ten years! For the Annual. And eleven for the conference! Not long in the grand scheme of things but a long time when it comes to conferences. I would estimate that there are 80% more "First Annual" conferences than "Second Annual." And, if we extrapolate a bit my guess is that less than 5% of the academic conferences are around for an eleventh incarnation. SITE is a survivor for several reasons. One is that it does a good job of meeting a need. There is a growing community of scholars and professionals who have a strong interest in technology and teacher education. SITE is THE conference if that is your interest. A country singer whose name eludes me had a popular song a few years ago that had the lyric, "I was country before country was in." SITE was here, with a focus on teacher education before that was an "in thing."

Today, technology and teacher education is an in thing. The U.S. Department of Education's $75 million dollar grant program on preparing teachers to use technology has raised the interest level and attention of teacher education, as have a number of other activities such as the AACTE report on technology in teacher education. Technology was not always in the limelight of teacher education, however. In introducing the special issue of Educational Technology Research and Development on technology and teacher education, Bob Hannafin (1999) commented that in the past teacher education and instructional technology "lived quite happily in separate worlds, neither really knowing - or caring to know - what the other was doing" (p. 27). Hannafin edited the special issue of ETR&D on technology and teacher education because he felt this was an emerging field that deserved the attention of the IT community. I am happy to say that of the seven authors involved in writing articles for that special issue, all except one are regular participants in SITE. Two have been or are presidents of the organization and several others have won awards for their papers at SITE.

The USDOE grants program, the work of NCATE, ISTE, and AACTE; and special issues of journals like ETR&D, are all indicators of the changing landscape of technology and teacher education. SITE and its membership has many opportunities to form collaborative relationships with other organizations. The time is right for that, thus the theme of the conference, Bridges Among Professional Associations. I hope you have a productive and enjoyable conference and that you become an active and energetic part of the process of building bridges in this time of high interest and attractive possibilities.

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INTERNATIONAL

Section Editor:
Dee Anna Willis, *Northwestern State University*

As an editor one of the joys of doing everything online is not having the long delay for papers to arrive from distant authors. On the other hand one of the disappointments is not receiving mail with beautiful and intriguing stamps in wonderfully scented paper from far away places (I treasure one received years ago from India that is lined with red silk and still smells of sandalwood.). Perhaps we should add simulated national stamps to our e-mail; e-scent I suspect, will be a long time coming.

In the past I have tried to take the reader on a round-the-world trip with me, organizing the papers in the International section as if I were a tour guide. Although that yearly tour was dear to my heart, it has become increasingly more difficult to do as this section becomes less a collection of papers from around the world and more a group of reports telling of international collaboration among teacher educators from a number of countries. As I have helped process the proposals for every conference (see the preface to this Annual and last year's) since our beginning I've had an inside view of this growth. No longer can I see this section's articles in a linear model, but rather as an interconnected, three dimensional matrix – first a bundle of a few twigs gathered together for mutual support, then more, adding strength, and finally building a structure – a home/house if you will, growing a community. At some point even paper books will have 'hot links' with articles arranged in 3-D, but until then I fall back on a somewhat linear path, linear but convoluted, like following a rabbit warren hither and yon. So come with me; our path will twist and turn and skip, but it will be worth the journey.

This year I am pleased to begin the International section with a paper from our invited International Panel organized by our Vice President for International Affairs, Professor Niki Davis, formerly UK, now, US. The other panelists are Therese Laferriere, Canada; Bridget Somekh, UK; Wim Veen, the Netherlands; and Jerry Willis, US. The panel examines the international dimension in teacher education and technology, noting that the context for education is becoming global through communication and other technologies. This provides a rich and continually expanding context for critical reflection and growth.

Crossing the Atlantic Roger Austin and Jane Smyth of Northern Ireland describe a case study of the Irish 'North South' Project." Several more papers from the UK, authored by Bruce Elson & Alan Phelan and D.J. Clare & J.L.Blackwell respectively, provide insight into IT from their perspectives.

The fifth report, from Brian Hudson, David Owen, and Alison Hudson, UK, together with Eila Jeronen, Finland, and Peter Schürz, Austria, move us to the European continent in "Promoting collaboration in a European context using multimedia and the World Wide Web." While there we visit the Netherlands for a response to the challenge of the Information Age from Marco Snoek, Douwe Wielenga, Karel Aardse, and Joke Voogt.

A short flight from the Netherlands and we're in Switzerland reviewing the work of Wilfrid Kuster and Fortunat Schmid in the development of a preservice ICT course for student teachers to use at secondary schools.

Heading northeast from the Alps we enter Poland where Jacek Gornikiewicz writes of an Internet dialogue of teachers and students. Moving southeast to Romania we nonetheless retain ties to Germany and the UK, building an international community of experts on learning in the Internet as reported by Nicolae Nistor, Germany, Mihai Jalobeanu, Romania, and Susan English, UK. Looping back to the west we explore teacher's attitudes towards computers in the education of young children as presented by Tamara Pribisev and Sanja Cvijic Vuckovic, Yugoslavia.

Sailing from Yugoslavia through the Adriatic, Ionian, and Aegean seas we arrive at Turkey where four papers take us through a number of aspects of Turkish education and IT. The reports by the respective authors, Selçuk Özdermýr, Ömer Delaýalýoðlu, Soner Yildirim, and Askýn Asan give us a number of windows through which to look at their IT and teacher education programs.

Crossing the Black Sea to the Ukraine, we are presented with a question, posed by Valentyna Kolomiyets, that we all have to face, one way or another, i.e., "What role can technology play?" The Ukraine, as are all former components of the old USSR, is in a state of extreme transition. Ludmila Gombozhabon writes of how Russia, too, is going through transition and its impact on teacher education.

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Leaving Europe and northwestern Asia we cross the land mass of China to Hong Kong where Wing-mui Winnie So, Hing-keung Vincent Hung, and Wai-cheong Jacky Pow, provide us with a case study of a teacher educator using IT in primary classrooms. From the mainland we cruise to the Republic of China for two papers. The first, by Shwu-yong L. Huang and Yeon-Chaw Liu, look at gender-related differences in computer anxiety while the second, by Min-Jin Lin and Ching-Dar Lin, looks at IT training for primary teachers in Taiwan and in Australia.

Malaysia is our next stop where two papers, by Haryani Haron & Sharifah Muzlia Syed Mustafa and by Soo-Lin Teh & Fitri Suraya Mohamad report on different aspects of IT and teacher preparation in their country.

From Malaysia take the Internet (planes take so long to cross the Pacific) to Chile and learn about distance education based on networks there with Jose Duran Reyes and Maria Ines Solar Rodriguez as guides. Crossing the great ridge of the Andes, Earth's longest mountain chain not covered by ocean waters, and skipping to the eastern side of South America we learn from Airton Cattani, of Brazil, about the new horizons and possibilities provided by telematics in professional training.

On the last leg of our trip we head north to Panamá where Gisela E. T. de Clunie, Damaris González, and Zenith Hernández write of their collaborative projects through the Internet. Panamá is a good ending for our odyssey; Yankees have had practice leaving there recently. While I am in a geographical mind, I am reminded of a fact I have always found curious, that the Atlantic opening of the Panamá Canal is northwest of its Pacific mouth, a good example of perception versus reality. For those who might doubt, see the map, brought to you through ICT, specifically: http://geography.about.com/

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Developing and Researching the International Dimension in Teacher Education and Technology: A SITE Invited Panel.

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Abstract
SITE'00's theme is building bridges among professional associations so it is only right that one the panels should look at the joys and challenges of developing and researching an international dimension in teacher education. The panelists come from both sides of the Atlantic and will stimulate the discussion though their experiences of collaborating across communities, cultures and languages. Niki Davis and Wim Veen have been developing and researching European teacher training enhanced through information and communications technologies. Bridget Somekh has been working with teacher educators in Europe to inform a view on pedagogy with new technologies. Therese Laferriere's focus has been the development of teacher education across borders and cultures in North America. Jerry Willis has recently been focusing on curriculum reform in the Ukraine.

Background

The theme of this year's SITE conference is bridges among professional associations. This panel will consider the growing importance of international collaboration for teacher educators. International collaboration between two associations also brought the panel together led by the first and last authors. Niki Davis was the current chair, or president, of

the UK Association for IT in Teacher Education in the year that the Society of IT in Teacher Education formed in the USA. She met Jerry Willis, the founding president of SITE, at an international conference in Belgium and as a result of expressing the challenges of developing IT for teacher education was invited to give the Keynote speech for SITE'91 in Greenville North Carolina(Davis, 1991). The Associations formed close collaboration to the benefit of both. As the older but smaller organization, which aims to promote both good teacher preparation and scholarship, ITTE struggled to support the international community. However, ITTE was happy to support the growth of SITE and certainly has grown both in numbers and in participation across the world.

Why does the society need a panel on international collaboration?

The Society for IT in Teacher Education is an international Society that actively promotes collaboration for the benefit of its membership and the scholarly field. The current Vice President for International liaison is Niki Davis, the leader of this panel. In addition, there are at least three reasons to incorporate a global dimension in teacher education:

1. The context for education is becoming global
2. Communication and other technologies are being used to increase access to education on a global scale
3. Taking a global view can enhance teacher education through the provision of stimulating rich contexts for critical reflection.

At last year's SITE'99 conference Niki Davis argued this in some detail (Davis, 1999) referring firstly to the commercial situation, which is now possibly more influential that national politics:

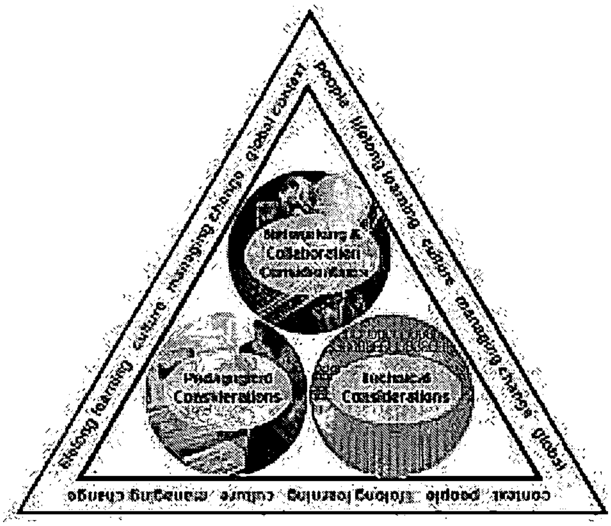
> As teacher education moves towards more complex organizational arrangements of collaboration and competition at different levels, we are following similar trends in commerce and industry pushed and pulled by Globalization. Dauphainais & Price (1998) edited together the views of prominent chief executives under six themes, with the first as Globalization. The others were radical change, leadership, culture, innovation and customer service. The five latter themes are already challenges in teacher education and this paper suggests that we must also face up to our role in the globalizing of our cultures as workers across the world struggle for job retention and standard of living enhancements made possible through the *"uncoupling of the corporation from the nation state. Rapid free flows of technology, capital, and employment contribute to this 'global village' effect." (p21)*

In that SITE'99 paper provided suggestions of exemplary technology resources linked to SITE's Principles for technology in teacher education as well as a framework for curriculum development created by the international T3 project working across Europe (Davis and Tearle, 1999). Both Wim Veen and Niki Davis may use T3 Core Curriculum within the panel discussion, see Figure 1 for the holistic treatment of the three main dimensions bound together by lifelong learning, globalization and management of change:

1. collaboration & networking

2. pedagogy
3. technology

Figure 1. The T3 Core Curriculum International Principles



For the international dimension it is particularly important to pay structured attention to collaboration and networking. However perhaps as other panelists explore the socio-cultural dimension we will together suggest that all these dimensions are important to all programs of teacher education across the globe.

Educating for Agency across the globe

Bridget Somekh's view of developing and researching the international dimension in teacher education and technology will draw upon two major scholarly activities. She has led the Community of Action Research Network and its international journal since its inception with John Elliott and colleagues. More recently the work of the REPRESENTATION Project, sponsored by the European Union, which is using concept mapping as a tool to capture children's mental schema for new technology, has informed her views (see for example Baron, Bruillard & Dansac, 1999). Representation is a research and development project funded by the European Union through the Multimedia Task Force. Kathy Kikis-Papadakis, FORTH, Institute of Applied and Computational Mathematics, Greece, coordinates the project. The partners are INRP, France; Orfeus, Denmark; MAC, Ireland; University of Crete, Greece; University of Amsterdam, The Netherlands; Open University of Catalunya, Spain; and University of Huddersfield, UK. Associated partners are IUFM de Creteil, France; and the University of Mons-Hainaut, Belgium.

The project has led Bridget to question to what extent existing education systems are capable of meeting the needs of today's young children, given the rapid infiltration of new technology into their lives. Bridget may clarify how the comparison across different countries and educational systems has enabled her to better argue that it is imperative to change some of the structural factors in education systems that currently prevent teachers from meeting children' needs. Her argument is that changes are possible that would enable us to use the capabilities offered by new technology tools to meet the socio-cultural needs of local communities. Bridget will end by arguing that we should educate for agency, to produce teachers and young people who believe that they are capable of making a difference to existing systems and enjoy the challenge of change.

TeleLearning Professional Development schools

The North American experience of professional development through communications technologies also holds valuable insights into the collaboration across institutions and countries to create new professional communities. These communities "reach far beyond a school or university by including among their active participants teachers, students, undergraduates, and various other experts from a number of schools, universities and associations." Therese Laferriere and her colleagues in the TeleLearning Network of Centers of Excellence are researching and developing models of time and information management between and within sites (Laferriere, 1999). In this research they note the importance of providing opportunities for 'the construction of shared understandings of teaching and learning'. The panel may explore how close these are to the European T3 projects' core curriculum that includes a dimension for both 'pedagogy' and 'collaboration & networking'.

Central and Eastern European challenge

In addition to the fast moving changes of technology some countries are also experiencing enormous changes in their educational systems. Jerry Willis will reflect on the challenges of providing support through international collaboration from the USA to the Ukraine. Where colleagues are under such stress it can be difficult to avoid cultural imperialism. Yet there is no doubt that the challenges of a centrally imposed curriculum that has now been swept away, led to a reaction in education. At times there is evidence of a much richer appreciation of literature and culture than might have been expected plus an extraordinary appetite for study. Support for Ukrainians redeveloping their curriculum can have benefits for their supporters in promoting reflection of the important value for education across the globe. Such challenges to pedagogical and curricular change have also been evident in international collaborations between Western and Central Europe as in the MATEN project for example, which is developing on-line multimedia courses with colleagues in four central and eastern European countries including the Ukraine (Dovgiallo et al, 1998).

The panels' discussion questions

- What added value does an international dimension provide for teacher education?
- What are the keys points for implementing international collaboration?
- What are the important research questions relating to international teacher education?
- Should all courses of teacher education strive for an international dimension, or is only important for some? e.g. advanced postgraduate courses
- What can SITE do to promote international collaboration and support in teacher education?

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Integrating ICT into the Curriculum: A Case Study of the Irish 'North South' Project

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Abstract: Government Departments of Education in Northern Ireland and the Republic of Ireland emphasise the need to integrate ICT into the schools' curriculum. The training of teachers and student teachers is vital to the success of this integration. This paper reports on the North South ICT Project which was set up to contribute to these aims by involving teacher training in ICT in several areas of the curricula on both sides of the Irish border. The paper also reports on the Project's efforts to promote mutual understanding through ICT between pupils from two divided communities in Northern Ireland and pupils in the Republic of Ireland.

Introduction

Ensuring that pupils keep pace with the Information Society has been exercising the minds of policy makers in the departments of Education in Northern Ireland and the Republic of Ireland for several years. Agencies have been set up by both departments to implement quality ICT initiatives in schools. (Northern Ireland Network for Education http://www.nine.org.uk/ and National Centre for Technology in Education http://www.ncte.ie/index.htm). The integration of ICT into the curriculum is considered essential in these initiatives. The training of teachers and student teachers in the use of ICT in the classroom is also seen as imperative.

One initiative, the North South ICT Project, funded by both government departments of education and co-ordinated by the University of Ulster (UU) and National University of Ireland Maynooth (NUIM) was carried out during the academic year 1998-1999. The Project used a web-based computer conferencing system, Web Crossing and videoconferencing to link 20 student teachers from both universities, 26 teachers and 300 pupils in post primary schools in Northern Ireland and the Republic of Ireland. The pupils were in the age group 15 - 17 years. The collaboration led to a range of twelve cross-border curriculum-based projects on the theme of "This Island we live on", published as part of a website, www.ulst.ac.uk/thisisland/

The aims of these links were to increase ICT competence of student teachers, teachers and pupils in schools, to produce curricular resources through collaborative ICT school projects and to use ICT to foster collaboration and mutual understanding on both sides of the Irish border.

The term ICT is a wide one and whilst many aspects of it were included in the North South Project, the emphasis was on the 'C' element of ICT, namely communication. It was a key factor of the Project that this subset of ICT remained inside the curriculum (Misanchuk et al 1997; Austin 1995; Riel, 1992; Teles and Duxbury, 1991).

Data Sources

This paper evaluates the North South Project from the perspective of practice and attitude towards the integration of ICT into the curriculum. Evidence was gathered by use of questionnaires, pre and post Project, issued to all participating teachers and student teachers. Focus group interviews were carried out with teachers and pupils in 4 schools and with teachers only in 4 other schools. An external report was incorporated into the final internal evaluation. In addition, all student teachers in Northern Ireland who were involved in the Project produced evaluation reports on the North South Project as part of their final assessment.

Also, as part of the overall evaluation, student teachers and teachers were encouraged to contribute short progress reports to a specially created discussion, called *Reflections,* in the computer conference served by Web

Crossing. These and all other messages to conferences were regularly examined, as this was considered a valuable source of information. (Kaye, 1991; Harrington and Hathaway 1994; Marttunen, 1997).

Training in ICT

Integrating ICT into the curriculum at schools obviously needs the full co-operation of teaching staff, and training is essential. Government strategy emphasises the training of student teachers and teachers. The strategy adopted by the North South Project was to place student teachers in Project schools to work alongside subject specialist teachers and to provide them all with the necessary technical skills to enable them to fully participate in the project.

At the outset of the project one of the main concerns registered by teachers was their lack of technical skills. In January 1999, separate training workshops were organised in UU and NUIM to give participants hands-on experience of using both computer conferencing and videoconferencing technologies. These workshops were attended by student teachers, teachers and other school staff including ICT coordinators and in some cases vice-principals and principals. Project staff visited the schools in the following weeks to ensure the equipment was working properly and the appropriate settings were being used. Schools were also able to test the new equipment by carrying out trial videoconferences with NUIM and UU.

It was also noted that student teachers at both universities were taught ICT skills in different ways. At NUI Maynooth all Education students were obliged to participate in a basic course in ICT. A small number elected to take an additional course in ICT. The student teachers involved in the North South Project belonged to this latter group. Neither ICT course had a connection to students' subject specialism. For student teachers at UU, integrating ICT into their classroom activities ran parallel to their own subject specialist training, where computers formed an integral part of their learning at the university.

Strategy for Planning Projects

In early February 1999, a two-day residential meeting was held in Belfast to organise curricular projects. This was attended by teachers and student teachers from the 13 participating schools from both sides of the border, with representatives from the Department of Education Northern Ireland (DENI) Inspectorate, and academic staff from UU and NUIM. At this first planning conference in Belfast it was observed that teachers still seemed apprehensive about the new technologies despite the initial training they had received in January.

Teachers and student teachers were initially divided into subject groups to discuss areas of the two curricula where collaborative projects could be developed. Since the curricula in both jurisdictions differ significantly, this was quite a challenge. As common ground was established, clusters of two to three schools agreed to produce projects in Art, Design and Technology, English, Geography, History, Home Economics and Music.

Before the conference concluded, each project group was asked to complete a Project Agreement Form which outlined the details of the proposed project including the contribution of each school, a draft project timetable and agreed modes of communication within the project group. A prototype of the project website was presented at this inaugural meeting, showing where the curricular resources produced by the projects would ultimately be published. The potential use of digital cameras to complement project work was also demonstrated.

After 6-8 weeks work, a second meeting, to evaluate progress, was held in NUI Maynooth in April 1999. At this meeting teachers were encouraged to take more responsibility for the projects rather than depending too much on student teachers. This was in recognition of the fact that student teachers would soon leave the schools and that teachers should feel confident to continue with ICT without their support.

Integrating ICT into the Curriculum

Schools showed a lot of imagination in their choice of study and topics were chosen with care in order to accommodate the demands of the curriculum in both Northern Ireland and the Republic of Ireland. Projects all had a North South dimension in keeping with the theme "This Island we Live on". One history project, *'Ireland in World War One - Heroes and Traitors'* gave schools the opportunity of studying Irish Nationalism from a

southern and northern perspective. It also allowed pupils to examine in detail some of the historic figures of that era who had connections to both parts of the island of Ireland.

One teacher, who was involved in a second history project, called *'Ireland in World War Two'*, found that integrating ICT into her subject area had acted as a 'strong motivational factor' for the pupils. It had given the subject,' a clear, immediate and relevant purpose', making them see 'history as a living subject'. Again, the cross-border perspective was very valuable in enabling pupils to see a fuller picture, e.g. the effects of World War Two on one part of the country that was a combatant and another that was neutral.

A student teacher involved in one of the schools commented: *" Through the exchange of ideas pupils agreed that their learning was heightened and accelerated. The diversity of ideas also presented the pupils with further stimuli."*

The choice of a Yeats poem as an area of study was an example of a compromise. In Northern Ireland, schools were happy to incorporate it as a practice for unseen poetry for the Advanced Level Examination in English Literature while Yeats's poetry features on the Leaving Certificate syllabus in the Republic of Ireland.

Another English project, *My Place Your Place,* put the emphasis on creative writing, relevant to both curricula, while at the same time exploring local areas and presenting a flavour of each. One geography project consisted of a comparison of urban renewal in two cities, Dublin and Derry.

In another English project, *The Pity of War*, background information was presented on the 1916 battle of the Somme. This was connected to two World War One poets, and in turn to evaluations of their poetry, enabling pupils to see how the poetry could not be separated from the war. Information on Irishmen who fought in the war was connected to a creative writing exercise, thus bringing the whole experience of the poetry and its context to life.

The most rewarding experience for one of the Music teachers was when her pupils joined their counterparts across the border for a series of live musical performances via videoconferencing. On one occasion, the pupils had written a poem based on the theme of peace and reconciliation, and then set it to music. The song was performed live in a videoconference, with the two schools, north and south, taking turns to sing a verse.

For older pupils in particular, curriculum relevance was an important aspect of the North South project. Comments from pupils themselves, as they embarked on the project, indicated that their aspirations included increasing their understanding of subject. *"...Another reason why I got involved was that I am looking forward to getting other peoples opinions about Nationalism and World War 1."* Dialogue with distant collaborators led to new insights into the area of study. In general, adding to the body of knowledge of the pupils came in the form of another perspective. One teacher commented: *"The pupils have gained ICT skills and a deeper knowledge of history, with the added advantage of seeing events from other perspectives and gaining research and improved literacy skills".*

The importance of learning through relating to others by computer is emphasised by researchers (Kaye 1991; Austin and Mendlick, 1993; Harasim et al, 1995; Marttunen, 1997). The North South Project is an instance where different perspectives on a topic coming from Northern and Southern pupils enabled such collaborative learning. Many pupils highlighted the importance of another perspective, especially in the study of history.

ICT in Cross-Curricular Themes: Education for Mutual Understanding

Evidence showed that the North South Project involved both 'intentional' and 'experiential' learning, (Lewis, 1997) the latter often taking the form of cultural awareness. Because the schools chosen included those from within the Catholic sector and State sector (mainly Protestant pupils) in Northern Ireland as well as schools from the South, this cultural awareness was a three-way process. The need for increasing cultural awareness was reflected in the following comment by one Northern pupil: *'Forming links with other schools is needed especially with the way our country is at the moment'.*

Broadening horizons was very much a part of the North South project as pupils engaged in voyages of discovery of their own and others' areas. The '*My Place Your Place*' English project provided many opportunities to investigate locality (Riel, 1992) under several headings, including local personalities, local writers, colloquialisms and more. In a sociology/home economics project called *The Family* the study of two social security systems gave a valuable insight into the similarities and differences that exist on both sides of the Irish border. The *Transport* project, which drew in pupils from Design and Technology and Geography involved surveys of modes of transport used by pupils coming to school, concentrating on traffic congestion, a problem experienced both in Dublin and Belfast. Investigation of urban renewal in Derry and Dublin in another Geography project allowed pupils the opportunity of witnessing many similarities in city life on both sides of the border.

The different perspectives of pupils on both sides of the border were an integral part of the history projects. All of the projects were designed to open up pupils' minds and make them aware of life in two divided communities in Northern Ireland and also life on the other side of the Irish border. This filled the need of pupils as expressed by one teacher, "to find common culture in their daily lives."

Robinson (1995) warns of the danger of stereotyping caused by passive use of media. However, active use of media can present a different picture. Research has shown that impressions of Northern Ireland change when young people from other countries have direct contact, using electronic communications, with young Northern Irish people (Austin, 1997; Austin and Mendlick, 1993; Smyth, 1999). In the North South Project, pupils from the South were introduced to "ordinary" pupils from both communities in Northern Ireland who live normal lives not dominated by "the Troubles".

The Process of Learning using ICT

The use of video conferencing and Web Crossing enhanced interaction within and between project groups. Pupils were able to share ideas and experiences as well as text and image files. Video conferencing was new to the majority of pupils, student teachers and teachers involved in the project. While this proved to be an exciting experience for most, it also needed at least one attempt before student teachers and teachers felt competent with it. Student teachers felt that structured video conferencing, with a maximum of six pupils worked best and various strategies were used to put pupils at their ease. Video conferencing proved to be the highlight of the North South Project for pupils who were excited by the prospect of "seeing and talking to people over a hundred miles away". Most project groups took part in at least two videoconferences.

Teamwork

Teamwork in the North South project existed on two levels, within each school and inter-school. Access to different perspectives because of the different backgrounds of participating schools was one of the main benefits accrued from this teamwork. The benefits of co-operation and collaboration made possible by computer and video conferencing (Robinson, 1995; Lewis, 1997) were evident in all projects to varying degrees. Working as part of a team was one of the most important skills acquired, according to pupils interviewed.

Collaboration was, however, impeded at times because of difficulty of access to computers. There were not enough opportunities to gain a lot of practice with video conferencing, as these synchronous conferences were notoriously difficult to arrange between schools. Findings also suggest that better collaboration might have occurred if access by pupils to Web Crossing had been more frequent. Also in order to increase academic interaction, more guidance from teachers and student teachers would be needed, as this type of academic debate was a new experience for pupils. There is evidence of better social interaction between pupils than academic interaction in Web Crossing. This is in contrast to the interaction using video-conferencing, where pupils were more relaxed when the focus was on work rather than on themselves.

ICT without the 'C'

All aspects of ICT, not just the communications element were utilised during the project. Student teachers found the North South Project gave them more confidence in putting computer packages demonstrated in their Education courses into use in a school environment. The majority of pupils got the opportunity of using a digital camera. In some cases, self-portraits were posted into Web Crossing accompanied by a digital photo. Others used the camera to take photos for inclusion in the finished product. Apart from using the Internet for communication purposes between schools, research was carried out using the World Wide Web and maps, diagrams and graphics were also cut and pasted from the Internet. Pupils also scanned pictures from textbooks to illustrate the project and used the computer for planning, drafting, editing and designing a layout for their publication; a minority of pupils used desktop publishing to present their project.

The Product

The collaboration on the North South Project culminated in the production of a total of twelve projects in seven areas of the curriculum. These were presented in the form of pages in the main website called "This Island we live on". This was seen as crucial in the integration of ICT into the subject area. Pupils had a tangible goal at which to aim. They looked forward to seeing their work on the World Wide Web presented as learning resources for other pupils to access. This was the "pay-off" recommended by Teles and Duxbury (1991) in the form of an electronic anthology. Evidence coincides with findings of Cohen and Riel (1986) and Austin (1995) that writing for an audience produced higher quality work. However, findings suggest that pupils should have been more involved in the completion of the project for the website, allowing them to engage in development of higher order critical thinking skills.

Student Teacher and Teacher Collaboration in ICT

One aim of the North South Project was training student teachers in the integration of ICT into their chosen subject while at the same time being "ambassadors" for ICT in the schools in which they did teaching practice. A recent UK study into the effectiveness of ICT in schools shows that teachers are still quite sceptical about ICT improving the quality of learning. In particular, teachers felt that their perceptions of the value of ICT differ from those of the policy makers (Cohen, 1999). In the North South Project, incorporating ICT into the curriculum was seen as a problem by some of the older teachers, whose teacher training took place before the widespread use of technology. Evidence shows that the student teachers played a very active role and often took the lead in promoting ICT in schools. Even though many of them had very little experience of ICT, their enthusiasm was very evident from comments such as:

"Nine months ago I didn't know how to word process, never mind send electronic mail or videoconference, so this year has been one great, enjoyable introduction to ICT."

According to informal feedback obtained from school visits, one of the key issues which seemed to impede progress in projects was an over-reliance by teachers on the student teacher's technical skills. In the last term, as examinations approached, the student teachers felt the strain of this responsibility.

Because the student teachers were often seen as the local expert in the school, it was very important that they felt supported by the universities when technical issues arose. The importance of quick responses in Web Crossing was emphasised by all student teachers. Heflich (1996) draws attention to the role of outside agents, such as universities, in the successful implementation of online computer technology in schools. The link to the universities in the North South Project provided a 'comfort zone' as assistance with technological problems was always at hand. Although this assistance was, in theory, available to all participants in the Project, it was only the student teachers that took advantage of it.

However, it emerged in many of the teacher interviews that as the project progressed the teachers gained more confidence and practically all of them believed the project had given them a real appreciation of the potential of ICT as a valuable teaching tool.

While projects such as North South motivate staff, it is important that this energy and motivation is sustained in order to support the strategies of the Departments of Education in both jurisdictions to equip teachers and student teachers with the skills necessary to integrate ICT into the curriculum. The North South Project recognised that student teachers were only temporary members of staff in their practice schools and the duration of the Project may not have been long enough for ICT skills to be assimilated by full-time teachers. The strategy adopted therefore at the second face-to-face meeting in April was to put more focus on teachers' input and to invite schools to continue the work the following year, even without student teacher support.

Conclusions and Recommendations

The North South Project attempted to implement some of the ICT aims of the Departments of Education in Northern Ireland and the Republic of Ireland in its overall framework. Improved confidence and competence of student teachers, teachers and pupils in the use of ICT, its integration into the curriculum and as a vehicle for

cultural awareness were outcomes of the Project. Technical support from the co-ordinators at the universities and also, in some cases, assistance from ICT technicians in the schools resulted in much greater awareness of the potential of ICT. As well as academic interaction, there was evidence of social interaction, particularly visible in Web Crossing. Access to different perspectives was considered to be very valuable.

The greatest challenge to the use of ICT, from the teachers' perspective, appeared to be restricted access to the Internet. Better online facilities in schools would facilitate more regular pupil involvement, resulting in more frequent communication. Increased training of teachers in the use of ICT would lead to a better 'comfort zone' around computers and hence more confidence in using them. Correct timing for the Project was another factor determining its success. All schools interviewed considered that the first term would be more suitable for such projects because teachers are less busy with examination classes, and student teachers are less busy with their own studies.

Opportunities to follow through these issues will arise in a new project entitled "Dissolving Boundaries through Technology" which will involve 25 schools on each side of the Irish border and will run from 2000-2001.

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A Modular Approach to Education – Its Application to the Global Campus

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Abstract: A range of pedagogic, administrative, socio-economic, structural and resource issues surround the establishment of a global campus. This paper identifies and discusses such issues, and suggests that pedagogic aspects are paramount. The limitations of conventional subject-based approaches are considered, and local experience in curriculum design and module integration is discussed in the context of flexible learning, wider access and participation. The need for a range of learner support mechanisms is indicated, and our implementation (together with others) is described. The concept of a global campus is underpinned by appropriate technological developments. Internet- and Web-based experience is discussed, as is the need for more radical approaches such as Virtual Reality techniques.

Introduction

The nature of higher education (H.E.) is changing globally: the convergence of wider access demands, greater emphasis on vocational preparation, new teaching and learning delivery mechanisms, and the emergence of globalised economies is propelling forward-looking H.E. institutions into careful self-analysis. At the same time, many countries (for example, U.K., Australia, U.S.) are witnessing a withdrawal from state-funding for both H.E. institutions and for student maintenance costs. With other but equally significant structural and resource difficulties, developing nations also share these problems (Koul, 1995)

As well as financial challenges, certain global trends are beginning to emerge. Valcke and Vuist (1995) describe experiences in the Netherlands that matches our local experience in the UK. Demographic changes mean that the profile of the traditional student is becoming older, often working or balancing the requirements of other family/career commitments: this implies a growing demand for increased part-time and more flexible learning provision. An increasing number of UK institutions have adopted a modular approach to course design and delivery – see, for example, George, Murfin, and White (1992). At the same time, there are many pressures for more effective teaching and learning delivery mechanisms. Active learning, student-centred and case-led methods are now accepted parts of the educator's canon (Rogers [1991]), and such changes have been growing in influence since the late 1980s. What is now emerging as a radically different and (potentially) revolutionary change is the use of Internet- and Web-based delivery channels.

Open Learning and emancipation

Before discussing such issues, it is worth recalling that one of the strengths of an open learning approach is what Reid (1995) refers to as an 'emancipatory tradition' - the barrier-dissolving aspects of such learning. Such emancipatory aspects are principally associated with learners previously denied access to education and assume a much wider relevance within the context of a global campus. Reid (1995) directs our attention to 'structural constraints' relating to institutional, social, cultural, and political/economic factors. While the cost of commissioning and building new higher education institutions may stretch the financial resources of the developing countries, the ability to 'tap' in to such programmes of study offered via the Web may be of great emancipatory, as well as economic, potential.

This implies fundamental challenges for the future of higher education. Dolence (1995) suggests that these challenges stem from the use of an educational model developed from and for an industrial model of society. Is this appropriate in what Dolence calls an 'information model' of society? Is the cost model of such a paradigm still valid given the nature of such an "Information age"? Can the higher education sector ignore the potential of technologies such as Web-based 'push' technology, 'click-thru' mechanisms, video-conferencing, and virtual reality models?
In a wide-ranging survey of current thinking about pedagogical issues facing H.E. Diana Laurillard articulates the necessity of 'situation-learning' (Laurillard, 1993). Such learning implies that "the acquisition of inert concepts (e.g. algorithms, routines, decontextualised definitions - i.e. the stuff of many university courses) is of no use if the student cannot apply them...[We] have to use our knowledge in *authentic activity*, i.e. genuine application of the knowledge; this allows us to build an increasingly rich understanding of the tool itself and how it operates" (page 17). Here, the application of Virtual Reality models and techniques offers potential for implementation of 'authentic activity' and 'situated learning'.

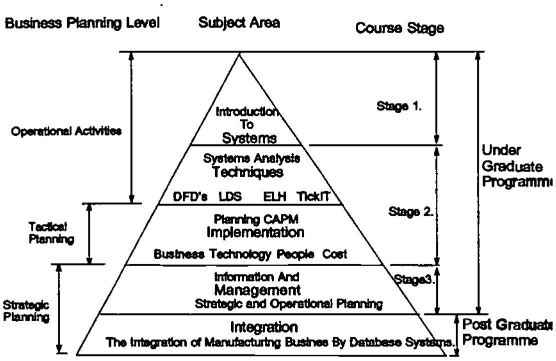
Globalised education

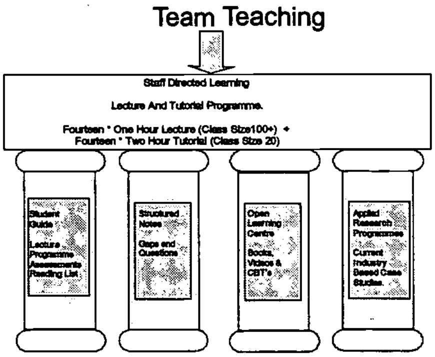
The idea of a globalised higher education sector - a 'global campus' - implies administrative, pedagogic, operational, and technical issues, and the Virtual Online University (www.tcet.unt.edu) offers an interesting metaphor for the learning 'cyberspace'. It is structured around a virtual campus, designated as a 'MOO' (an Object-Oriented Multi-User Dimension), around which students can wander as they would around a physical campus. At the same time, the range of courses offered remains very traditionally 'subject-based'. Is this appropriate to such a new learning environment?

Such an environment may well present a lack of unified focus for learners. Laurillard (1993) draws attention to the decentralising effect of new technology. She argues that this can push forward a very fragmented view of knowledge. This is opposed to, what she typifies as, 'academic knowledge', which has an integrative function different from simply 'knowledge'. It is this reflective aspect which is likely to prove difficult to deliver in the information model described by Dolence (1995). Learners in a virtual campus may well require a much stronger structural identity. It is, therefore, important that there is a strong conceptual platform that integrates and preserves a sense of intellectual and discipline consistency.

Local implementation

At a local level, we have attempted to incorporate such issues and challenges within a conceptual and pedagogic framework for the education of information engineers. A set of modules has been implemented within a conceptual framework entitled Systems, Techniques, Implementation, and Integration (STIMI). An outline of this is shown in figure 1 (The STIMI Progression). In stage 1, the concept of systems and systems thinking is introduced to students. This theme is elaborated in separate semesters in stage 2. The first emphasises the usual systems analysis techniques of process, data, and event modelling. Implementation within the context of Computer-Aided Production Management (CAPM) is combined in the second semester. By stage 3, management and management-information related issues are addressed by examination of strategic and operational planning aspects. The integration of 'islands of automation' within the context of manufacturing businesses is the prime concern of the postgraduate programme. This module is designed to enhance the learning experience of those continuing students who wish to pursue their studies at this level, together with providing a firm base for external students entering the programme from a wide range of industrial and educational backgrounds.





The basis of delivery for the modules is illustrated in figure 2 (Support for Module Teaching programmes). A body of structured teaching material (linked and sustained by four pillars that rest on the STIMI conceptual foundation) has been developed to minimise duplication of content and to provide a common platform for delivery. Following Race (1989), this incorporates a range of techniques developed from Open and Distance Learning models, such as self-assessment questions and other developmental questions and activities consolidated within the text.

The particular problems of part-time students, those students beginning their studies at differing entry points, and students who require extra support are recognised, and are of especial relevance within the context of this paper. Such students have significant demands placed upon them by work and family pressures so such students can also access this material via the University web site. Open and distance learning material may appeal to university management because of its apparent cheapness, but such students are likely to require significant support mechanisms. They may be unfamiliar with the nature of independent learning implied by a higher education programme of study. How are such mechanisms to be implemented and managed given an electronic local campus, let alone a 'global campus'? Learner support in the global campus will rest upon two pre-requisites: learner support and technological delivery mechanisms. We will address the latter aspect later in this paper. For now, we wish to describe briefly some of the issues involved in supporting widely-dispersed learners. Such learners may well be dispersed temporally as well as geographically. The use of packaged material (CD-Rom, text-based and other resources) is the conventional means of handling knowledge content. But how can learners benefit from a shared learning experience? Romiszowski (1995) describes how a co-operative programme can be established, and can be extended by various Internet and Web-based technologies - bulletin-board conference facilities, email, links to resource materials (virtual museums, virtual libraries). All of these offer significant potential as an integrated collaborative platform.

Distributed learning

Such initiatives still, however, rest upon a traditional view of teaching and learning. The support of Distributed Learning paradigms should now be considered. Distributed learning is founded on the belief that the personal needs of the student are paramount. Academic institutions can evolve courses based upon modules (STIMI), that can expand choices for students whilst maintaining educational quality across location and time-bound constraints, as well as providing the student with a more self-paced, self directed, career-biased learning experience. A distributed learning environment can essentially be stand-alone with a single subject/operator or can be linked via with a common database and/or other systems into a distributed system/servers. The common database may either be held centrally (and modified if required by each system/server) or local copies can be used with changes highlighted to the other components of the system/network. For example, for a design engineer a distributed learning environment is desirable, but design engineers can be trained individually. For other learning contexts, it is mandatory, especially where teams of operators interact in command and control of resources. An example where a distributed environment would be mandatory is in Air Traffic Control where visualisation of air space needs to be accessed and controlled by many operatives.

Technological aspects

One of the potential problems with distributed learning is data transmission rates over networks. Optical Fibre technology has developed such that within the near future transmission rates of 10 Gigabits sec^{-1} will be possible over broad band optical networks (Chan, 1995). A current or near term technology is the so-called "DVD" CD-ROM (Bell, 1996) where data is written to a multiple layer CD. This technology gives the CD-ROM the capacity to store up to 17 Gigabytes on a single disc with a data rate capacity of 11 Mbits sec^{-1}.

Such technologies (given development) are of direct relevance to Distributed Learning and its application, by affording a platform for the development of such teaching aids as Virtual Reality (VR). Given the inherent ability of VR to display three or multi-dimensional properties of objects to a operator its uses in teaching and training are virtually endless. It must, however, be remembered that VR is essentially only a display tool and therefore cannot fully substitute for other forms of learning. It is also important, given the growing importance and development of VR technology, that VR itself should be taught as a module at core level (STIMI). Being a multi-disciplinary subject it can only be taught at a relatively high level. It should however become a mandatory subject in all information technology courses even if minimum time is devoted to it (Elson, Simms [1997]).

Table 1 below lists some potential applications for VR in teaching. This list is not meant to be complete and many other applications may occur to the reader.

Table 1: Some Uses of VR in education

Subject	Use
Physics	Motion, Orbital Mechanics, Gas Physics, Multi-dimensional analysis
Chemistry	Structure of compounds, molecules
Biology	Structure of organisms, behaviour of organisms
Earth Sciences	Earth observation, landscape
Geography	3-D structure
Geology	Structure of fossils
Engineering	CAD/CAM
General	Display and analysis of multi-dimensional data

For basic tutorial type work the basic technology already exists with PC's and CD-ROM's. For more extensive use lightweight cheap helmet-type displays need to be available along with the appropriate computer technology (fast networks delivering M-Bytes $sec^{-1)}$

In conclusion then, the Global Campus is a rapidly developing field with many potential applications. It has direct application to teaching and training at many levels. Educators should be made aware of the capabilities and limitations of the technology. Distributed systems are required for its effective use. The concept of a Global Campus offers a useful metaphor for the delivery of a new mode of education, supported by fast and flexible delivery mechanisms.

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Information and Communications Technology: Teachers' and Students' Preconceptions and the Implications for Teacher Education

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Abstract: The authors have for some time been concerned with notions about *information and communications technology* (ICT). The term has only recently come into use in the UK, where *information technology* (IT), had been previously used. Elsewhere *IT* is still common as is *Telematics* or *Informatics*, even when the term is agreed there seems little consensus as to its meaning. Although there might be some agreement between teachers, the authors are not sure this extends to their students. Within the constructivist tradition, it is considered vital that teachers understand and take account of the preconceptions of students for successful learning to take place. Where no shared understanding exists, planned learning is unlikely to happen. This paper introduces a research project investigating the preconceptions of teachers and their students and, with reference to initial findings, identifies possible implications for teaching, particularly in the context of teacher education.

Definitions of ICT

The development of integrated circuits and in particular very large scale integration and microprocessors in the 1970s led to what has been widely called the second industrial revolution. In the early 1980s, the term *information technology* (IT) was being used to describe the resulting microelectronics-based computers and associated technologies. At this time, the newly developed microcomputers started appearing in schools, with peripherals and software. In the UK, in response to perceived challenges to competitiveness in microelectronics industries, government initiatives to support IT in industry and in education were launched. It was generally assumed that IT included computer hardware and software artefacts and functions but no single definition was dominant. In the UK a number of organisations and individuals gave their own definitions including, IT:

is 'the technology associated with the communication, storage and retrieval of data' (Chandler, D. 1984)

'includes matters concerned with the furtherance of computer science and technology, design, development, installation and implementation of information systems and applications' (San Diego State University 1998)

There are many more, but in particular from the UK central government education department, IT is:

'the technology associated with the handling of information: its storage, processing and transmission in a variety of forms by electronic means, and its use in controlling the operation of machines and other devices' (Her Majesty's Inspectorate, Department of Education and Science 1989)

'the use of technology to process information by the use of computers or electronic telecommunications' (Her Majesty's Inspectorate, Department of Education and Science 1991)

'the acquisition, production, transformation, storage, and transfer of data (information) by electronic means – in forms such as vocal, pictorial, textual, and numeric – so as to facilitate interactions between people and between people and machines. It also includes the applications and implications (social, economic and cultural) of these processes' (Mansell, J. et al 1987)

Even where definitions are published by the same organisation, then, there is not necessarily an agreement. Most definitions do include reference to microelectronic technology and its use in dealing with information

(rarely differentiated from data), with varying degrees of detail. Since there is then no authoritative definition of ICT, for the purpose of this research the authors have taken the Further Education Unit (Mansell 1987) definition as a convenient starting point.

In UK education, in 1988 the National Curriculum for England and Wales was enacted. This included statutory Programmes of Study for IT Capability for all school students in maintained schools from 5 to 16 years, and Statements of Attainment for assessment and reporting learners' progression in IT Capability, which were published in 1990. The IT elements have been revised since (1995 and 1999) and now, termed ICT, include the definition:

'ICT is used to refer to the range of tools and techniques relating to computer-based hardware and software; to communications including both directed and broadcast; to information sources such as CD-ROM and the Internet, and to associated technologies such as robots, video conferencing and digital TV' (Department for Education and Employment 1999)

It is worth noting that the UK government has also introduced the statutory Initial Teacher Training National Curriculum for the use of Information and Communications Technology in Subject Teaching (Department for Education and Employment 1998a), relating to this definition of ICT. This includes discrete and compulsory *Expected Outcomes* in ICT for all students graduating after 1998. To accomplish the government's targets that 'serving teachers should generally feel confident, and be competent to teach, using ICT within the curriculum' and 'most school-leavers would have a good understanding of ICT' by 2002 (Department for Education and Employment 1998b), a major programme of continuing teacher education has also been established for practising teachers. This is based on published competencies by the Department for Education and Employment reflecting the initial teacher education expected outcomes and the published definition of ICT.

Meaningful learning

Ausubel (1968) used the term *meaningful* for learning that related to a learner's own constructed knowledge, indeed he considered 'the most important single factor influencing learning is what the learner already knows'. This sentiment certainly relates to classroom experience where teachers will generally agree it is much more effective to start 'where the student is' then move to new knowledge, skills and understanding than making inappropriate assumptions and see little learning. Driver (1983) undertook her highly regarded research in science education on this theme identifying the *alternative frameworks* students construct and, when in conflict with the framework the teacher intends communicating, prove a barrier to learning. She fully concurs with Ausubel's (1968) statement that 'preconceptions are amazingly tenacious and resistant to extinction', recognising the importance of the teacher understanding those preconceptions and designing learning experiences accordingly.

The authors see this as relating to teaching and learning in ICT. Although the issue of knowledge acquisition is less significant than developing skills and gaining understanding, it is as important that these are *meaningfully* developed, through a clear understanding of students' preconceptions. To gain some insight into the issue of alternative preconceptions a research programme was set up to discover what students (15-16 years old) understand by ICT. In addition, the same was attempted with teachers and initial teacher training students, for whom the research was extended to also find out what their expectations were of their students' preconceptions.

Methodology

It was considered inappropriate to ask subjects to define ICT since initial work indicated this would at best result in rote-learned definitions, students being well practised in giving teachers the 'right responses', that is those that the teacher wants to hear. This is no less true of teachers and student teachers. For the initial research then, a questionnaire was prepared asking subjects to identify items listed as examples of ICT by choosing *yes*, *no* or *not sure*. The items were chosen to reflect the preferred definition and to include examples of audio, graphical, textual and numerical media; acquisition, production, transformation, storage and transmission

functions. The items for each included what the authors considered to be strongly, weakly and unlikely examples of ICT. For example, for audio transmission:

Megaphone
Radio
Mobile phone

were listed. In addition, items that did not fit into any one category were included, such as:

Internet
Automatic doors
Air-cushion trainers
Books

In all 90 items were listed, in alphabetical order. For teachers and student teachers, two lists were given one for their own responses, the other for their expectations of the response of a typical 15-16 year old. In addition, teachers and student teachers were asked to identify their own Gender, Main teaching subject, Age band (five bands).

The initial results discussed below come from:

314 student returns, 48 teacher returns, 36 student teacher returns

The students and teachers were asked to complete questionnaires in the autumn of 1999, the range of schools was selected to approximately represent the comprehensive education of males and females between 14 and 16 years old and in London, and includes single sex and co-educational schools. Approximately 20% of dispatched questionnaires were returned completed. Very few items were not responded to, blank returns being considered insignificant. The data received represents the first phase of a bigger project targeting receipts from up to 5000 students and 1000 teachers, and from that quantitative survey follow-up interviews will be undertaken.

The student teachers were post-graduates following subject-based programmes for teaching students of secondary school age (11-16 years). All attend one University in South London and were mixed in terms of age, gender and main teaching subject. This data was also collected in autumn, 1999. These represent limited samples for quantitative research, yielding only indicative results to which further, more substantial data sets will be added as the project progresses.

The initial analysis determined the degree of confidence each group demonstrated in choosing *yes* for each item, that is in considering the item *was* an example of ICT. This was calculated by comparing the proportion of *yes* responses to *no* and *not sure* responses giving a value of between +1.0 and -1.0 for each item. A band of confidence measures between +0.33 and –0.33 was considered adequate to cover confidences calculated from non-significant data, that is responses that could have occurred by chance alone. Values above +0.33 were identified as having high confidence as examples of ICT and probably representing a tacit understanding of ICT.

The data for each subject group was formatted as ranked lists of items (Tab. 1), although there was some clumping of rankings and the size of the differences in confidence varied the ranked lists are useful indicators of these tacit ICT definitions.

STUDENTS OWN	STUDENT TEACHERS' OWN	STUDENT TEACHERS' EXPECTATIONS	TEACHERS' OWN	TEACHERS' EXPECTATIONS
internet	*computer*	*CD-ROM*	answering machine	*Computer*
worldwide web	*worldwide web*	*computer*	barcode	*electronic mail (email)*
computer	cable television	*internet*	*CD-ROM*	*internet*
fax	*CD-ROM*	*worldwide web*	*Computer*	*worldwide web*
CD-ROM	*digital camera*	*electronic mail (email)*	credit card reader	*laser printer*
electronic mail (email)	*fax*	pocket television	*electronic mail (email)*	*spreadsheet*
word processor	*internet*	*scanner*	*fax*	playstation / games console
broadcast television	*mobile phone*	*word processor*	*internet*	*word processor*
answering machine	*word processor*	*digital camera*	*worldwide web*	*fax*
security cameras	broadcast television	*satellite television*	*digital camera*	*scanner*
satellite television	calculator	playstation / games console	heart-rate monitor	spell checker
mobile phone	CD player	*fax*	lottery terminal	*CD-ROM*
teletext	credit card reader	*laser printer*	*mobile phone*	LCD (computer screen)
barcode	*electronic mail (email)*	*mobile phone*	*satellite television*	projector
credit card reader	lottery terminal	cable television	*teletext*	*mobile phone*
cable television	public telephone	music sampler	*word processor*	*satellite television*
scanner	*satellite television*	radio	baby alarm	*digital camera*
heart-rate monitor	*teletext*	robot	burglar alarm	*teletext*
LCD projector	LCD (computer screen)	*spreadsheet*	cable television	credit card reader
spreadsheet	projector	*teletext*	cash card	barcode
laser printer	barcode		phone card	cash card
pocket television	radio		spell checker	lottery terminal
audio / music CD	speedometer		video editing suite	security cameras
spell checker	*spreadsheet*		pin number	
robot	traffic lights		pocket television	
radio	audio / music CD		*spreadsheet*	
traffic lights	answering machine		telephone redial	
digital camera	cash card		broadcast television	
CD player	cassette recorder		camcorder	
calculator	digital watch		cash till	
photocopier	hearing aid		LCD (computer screen)	
baby alarm	heart-rate monitor		projector	
public telephone	photocopier		playstation / games console	
burglar alarm	pocket television		security cameras	
	scanner		traffic lights	
	security cameras		public telephone	
	baby alarm		*scanner*	
	camcorder		CD player	
	cyberpets		digital thermometer	
	laser printer		digital watch	
	microphone		*laser printer*	
	music sampler		radio	
	spell checker		calculator	
	video editing suite		cyberpets	
	books		synthesiser	
	burglar alarm		audio / music CD	
	cash till		hearing aid	
	cassette tape		robot	
	central heating controls			
	morse code			
	phone card			
	pin number			
	telephone redial			
	train timetable			

Table 1: Ranked items chosen as examples of ICT with high (>+0.33) confidence (common items shown in italics)

Subject group	*Items identified(/90)*
Students	34
Student Teachers own examples	53
Student Teachers expectations of Students' examples	20
Teachers own examples	47
Teachers expectations of Students' examples	22

Table 2: The number of items identified as examples of ICT with a high degree of confidence

Results

The numbers of items confidently chosen as examples of ICT varies considerably with a clear indication that teachers and student teachers include a wide range of items in their own definition of ICT while including a much smaller range in predicting student responses (Tab. 2).

Within the items identified by the data from each subject group there are fourteen items common to all data sets, these largely represent visual media with only one example each of sound (mobile 'phone) and numerical types (spreadsheet). The extent of this difference is not as marked in individual subject groups.

Conclusions

The data sets used are small and to some extent lack reliability, particularly in terms of validity, however they do indicate possible trends. The expectations of teachers' and student teachers' definitions of ICT thought to be held by students were very different from their own in terms of scope. In addition, they differ considerably from the students' actual choices that represent approximately, what one might expect (about 1/3 of items confidently identified as examples of ICT). There is some indication of underestimating students' understanding of the range and variety of ICT, and at the same time maintaining the very broad definition apparently held by their teachers. Although there is a core of common items selected, many more within students', student teachers' and teachers' definitions are not common across all groups, however mapping this core onto the selected definition shows all aspects to be covered in terms of examples. This does not in any way suggest the definition could be derived from the examples:

'the acquisition [*digital camera*], production [*laser printer*], transformation [*scanner*], storage [*electronic mail*], and transfer [*internet*] of data [*information*] by electronic means – in forms such as vocal [*mobile 'phone*], pictorial [*satellite TV*], textual [*wordprocessor*], and numeric [*spreadsheet*] – so as to facilitate interactions between people [*fax*] and between people and machines [*teletext*]. It also includes the applications and implications (social, economic and cultural) of these processes' (Mansell, J. et al 1987)

A survey of items largely categorised as *not* ICT or *unsure* includes games console, lottery terminal (National Lottery device used to electronically enter the draw and transmit data which is held centrally), lottery lucky dip (generates random lottery numbers) and cyberpets. These are all relatively high profile applications and might have been expected to be chosen. Synthesiser and plotter were also largely in the *not* ICT choices. These lead to speculation about the subjects' knowledge of the named technologies or perhaps the fact that questionnaires were completed in educational environments led subjects to ignore ICT outside that context. This condition is reflected in published case studies where traditional ICT applications are related, almost exclusively, as examples of good practice.

Despite these speculations, the ranges of items included in subjects' choices indicate a generally broad perspective on ICT although this also includes a great deal of uncertainty. This indication of uncertainty causes some concern, not only regarding the points made above about the need to understand the students' preconceptions to engage them in effective, planned learning but also in terms of clarity in the planning itself when intentions are unclear.

The indications outlined above emphasise the good practice of diagnosing the starting points of students, to inform planning for teaching and learning. This is perhaps less obvious in ICT education than in other, traditional and more knowledge-based subjects. Many of the definitions, particularly those promulgated by government departments, describe ICT largely in terms of tools to be applied elsewhere. It would be easy for a teacher to make assumptions about students' understanding while focussing on the application, possibly missing opportunities for students to also progress in their understanding of ICT. The other side of this is having inappropriate expectations of understandings and skills, obviating the achievement of any objectives or limiting the appropriate exploitation of ICT. For student teachers, these issues are compounded by their need to monitor and exploit their own uses of ICT. A first step in this might be to encourage student teachers to determine their own definition of ICT. By necessity, this will need to be flexible since the technology is continuously developing, as are individual relationships with ICT resources. Student teachers should also take advantage of time in schools to explore students' preconceptions, aspirations and situations in order to identify their needs and celebrate achievement. To understand their learners and to recognise the potential, both positive and negative, of ICT in their education, teachers and student teachers will need to share in students' perspectives on ICT and use or challenge preconceptions in a planned, considered approach.

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Promoting Collaboration in a European Context using Multimedia and the World Wide Web

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Abstract: This paper is a report on developments arising from the collaboration between a number of institutions and departments of teacher education under the European Commission SOCRATES programme. The background and aims of the developments involve the building of the "European dimension" through the use of multimedia and the World Wide Web into schools and teacher education institutions. In reflecting upon these developments in general terms, the role of telematics has played a crucial part in promoting communication, fostering the development of social relationships across the project team and facilitating the effects of synergy arising from this collaboration. Sustained and effective communication is seen to be the key to the success of such collaboration at all levels. A collaborative goal-oriented approach leading to purposeful activity can be seen as a common feature of the successful working of the project team, groups of student teachers and also pupils in schools.

Background and aims of the development

The EUROLAND project (1996-99) has been supported as an In-service training project under the Comenius 3.1 Action of the SOCRATES programme of the European Commission. It brings together partners from Austria, England, Finland and the Netherlands, in building the European Dimension into the curriculum of schools and teacher education courses (see also Hudson et al. 1997 and Hudson et al. 1999). The aim of the project is to develop the curriculum through the production of resources and teaching approaches with a cross-curricular focus at the upper primary/lower secondary school age range (8-14). The classroom resources are built around the use of a CD-ROM with simulations of and links to the World Wide Web. Teacher education institutions and departments lead the project in close collaboration with partner schools and teachers in each

country. The resources that have been produced by the project have been used as the basis for the development of pedagogical approaches with teachers on intensive in-service training courses, which have been supported under the Comenius 3.2 Action of SOCRATES. They have also been used with students in initial teacher education via the SOCRATES European Module ECOSCHOOL (1997-2000). This project has been supported under the ERASMUS Action of SOCRATES that focuses on development in Higher Education. The content of the EUROLAND project involves the geography, history, economics, sights of interest and aspects of day to day life of the participating countries. Further it includes opportunities for the development of literacy, numeracy and ICT skills in problem solving contexts relevant to real life.

Nature of the resources and tools

The CD-ROM resources are used in an integrated way within the classroom with an emphasis on group work and discussion. Through this activity, it is intended that pupils gain increased knowledge of the capital cities and countryside of Austria, Finland, the Netherlands and England. It is further intended to provide opportunities to develop:

- information skills in the use of maps, charts, timetables and tourist information literature;
- skills of numeracy, literacy and ICT through problem solving activities in a European context;
- decision making skills in real life contexts and
- a wider awareness, appreciation and understanding of other countries and cultures in Europe.

Full use of the resources is intended to address the three aspects of *Information, Activity* and *Communication*. Students use their ICT skills to access *Information* from the CD-ROM and the WWW. They engage in problem solving *Activities* through the activities section on the CD-ROM. Further they develop their *Communication* skills through group discussion and also their wider communication skills by utilising possibilities to link to the World Wide Web and to make use of the EUROLAND Discussion Forum for example.

Users

Currently the resources are being used in a number of schools in Austria, England and Finland. The materials have been used also by groups of teachers from across Europe as the basis for development and evaluation as part of the Comenius 3.2 In-Service training action. Courses have been held in Linz in April 1997, in Sheffield in July 1999 and a further course will be held in Sheffield in February 2000. As a result of the recent course in Sheffield, a EUROLAND "chat day" is planned for January 2000 involving school students from Austria, Finland and the UK, with further participants expected from the other countries. In addition a videoconference was held in November 1999 between Oulu, Linz and Sheffield as part of the European Commission Netd@ys Europe initiative. The main objective of this initiative has been to familiarise participants with the possibilities of new media such as multimedia and video-conferencing, with priority given to supporting projects based upon educational content rather than to technology. The focus of this videoconference was a comparison of prices of different shopping items in the three different countries, which took its initial motivation from the EUROLAND section on "shopping".

The ECOSCHOOL project leads on from EUROLAND developments by focusing on web-based learning and communication. It is a potential means of students and teachers discussing their use of EUROLAND although the project is not entirely dependent on the use of the CD-ROM resources. Accordingly the ECOSCHOOL project has two aims:

- to develop learning by using the WWW and email across Europe, and
- to learn about the social and economic aspects of the participant's home city.

The resources and tools being used are university email communications and the resources provided by the ProTo environment at the University of Oulu – *Project Learning Tools on the Web*. This is an open learning environment that has been developed at the University of Oulu. Students can access the ProTo system via the World Wide Web. They have a password that allows them to create simple web pages and enter messages on a bulletin board.

The participants are primary teacher education students from Linz and Sheffield together with students on an international teacher education course at Oulu. A more recent partner to this development is the University of Darlana in Sweden. This has led to the participation of a group of social studies student teachers from Falun in Sweden.

Theoretical framework

The pedagogical approach underpinning the EUROLAND development is strongly influenced by a socio-cultural communicative perspective, as outlined in Hudson (1998, 1999). This approach is underpinned by the notion of *Activity* whereby students are engaged in purposeful tasks that can involve group work, discussion, problem solving and the use of ICT. Some of the activity is computer-based whilst some is away from the computer. A full and active role for the teacher is envisaged that involves the introduction and structuring whole class activities, monitoring group activities, intervening with individuals and small groups and drawing the class together in whole group discussion where appropriate. The role of the teacher in a technology rich classroom is discussed more fully in Hudson (1997). The open-ended nature of the resources enables use by students across a wide range of capabilities.

The European Dimension

A key aim of the project has been to promote the European dimension and the use of ICT in teacher education across Europe. The design of the material and the pedagogical approach has, therefore, been developed to accommodate implementation and wider development.

Phase one developed the foundation for the project by focusing on resources for Austria. At the time of writing, the Finland section is practically completed and work is ongoing on the UK section. The CD-ROM contains content-based information with Web links, teacher's notes and classroom activities. The Web site provides information about the project and is the basis for evaluation activity and further development of the communicative aspects of the project. The first version includes multilingual audio tracks on the CD-ROM (English, Finnish, German and Dutch) and corresponding versions of the evaluation forms. The final phase of the project will involve the implementation of appropriate sections of the material in the languages of the partner countries.

Example of use

Links to the Web have been incorporated and a Web site for the project has been established. The Web site includes both EUROLAND and ECOSCHOOL forums. The former has been used mainly by teachers and pupils in participating schools whilst student teachers have been the primary users of the latter. This section of the paper gives an account of how the ECOSCHOOL project has developed in particular.

Initially students in each country worked in collaborative groups to produce a short illustrated report on one of the following aspects of their home city. This involved:

- a general description of the city;
- the environmental situation of the city;
- the employment structure and opportunities within the city;
- the regional or national education system.

Subsequently they presented these reports as web pages by writing them in to the ProTo learning environment. Figure 1 shows a page produced by the Sheffield students.

They also emailed their work to other students in the partner countries who were presenting the same topic. Once all web pages were complete, they read their partner's pages, asked questions and made comments about them on the bulletin board.

Each group evaluated their work using the same criteria designed by the tutors in each country. The tutors then read each group's pages, assessed the pages and provided feedback to the each group. The students' work was assessed against the criteria and graded A to C. The tutors posted written feedback on the bulletin board.

Three cycles of the ECOSCHOOL project have been completed; one is in progress at the time of writing. Figure 1 illustrates an example from the first cycle in which each group of students presented their own home city.

Figure 2 is an illustration of the activity in the second cycle. The aim of this round of co-operation was for students to share lesson plans and teaching ideas. Each group of students planned lessons with the aim of children learning more about their local town or city.

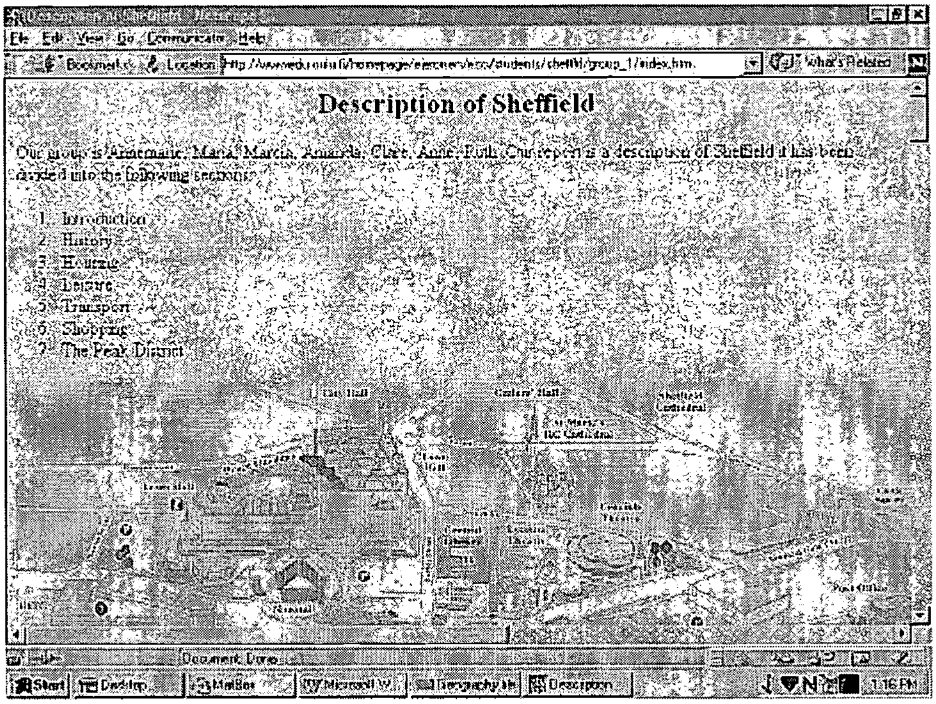

Figure 1: Work from the Sheffield students posted to the ProTo learning environment.

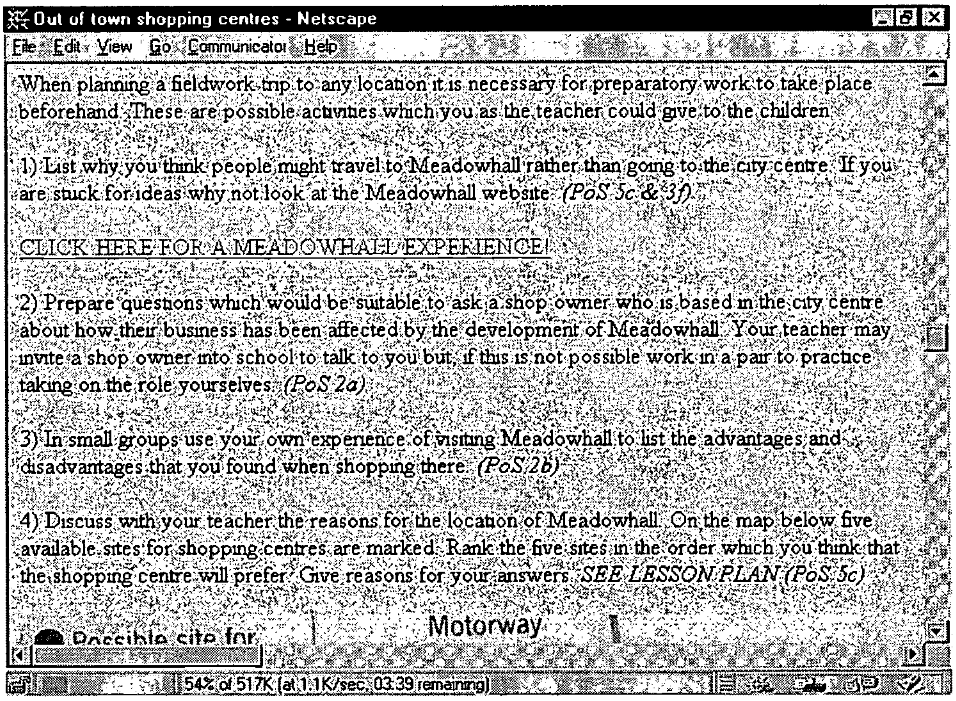

Figure 2: Teaching and learning about Sheffield

900

Evaluation

Evaluation has been an ongoing aspect of this development and has been built in as an integral part of the developmental process. Feedback has been gained from teachers involved in the in-service courses; teachers and pupils involved in classroom trials in the pilot schools and students on initial teacher education courses. The project Web site has been designed specifically to facilitate on-line evaluation. The evaluation of the use of the EUROLAND CD-ROM can be carried out in English, German, Finnish or Dutch.

With specific regard to the ECOSCHOOL project, the analysis of evaluation data for the first cycle shows that the students developed their ICT (Information and Communications Technology) skills and confidence during the project. The majority of students in all counties reported that they had linked well with their partner students by email and by using ProTo. A key issue was the demand for academic credit for their work, as this project was not assessed as part of their degree programme. The students who took part were motivated and enjoyed the process. This is significant and positive point as all the students had limited ICT skills at the start of the co-operation and many students viewed the creation of Web pages with some anxiety.

Evaluation of the second cycle revealed that communication between the students was not as frequent as in the first cycle. Reasons given for this lack of communication included the 'interruption' of the project by school teaching practice in the UK and Finland, and that students spent more time on constructing their own pages than communicating with their partner groups. This time the work formed part of an assignment at Sheffield Hallam University so the students received credit for the design of their Web pages and for the production of a report concerning the project. This pressure of assessment had two effects; it satisfied the students in the demand for academic credit, but it also reduced the importance of informal communication between the groups.

The ECOSCHOOL project has involved the use of ICT appropriately to support environmental and social learning. It has been successful in terms of developing ICT skills, subject knowledge and has provided the opportunity to compare different approaches to teaching and learning across the European Union. Sustained and effective communication is the key to such a project. This can be elusive and an important finding from the evaluation process is that placing too much focus on producing the resources can hamper communication.

Primary and secondary schools in the UK are now being connected to the National Grid for Learning and students need the skills and pedagogic understanding to use ICT as a medium for European and global communication. The ECOSCHOOL project has prepared teacher education students for developing communication projects when in school. One student has already set up a similar project whilst on teaching practice. In this example infant school children communicated via email with children in Bermuda and compared their localities, hobbies and homes as part of English and geography learning.

Discussion

The ECOSCHOOL project is running during the autumn 1999 with several new developments. The students are in internationally composed groups rather than from one single country; the focus of the project will be to choose an educational problem and present a solution to this by co-operating and communicating using ICT. The students can use email, create their own web pages, use ProTo2 (a more sophisticated version), or use the EUROLAND bulletin board at http://www.shu.ac.uk/services/lc/cmeweb/euroland/dgroups.htm.

It is timely to reflect upon the overall aims and objectives of the SOCRATES II programme of the European Commission which is the programme that is currently being phased in to replace SOCRATES I. This places the emphasis on lifelong learning as a means of fostering active citizenship and enhancing employability. The objectives contain many elements that can be seen to be very relevant to the experience of the project team with regard to the developments outlined in this paper:

- To strengthen the European dimension in education at all levels and to facilitate wide transnational access to educational resources in Europe while promoting equal opportunities throughout all fields of education;
- To promote a quantitative and qualitative improvement in knowledge of the languages of the European Union, in particular those languages which are less widely used and less widely taught, so as to lead to greater understanding and solidarity between the peoples of the European Union and promote the intercultural dimension of education.
- To promote co-operation and mobility in the field of education, in particular by:
  - encouraging exchanges between educational institutions,

- promoting open and distance learning
- encouraging improvements in the recognition of diplomas and study periods,
- developing the exchange of information,

and to help remove obstacles in this regard.

- To encourage innovation in the development of educational practices and materials and to explore matters of common policy interest in the field of education.

In reflecting upon these developments in general terms, the role of ICT, multimedia and the WWW or (more concisely) telematics has played a crucial part in fostering communication, facilitating the development of social relationships across the project team and also the effects of synergy arising from this collaboration. A core group of partners involved in these developments began their collaboration in the autumn of 1994 around a shared interest in environmental education and supported by the European Commission as a network, which met just twice a year. The communication between meetings consisted of fax only at that time. The transformation that has taken place since then owes much to the effects of telematics in fostering communication between project members and facilitating the current level of collaboration which has the potential to develop much further.

The successful synergy effects can be seen in the level of teacher and student exchanges between the partners and the level of joint teaching, curriculum development and evaluation and increasing levels of research and international dissemination activity.

Sustained and effective communication is seen to be the key to the success of such collaboration at all levels. A collaborative goal-oriented approach leading to purposeful activity can be seen as a common feature of the successful working of the project team, groups of student teachers and also pupils in schools. The role of telematics has been crucial to achieving this stage of development.

We believe that we have learned a great deal collectively from our experience and that there is enormous potential for further development. We hope that we have something to offer others who are interested in learning from our experience and look forward to benefiting from wider responses to our dissemination activities.

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TOWARDS A NEW CURRICULUM FOR PRE-SERVICE TEACHER EDUCATION: A RESPONSE TO THE CHALLENGE OF THE INFORMATION AGE

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Abstract: The information age challenges pre-service teacher education to change rapidly. This is the result of the catalytic impact of technology on the changes in society at large, and consequently on the changes in the role of learning and teaching in society. Therefore the challenge is not only that prospective teachers need to acquire the knowledge and skills to use Information and Communication Technologies (ICT) in education, they also need to learn a new approach to teaching and learning. In 1997 a national contest in the Netherlands challenged all Colleges of Education to put forward a proposal for the development and implementation of a new approach to teacher education, reflecting the needs of the information age. As a result two Colleges attained the status of 'Experimental College of Teacher Education'. In the four contributions of this panel the vision on education and the implementation after two years of experience are shared.

Curriculum Innovation between Care and Courage: National Curricula and Innovation Strategies in the Netherlands

In November 1996 a Dutch ministerial committee published a report about the transformation needed in education to meet the demands of the 21st century. The changes that are taking place in society are

characterized as a transformation from an industrial society to an information society. This transformation influences all levels of society and will have enormous impact on education. However, the consequences of this transformation can not be predicted, because the future is yet unforeseen. It is fundamentally impossible to foretell what new ways of education there will be in the future and the only senses we have are for today. This transformation requires a process of change in education of which the outcomes are unknown. According to the committee two parallel strategies are necessary to move from the old, present-day situation to the new situation. These strategies are characterized by the words 'CARE' and 'COURAGE':

- CARE for the existing system: how can we make innovations in the existing system, taking care of the present-day students and schools.
- COURAGE to start experiments that will give some outlook into the future: exploring new ways, new technologies, new methodologies.

A crucial factor in the dilemma of the combination of CARE and COURAGE is the extend to which the innovation of teacher education is based on explicit ideas about the future of teacher education. Often, the changes in the policy and regulations from the government are brought forth by problems in the present-day system and not explicitly by ideas about how society is changing and what the consequences of these changes are for education.

These two approaches of the innovation process should be really complementary: together they create a change process that is both realistic and innovative and in which teacher education institutions are able to innovate their curriculum along different routes at different speed according to the local situation and their potential for innovation.

Since 1996 both the CARE-line and the COURAGE-line have been present in two major developments concerning curriculum innovation in teacher education in The Netherlands:

1. The Minister of Education started a process to develop a 'national curriculum' for teacher education;
2. The Minister started a program on the implementation of information and communication technology in teacher education.

CARE: A National Curriculum

A national Process Management developed a project plan, in which they described their main aims to improve teacher education: Curriculum innovation: development of common curriculum guidelines and teaching goals for primary teacher education and secondary teacher education; Regional co-operation between the institutions for teacher education; Professional development of teacher educators.

In March 1998 the national curricula for primary teacher education and that for secondary teacher education were published. The underlying assumptions in the national curricula about 'good' teaching and learning and teacher education are that teaching is a pedagogical process and that good teachers are able to reflect upon themselves and the teaching situation in order to improve teaching and learning.

The curricula exist in three parts. The first part is the introduction to the national curriculum. The second part consists of quality standards that each institution for teacher education has to meet. These standards give an indication about the quality of the curriculum that must be developed on an institutional level, and give institutions a lot of freedom and responsibility in the actual translation of a national curriculum into a institutional curriculum. The third part of each of the national curricula contains the teaching goals for the general pedagogical part of the curriculum and for each school subject.

The national curricula mirror the existing views on teacher education in The Netherlands. They are important tools in the discussion about teacher education because they present a general view on teacher education, quality standards for all institutions for teacher education and general and subject related teaching goals that can be used to assure the quality of teacher education in The Netherlands. In this respect the national curricula represent the CARE-line.

COURAGE: Innovative projects, the experimental teacher education program and research

In answer to the committee-report the Minister of Education started a program on the implementation of multimedia and ICT in teacher education in June 1997. The main aim was to stimulate the integration of the

use of ICT in the curricula of teacher education. This was done by challenging the institutions to start projects and experiments based on new teaching methods, combining CARE for the existing practice and COURAGE for new way of educating teachers. In this way new 'emergent practices' evolved. These emergent practices in which ICT is used, will fit with the new ideas on education, in which concepts like active and self-responsible learning, problem-based learning and learning strategies play a central role. The program contained several elements: Institutional projects, Experimental teacher education program, Development of new educational software, Research on and monitoring of the use of ICT in (teacher) education, Regional centers of learning technology.

After a contest two institutes were designated to host an experimental teacher education program. The Ichthus Hogeschool Rotterdam conducts an experiment on a restricted base (elementary schol level, with each year an increasing number of students involved). The Amsterdam Faculty of Education, on the other hand, is transforming a whole large faculty that provides for 4000 students. In this SITE-panel both experimental teacher education programs are represented, together with people who conducted academic research during the development and implementation of the new programs.

The Courage-line and the Care-line have been separate developments in the period 1996-1998. The most important difference is the perspective: while the Care-line focuses on the system of today, the Courage-line focuses on the demands that the rapid changes in society place on education. This separation between both lines can be seen as a necessary phase in the innovation of teacher education. To start a transformation from present-day teacher education to teacher education for the future, it is necessary to have consensus about what good present-day teacher education is. By taking the initiative to develop a national curriculum for teacher education the government has defined the starting point of the transformation of teacher education towards the demands of the information society.

The simultaneous implementation of the national curricula and the Courage-program also has its problems. If emerging practices and experiments on new ways in teacher education have to fit in the national curriculum, within today's system of teacher education, the innovation is limited. When the experiments have to exist within the boundaries of the existing system, the existing educational model and the existing practices of assessment, it is impossible to really discover the possibilities the future has to offer. This is the challenge where the two experimental teacher education colleges have to cope with in implementing their visions and ideas of a new curriculum. After all, Care for the existing must lead to Courage for the new.

The Education of Teachers: A Change in the Concept of Curriculum is Needed

The Amsterdam Faculty of Education, which attained the status of "experimental teacher education" in the Netherlands through a national contest in 1997, is developing and testing a new curriculum concept for professional education, focused on meaningful learning. Education should reflect the way a professional works. This means that students, like professionals, work together on complex authentic tasks, and take control and responsibility with respect to their work, their learning processes and the way they will prove competence. In this concept, nicknamed "learning through producing", we integrate ideas on authentic learning practices, first-order and second-order learning, integrative assessment and electronic web-based portfolio systems. ICT is not used as an add-on technology, but the technology plays a role as catalyst of the curriculum transformation in the same way it induces changes in society. In our view, this new type of "dynamic" curriculum meets the needs of professional education in the information age.

Core Characteristics of the Experimental Teacher Education Program

Capable of managing change: Teacher Education should adequately prepare students for their profession in a largely unknown future. We cannot predict what that future will be like. However, what we do know is that in the decades to come there will be an increasing demand for professionals who are capable of coping with change and who can shape education in the information society – not only because teachers must be able to react quickly to changing circumstances in their teaching, but also because learning paths, in part due to rapid developments in information and communication technology, are becoming increasingly individualized. This does not necessarily mean, however, that learning is an individual activity. For teachers, this means that they, above all, as experts in guiding learning processes, must be able to shape their own learning processes.

Responsible Students: The program should offer students an environment in which they are indeed given the opportunity to shape their own learning processes. For this, students need to be given responsibility and they need to accept it - responsibility not only for the way in which they acquire the (constantly changing) competencies they will need in professional practice, but also for the way in which they demonstrate to the outside world that they have indeed acquired these competencies. To this end, at an early stage, the program offers students an environment that mirrors professional practice. In that environment, acting responsibly is related to real working situations. We view the program as a collection of facilities which students use to take responsibility for realizing their learning processes.

Freedom: In this environment, students have a considerable degree of freedom in filling in the details of their own learning processes. Our program operates in a context in which the requirements for newly qualified teachers are stipulated by law. This means that, although students should be given the opportunity to create their own learning paths toward becoming adequately qualified, we wish students to demonstrate to us, through integrative moments of assessment at three points in the program, that they have acquired the competencies they need to be admitted to the next phase. This view is in contradiction with the dominant view in education, namely that under the direction of the institution offering the program, the road to becoming a competent and qualified teacher consists of parts of a curriculum that have been determined in advance, and that evidence of competence is synonymous with the successful completion of those parts of the curriculum.

Dynamic Curriculum: Given the goal of our experiment and our view of teacher training, the current static curriculum needs to be made more dynamic. This is necessary because:

- Students must have the freedom, in consultation with their mentor, to shape the learning processes they feel are necessary to acquire the required competencies;
- Students must have the freedom themselves to organize the evidence they wish to present at the integrative moments of assessment;
- The program must have the freedom to be able to anticipate and react quickly to changing circumstances in society. In fact: the program itself must also be capable of quickly coping with change.

Authentic Learning in Professional Education: At as early a stage as possible, the program should create an environment for students which mirrors professional practices. Learning during the program must be linked as far as possible to useful and responsible work resembling work in the profession for which one is being trained. In professional practice, teachers have to carry out relatively complex tasks that fit in with the objectives of the school. To be able to do this useful work well, they must be able to use 'two kinds of learning'. They should not only be able to acquire on their own initiative the knowledge and skills they need to do their job well (learning of the first kind), but they should also be able to continue to learn from the experience gained and to experiment systematically with actions leading to improvement or change (learning of the second kind).
Both kinds of learning are important in the concept of 'lifelong learning'. Both are 'guided' by the competencies, which the competent and qualified teacher must have. The program offers an environment in which students can (and indeed should) put these two kinds of learning into practice in order to acquire the skills required for the profession.
Each learning process the student goes through in that environment consists of the phases of orientation, planning, execution and evaluation, and is guided by the competencies derived from the professional profile.

Assessment: For students this means that, in their orientation with respect to the learning and working process, they take the competencies they need to acquire as their point of departure. In doing so, they are aware of the fact that at a later stage, during the assessment, they will have to demonstrate that they have actually acquired the required competencies using their portfolio. On the basis of that orientation, they formulate concrete learning goals and activities (plans), subsequently work on useful products in a learning environment created by the program (execution), and, finally, they evaluate the degree to which those activities have contributed to the realization of their learning goals and the acquisition of competencies. The assessment of a teacher's work is – if all is well – based on the degree to which the teacher's work has been useful in aiding the achievement of the school's objectives, and on the teacher's ability to make

improvements and cope with change. This assessment is therefore not based on disconnected knowledge and skills. Since the program is intended to mirror professional practice, it includes at three points in about four years time an integrative assessment based on competencies. During these assessments, students must show that they are qualified to take the next step: first to be admitted to the main phase, then to enter the assistant teacher phase, and, finally, they need to show that they are competent and qualified to start a professional career. The student's admission to each phase depends on the outcome of these integrative moments of assessment, which are in that sense decisive and final. During these integrative moments of assessment, students demonstrate individually to a small committee (consisting of people from within the institution and from outside) that they have reached a level of development which is at least that required. They also show how their growth in acquiring competencies has progressed so far. As proof of their growth, students must compile a 'showcase' from their portfolio containing results of their work and studies, including judgements made by others. In principle, students are thus made responsible for proving their own level of competence, measured against externally specified criteria. This is also in accordance with the procedures followed in professional organizations and professional practice. Our traditional, static curriculum only offers students sufficient freedom to take responsibility in the execution phase of learning processes. In the educational environment we have in mind, students will be expected to take responsibility in all phases.

Program facilities in relation to learning processes: The program environment consists of a number of facilities which students may use in taking responsibility for achieving their processes of learning and gathering evidence of competence. It is this change in the concept of "curriculum" that is meant in the title of this contribution.
The facilities can be categorized along the circle of orientation, planning, execution and evaluation. They consist of a set of competencies, an assessment procedure, a web-based portfolio system, lots of authentic learning practices, a continuous line of metacognitive work and a demand driven set of resources of knowledge and skills. More about these facilities can be learned about at other SITE 2000 contributions, e.g. on Integrated Assessment, Learning Practices and Web-based Portfolio System. Also the Website of the Amsterdam Faculty of Education is a source of information for this purpose: www.efa.nl

Realizing New Educational Concepts Using New Technological Possibilities

The Explo project of Ichthus University - Department of Education aims to train elementary-school teachers who have both vision and skill in handling ICT. Explo is a new, experimental teacher-training program, related to the Dutch government's Prommitt program (Program on Multimedia in Teacher-Training). Reflecting the program's *exp*erimental nature, the name Explo stands for Exploration, particularly the exploration of new educational concepts combined with new technological possibilities.

The curriculum's educational principles

Explo's objective is to train learning professionals. Thus, it is important for the program to train students to learn-as-they-work. We achieve this through both the in-school and outside-of-school curriculum. An important aid here is the multimedia portfolio, helping students to learn how to react to their working and learning experiences.

Learning how to think, learn and work independently: Students engage in learning activities to achieve certain learning objectives. They decide for themselves which learning activities to undertake. Nobody can take a student's place in learning, and there will be no learning results without learning. That is why, in Explo, we expect students to actively control their learning guided by their learning styles, learning concepts, knowledge, learning motivation and learning abilities, likewise guided by their experiences in interacting with education. Two consequences result from this view. First, we endeavor to teach students how to learn, think, and work independently. Hence, we see to it that students' learning, which initially is more program-controlled, gradually becomes more student-controlled. Tasks that were initially performed by lecturers are gradually taken over by students, such as selecting learning objectives, planning learning activities, the application of knowledge, monitoring progress and even evaluating the results. Secondly,

learning to think, learn and work independently means a change in the tasks and roles of lecturers. They now pay rather more attention to the way students learn, they challenge students to start controlling their own learning process and help them to develop their "meta cognitive skills". The entire learning process is recorded as much as possible in a (multimedia) portfolio, in which students report their experiences in images, sounds, products and statements. Moreover, the study program is arranged so as to allow students to set their own speed in following their own learning routes.

View of learning: Increasing self-control in learning	→	View of teaching Emphasis on guiding the learning process

Learning how to think, learn and work independently

Links between theory and practice: Explo's system of instruction is determined by the link between theory and practice. The world of employment is the principal standard for the selection of learning objectives and program contents. Here, we are guided not only by the world of work and by theory, but also by individual students' subjective concepts. They consist of the values, opinions, convictions, ideas, principles, rules, guidelines and expectations that students have regarding education and those developed during the course of the program.

Practical work: In a professionally oriented program, students are prepared for work through internships as well. In Explo, we use the following lines of development to learn how to work as professionals:

a) From observation to education;
b) From working with a few children to working in a combined class;
c) From standard education to special education;
d) From performing a single teaching skill to giving a series of connected lessons;
e) From giving a lesson to a whole class to developing differentiation within a class;
f) From performing internship assignments set by lecturers to performing tasks based on students' learning questions and planning;
g) From teaching a single subject or several subjects under the guidance of a mentor to functioning independently as a class instructor for a few days a week.

Both in the internship school and in the learning environment of the program students are expected to learn from each other. We encourage this through the joint preparation of internship assignments, attending each other's lessons in the internship school and offering practical examples from internships during lessons and modules.

Links between subject areas and fields of training: The program's point of departure is the professional qualifications for novice teachers. We distinguish the teacher as: (a) a professional, (b) a didactician, (c) an educationalist, and (d) as a team member and colleague. Since the teaching skills of novice teachers require a subject-related content, we start from the subjects that must be taught under the Elementary Education Act. In addition, we base the program on the starting-level requirements and the recommendations of the Process Management in Elementary-Education Teacher-Training Programs memorandum. Since we also assume that elementary-school teachers must be generalists, each program term has its central theme matching the students' development as much as possible. This theme forms the framework for all multidisciplinary and discipline-related tasks that students work on.

Study counselling and student counselling: Study counselling involves the development of students into learning professionals. Here, lecturers pay special attention to the way the students structure, regulate and assess their own learning processes. Student counselling involves a student's personality development and his or her cultural and social performance. One important object of counselling is that students develop a personal work concept. Several persons provide counselling: a) the phase-coordinator provides information about the program structure, b) the tutor provides counselling regarding the learning process students go through in their in-school and outside-of-school curriculum and c) the internship school mentor deals with

day-to day student counselling, in particular students' practicing of skills and the performance of assignments.

ICT in education: vision and skill: In Explo, the development of views and skills is not an isolated activity, limited to any one subject, component or theme. It is an integral part for all components of the curriculum. In Explo, we wish to train teachers who: learn-as-they-work and are innovative, function in a multi-cultural and international environment and in doing so use ICT with vision and skill.
In Explo, five uses of ICT derive from this mission. ICT serves as:
1. A link between learning-as-you-work in practice and learning-as-you-work during coursework (the Internet);
2. An aid in providing adaptive education in elementary schools in a multicultural and international context (multimedia software, the Internet);
3. A means for students to develop vision and skill in the use of ICT in education: "being digital" (a laptop as a mobile toolbox for daily use);
4. A motor for lecturers and students to be innovative colleagues in designing (digital) learning environments (the Intranet to share knowledge);
5. A hub for the exchange of knowledge (website, electronic discussion platform) and to maintain the organization's external contacts (e-mail).

Technology Rich Learning Environments in Pre-Service Teacher Education: Implementing Ideas in Practice

One of the core characteristics in the changes towards a new curriculum for pre-service teacher education deal with the notion that prospective teachers need to be able to design learning environments in which learners are able to accomplish authentic tasks. In pre-service teacher education programs these authentic tasks often consist of the realization of concrete products which could be used in educational practice. Important features of such learning environments are that a) curriculum content is not offered separately but derived from the authentic tasks and attuned to students' needs, b) students get responsibility for their own learning and c) teachers guide and facilitate the learning process of students. In short these characteristics reflect present ideas in education such as constructivism and situated learning.
Technology can facilitate the realization of these learning environments in several ways. It can serve as means of communication between students and teachers (e.g. e-mail, CSCL) and as source of information (WWW). Technology can support the curriculum organization and learning process (e.g. digital learning environments, electronic portfolio). Finally students can develop digital products as an authentic task.

In the two experimental colleges of teacher education in the Netherlands a variety of such learning environments are part of the pre-service teacher curriculum. In the Amsterdam Faculty of Education these learning environments are referred to as Learning Practices. Learning Practices are one of the main parts that constitute the dynamic curriculum. The Ichthus' Faculty of Education has realized a cooperative project with elementary schools. Within this setting elementary schools implement innovative projects using ICT and pre-service students support the elementary schools in the realization of their project. The following examples represent two typical innovative learning environments.
A multimedia database for history teachers (Amsterdam Faculty of Education): The toolbox of a history teacher is a database of resources (video- and audiotapes, pictures, texts) on historical events together with student activity sheets and lesson plans. Pre-service history students are jointly developing such a toolbox in a digital format. The toolbox will be used in their internship program. Each student has to prepare 25 contributions to the database, share them with peer students and teachers and evaluate as a group the quality of the contributions. The students apply a number of ICT skills in realizing the database.
'A view on the world' in the Kindergarten class (Ichthus'Faculty of Education): Pre-service students in the elementary teacher training program cooperate with elementary school teachers in a project for the Kindergarten. With the help of a digital camera and PowerPoint children, teachers and pre-service students are jointly developing an interactive picture book about the process of milk production. The pre-service students have the expertise on the use of technology, the teachers have their didactic experience and the kindergarten students put their curiosity and creativity in the project.

The role of formative evaluation

Formative evaluation activities are being conducted to guide the process of development and implementation of these new learning environments in both experimental teacher education colleges. The starting point of the evaluation is a conceptual framework, which reflects characteristics of innovative practices using technology in education (Voogt and Odenthal, 1999). This framework has been fine-tuned to the specific characteristics of the innovative learning environments as they are defined in the two experimental colleges of teacher education respectively. In both sites the formative evaluation aims at 1) sharpening the educational concepts and ideas which the learning environment intend to reflect, 2) contribute to a sound implementation of the learning environment in practice and c) description of the learning environment with a view to transfer of experiences. In the evaluation data (document analysis, interviews, observation) are collected to trace discrepancies between the intended curriculum (the educational concepts and their translation into curriculum materials) and the implemented curriculum (the realization in practice).

The formative evaluation points to the following concerns in the implementation of innovative learning environments:

- Educational concepts, such as 'self responsible learners' are not yet clearly elaborated in the learning environments. Students' are not always ready to take their responsibility and the instructors' repertoire is often insufficient to guide students in their learning process.
- The use of technology is not yet part of the routine of instructors and students and is therefore time consuming.
- The development of learning practices often starts from creative ideas of the teaching staff of the colleges of education. However, the organization of a curriculum through well defined learning environments cannot be based on creative ideas only, but requires also an appropriate blend between the competencies that students' need to acquire and the competencies that are dealt with in the learning practices.
- Pre-service students supporting schools in realizing examples of innovative use of technology have to deal with the outdated technological infrastructure in many schools.
- The elementary schools involved in the cooperation with the teacher education colleges have a very different experience in the use of and vision on technology. It implies that pre-service students cooperating with the elementary schools need not only to bring their expertise to the schools, but also need to become sensitive to the innovation process itself.

In the presentation these results will be presented and the implications for the further development and implementation of learning environments will be discussed.

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Preparing Student Teachers to Use ICT at Secondary School: A Course Designed at the University of Zuerich

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Abstract: Our two-semester course has been developed over several years. We specifically try to prepare student teachers to use information and communication technology (ICT) in their future work in the classroom. Thereby we are faced with three major difficulties: – the broad spectrum of subjects students have studied and will teach, – differences in the pre-knowledge and the pre-skills students bring with them, – most students have gained their own learning experience in classic lecture situations which are not compatible with a technology-oriented context. This paper will show how we try to overcome those difficulties. Our current course design is based on a learner-centered approach and combines different learning styles. In the first semester, our students work in independent groups following a guideline sheet. During the second semester, students create their own projects where they integrate ICT into classroom situations.

Introduction

Compared to America and most European countries Switzerland is very small. It has less than 3% of the inhabitants of the USA yet is composed of 26 cantons, which are autonomous concerning schooling. Hence many different school systems exist. However, we will only consider the situation of the canton of Zuerich in the north-eastern German-speaking part of the country. Secondary school are of two types. Most students (nearly 80%) attend normal secondary schools and after 9th grade leave school and start an apprenticeship. Only the remaining 20% go to grammar school and after the 12th grade will pass the final examination (called "Matura" in German), which is required to enter university. The following paper deals only with pre-service education of grammar school teachers. They have to acquire a first degree; afterwards they go through teacher education, which also takes place at the university. As a result, grammar school teachers teach only one, possibly two, subjects. Our two-semester course has been developed over several years and we have continued to adapt it to correspond to the evolving situation in information and communication technology (ICT). Because of restricted resources, our course is not compulsory, but optional to the students.

Concept

The goal of the course is to prepare students to use computers and communication technology in their future work in the classroom. This is not an easy task. Reports and our own experience show that ICT is not commonly used in grammar schools. For the novice teacher, there are many obstacles. Teaching itself is difficult and must be learned through practice. Due to their own lack of teaching experience, novice teachers tend to use the experience they

gained in earlier situations as learners. In the technology context, experience from a learner perspective rarely exists. Furthermore, working with computers on a personal basis and embedding technology in a classroom setting are two totally different tasks. There are considerable differences concerning pre-knowledge and the pre-skills in relation to ICT among the participants in our course. The ability to use technology is a pre-requisite but not a guarantee for effective action in the classroom. Experts in this field refer to typical examples, but there is rarely agreement on the best way to apply technology-based teaching. A very important point is the following: The participants of our course have studied, and will teach different subjects: Languages (German, French, English, Italian, Spanish, Latin), History, Mathematics, Physics, Chemistry, Biology and Geography. The questions arising in the teaching of English for example or Mathematics using ICT are really different. All in all, teaching such a course is a well-nigh impossible task. However, a heterogenous audience may also have positive effects (Moser 1999).

Summarizing the facts we have to deal with three major difficultes in designing our course:

- the participants will teach different subjects
- the participants have different pre-skills in the use of ICT
- the participants have no teaching experience,
  nor can they activate relevant learner experience.

An obvious strategy to overcome the difficulties is to individualize the learning process. This means a decomposition of the course: Students work individually on their own tasks. This is quite natural in a computer context, because this machine is tailored for individual use, having only one keyboard and one mouse. Nowadays however, it is widely accepted that learning also has a social dimension and that the learning process may be influenced positively by cooperation. There is currently interesting research being done on this subject (see for example Dillenbourg P. 1999). Bringing the two concepts together results in groups of learners. The size and the composition of such a group is of course critical. During the first session we normally let the students form learner groups composed of two to four participants teaching the same or a similar subject. The differences in pre-skills may also be evened out in such groups. This difficulty can, however, not be completely resolved. Cooperation in the groups and imposing the focus on didactical reflections reduces this difficulty. The third problem is the most difficult to overcome in a university framework. The best thing would be to give the students the possibility to observe lessons and to conduct their own teaching experiments. We are able do this to a very limited extent; external constraints do not allow more. As mentioned earlier, novice teachers use their learner experience as a resource in their own teaching activity. Therefore, in our course we try to prepare learning arrangements, which build up the experiences of the students, and we try to give concepts which they can copy later in their own classrooms. Our intention is a kind of "hidden curriculum". This may be explained easily by the famous saying: "Teachers teach as they were taught, not as they were taught to teach." By individualizing the learning process, we observe another slogan: "self-directed learning". This is an essential point in every learning process: To what extent is the learner guided from the outside and what part does he manage by himself. There is a continuum of possibilities from leading by the nose to not being guided. It is an art to find the right balance for every audience. Our convinction is that in most cases guidelines are needed to produce an efficient learning environment. Within an carefully fixed framework the participants of our courses have the liberty to create their own learning path.

Basic Course in Detail

In the first semester of our course (called "Grundkurs" in German) the student acquires an overview, basic techniques and basic knowledge. During this semester there are about fourteen sessions. Five of them, spread out over the semester, are plenum events where demonstrations, talks and other input are combined with group activities. The other sessions are arranged by the learner groups. A task sheet (called "Semesterpass" in German) describes the work to be done as structured in the following sections:

A organisation and tools
B telecommunication
C software for learner (tutorials, simulations, etc.)
D application software
E authoring software
F articles, books, videos
G practice
H portfolio

Figure 1: Part of the task sheet

A booklet (called "Arbeitsheft" in German) contains the necessary worksheets, guides and schemes organized in the same sections as the task sheet. Additional information can be found on our webpage (http://www.unizh.ch/hlm/ascifu/index.html) and additional material, for example software or videos, must be ordered by electronic mail. The learner group has to plan its activities at the beginning of the semester and report them to the professor responsible. Most communication is conducted by electronic mail. Search competitions on the internet aim to improve the search skills and the regularity of e-mail use of the participants. A panel discussion with active teachers and visits to schools give an insight into classroom reality. The progress of the group is supervised by the professor responsible in periodical conversations. As an example, let us take a closer look at section C, where a special scheme presents the tasks required. A software tutorial introduces the students to the features of tutorial- and drill programms. Learning software of their choice, ordered by mail, must be tested and evaluated by the groups. Leading questions are – what are the benefits of this software? – can the task also be fulfilled without technology ? The findings and the evaluation must be reported to the supervising professor.

Figure 2: Part of the scheme (section C)

Project Course in Detail

During the second semester of our course (called "Projektkurs" in German) the student applies the knowledge and skills gathered to a classroom situation. The goal is to develop, perform and evaluate lessons in the specific subject whereby ICT must be inbedded. Again students of the same subject work together in groups to carry out this task. Possible interdisciplinary cooperation is encouraged of course. Often groups firmed in the preceeding semester continue working together. The course is arranged as a pedagogical project. There are different definitions of such a project and we will therefore outline our concept, which is based on a description of Bruggmann (1992). The framework is given by the following facts:

- lessons must be designed, performed and evaluated
- at the end of the semester the results must be presented to the plenum
- during the lessons information and communication technology must be used
- milestones and a learner diary will accompany in parallel to the process

Besides these obligatory conditions, the groups are free to design their project. This means that decisions concerning the number of lessons, the topic, the technology used (internet, software, etc), to what extent the technology is used, the pedagogical methods and the social form are made by the group. We have a database with addresses of teachers who have agreed to place a class at our disposal. However, the groups themselves have to arrange the necessary cooperation. The most difficult aspect in projects is time management. As already mentioned, we emphasize the idea of guidelines and we shall now describe how we realized this in the project part of our course. The members of a group have to sign an agreement fixing in advance the topic and plan of realization. This should help to set realistic objectives, and is done in cooperation with the supervising professor. Secondly, each participant writes a learner diary und has to discuss it with the professor responsible. In particular we point out the metacognition aspect. Students dislike writing diaries during the process, but describe it afterwards as a very useful tool. The milestones are the third way in which to guide a project: The group regularly has to present the progress made in the project, the problems encountered, the support needed as well as the modification in project goals.

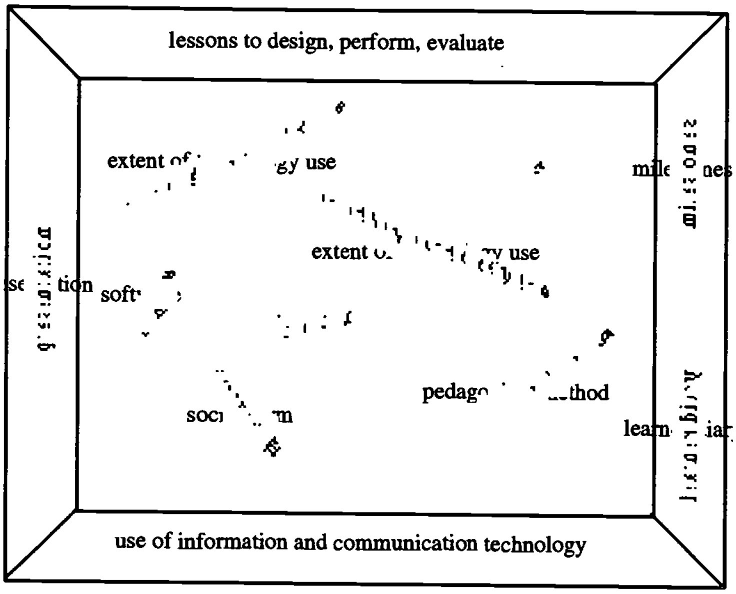

Figure 3: Framework of our pedagogical projects

Conclusion

As the development of technology progresses, course design and teaching material must be continuously adapted. Three years ago, we published a concept for cheap and efficient in-service teacher training (Kuster et al. 1996). We have recently been able to transpose this, starting with teachers of two subjects. There are plans to make connections between these two areas: On the one hand bringing together experienced teachers, and on the other, the less experienced students. There could be mutual benefit in such exchange. Moreover, we have started to use groupware tools, which will be useful in the project part of the course and in in-service teacher training.

Many articles discuss pre-service teacher training in the area of ICT (see for example Murphy and Greenwood 1998). Our efforts to focus on technology and on teaching style, and to offer student teachers excellent learning arrangements to enrich their own experience has proved very successful.

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Dialogue of Teachers and Students on the Internet in Poland of the Nineties in the Context of Moulding the Creative Vital Orientations by E. Fromm

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Abstract: Based on the latest Polish experience, the report attempts to estimate the validity of the common belief the Internet provides opportunity to create new quality in teacher-student relation and aids the process of moulding creative vital orientations of the two parties involved in the process of educational interaction. The main objectives of the article are determining possible obstacles to widespread distance education, acknowledging first efforts of communication through the Internet administered by educational institutions in Poland, and assessing how the initiatives aid the development of teacher and student creative attitudes.

Introduction

The objective of the paper is estimation – on the basis of the recent Polish experiences - of truth of the common belief the Internet provides opportunity of new partnership quality in teacher-student relation and aids the process of moulding creative vital orientations of both teachers and students. Hence, several questions must be raised on the subject. One issue is how possible is it in Poland? How easy/cheap is the access to the net for a Polish student or teacher? What can be other, non-economical obstacles against the dialogue over the Internet? What possible psychological barriers may underlie teacher and student attitudes to the use of computer in education or to Internet communication? What emotions do they declare? I searched for the answers to those questions in Polish GUS Statistical Yearbook of 1995-1997, in applicable literature and in my own surveys.
Other essential question to be answered is where such dialogue occurs by determining first endeavours of Internet communication administered by Polish schools. Where are such schools? How do they use the net for teacher-student communication? How seriously is the Internet used for educational purposes? How helpful for development of creative orientations is it and finally what (first) initiatives in connecting teachers with students are currently emerging in Poland? I tried to find answers in both electronic and printed reference materials, however I based my search particularly on WWW resources.

The condition of computerization in Poland

Statistical data on computerisation in Poland are provided below. The rates are given for various regions of the country and various social status groups. Poland is a country where distance education can be applied more widely, outside the local experiments conducted by educational institutions of different levels for the last few years. There are several economical, financial and psychological reasons for the above statement. Polish Gross Domestic Product is continuously growing. Annual rates of GDP increase place Poland among the most dynamic group of developing countries. There was 125 GDP increase rate in Poland in 1997 (the rate had amounted to 100 the year before), which was more than in most other European countries: the rate was 61 for Russia, 109 for Germany, 99 for Czech Republic, and 64 for Lithuania. USA achieved 110 GDP increase rate in 1997. It has to be certainly remembered GDP per capita in USD is still quite low in Poland and did not exceed 3702 in 1997, while in Germany it was 25754 and in Czech Republic 5184, however it was as little as 2982 in Russia and 2097 in Lithuania. In the USA, the rate was 29187 (Statistical Yearbook 1998).
The described financial condition of a country cannot be regarded as unimportant for the idea of the broad use of multimedia communication technology for educational purposes. The rates of computer equipment found in households are as vital for distance education. Unfortunately, the Polish Statistical Yearbook does not quote the number of personal computers used in Poland vs. other countries. However, the source provides information on rates of radio and television sets per 1000 population, which too are potentially important for distance education purposes. The rate here is 311 for Poland, 564 for Germany, 377 for Russia, and 805 for the USA. (Statistical Yearbook 1998) In 1995 there were 148 telephones per 1000 population in Poland, 493 in Germany, 170 in Russia, and 626 in the USA. The rate of telephones in Polish households (which is important for DE since it determines how many computer users can access the Internet via their modem and a phone line) is too small,

however the rates of increase in the number of telephones are truly satisfactory. The rate was 86 in 1990, 102 in 1992, 129 in 1995, 169 in 1996, and 193 in 1997 (Statistical Yearbook 1998). The source provides information on computerisation in Poland, however its relation to other countries in not quoted. Means for automatic production processes and electronic media in industry, and households furnished with selected durable goods are recognised. 88 publishers and printing firms had access to local area networks (LAN). 38 firms had access to external computer networks and 64 used Internet services in 1997. (Statistical Yearbook 1998)
Following table presents rates of computers found in households with specified number of person in 1997.

Table 1. Rates of microcomputers in households with specified number of persons in 1997 (Statistical Yearbook 1998)

Household categories	1	2	3	4	5	6+	Total
Employees	4.6	8.6	14.7	17.9	13.0	8.2	13.6
Employees in manual labour position	1.3	3.2	7.6	10.8	9.3	5.7	8.0
Employees in non maual labour position	6.9	13.3	23.9	29.8	22.6	20.0	21.7
Employees - Farmers	-	3.4	5.2	6.9	7.6	3.4	5.6
Farmers	1.7	0.9	2.0	4.7	5.2	3.6	3.4
Self-employed	21.1	20.7	25.4	27.4	23.5	13.3	24.4
Retirees & Pensioners	0.4	1.5	5.4	8.6	5.6	4.3	2.4
Retirees	0.5	1.5	6.2	10.3	7.2	4.9	2.5
Maintained from non-earned sources	3.4	4.4	3.4	2.2	2.2	3.2	3.2

The above figures show considerable diversity in rates of computers found in Polish households in relation to social and employment status of the families and the amount of children. Self-employed middle class families consisting of 3-5 members (i.e. with 1-3 children) own the most computers and retirees and pensioners own the least. The challenged position of the latter is certainly different from the situation of American retirees and pensioners. On the other hand, even in the wealthiest group computers are found in less than one third of the households and no information is provided about their access to the Internet.
Another question concerns the number of people now educated in relation to the number of population. In other words, the question concerns participation of young people in Poland of the nineties in various forms of education, regardless of its level. The answer will allow rough estimation of how much the educational needs (aspirations) of the residents of Poland, especially young adults and children, are satisfied. It will also make it possible to determine whether the current traditional system meets the needs and requires no changes or it's the opposite. Moreover, the number of foreign students in Poland will make it clear how accessible Polish universities are for foreigners. Thus, the figures will provide an answer to how much the current educational system meets the market demand and how much it should be modernised.
In 1995, primary education in Poland was provided to 130 students per each 1000 population, vocational education to 41 students and high school education to only 18 students per 1000 population. In USA, the figures were relatively 90/?/81, in Germany 46/28/72, in Russia 53/9/84, in Lithuania 60/14/86, and in Slovakia 62/76/48. The minute percentage of high school students in Poland is striking (Statistical Yearbook 1998). In case of university students, the tendency is less evident. In 1995/96 Poland provided higher education to 248 students per 1000 population while in USA the number of students was 540 per 1000, in Russia it was 300, in Lithuania 202 students, in Germany 264, and in Slovakia 172 students per 1000 population. While analysing the rates, one should remember about radical changes made on the map of Polish universities and colleges during the last several years (Statistical Yearbook 1998).
There have been established nearly 200 new non-state higher education centres in 1990, which offer higher education and thus certainly aid state universities, so while there were 248 university students per 1000 population in Poland in 1995/96, there had been only 134 in 1990/91. Unfortunately, Polish higher educational system provides too few students with opportunity to learn at the more popular courses. Classes are based on the traditional system of lectures, moreover courses consist of mostly obligatory subjects and students cannot chose their teachers. Distance education provides an opportunity to overcome problems of too little space or even lack of classrooms, of Polish university teachers overworking in spring and of under-heated rooms in poorer schools, and it also gives some hope for adding new and more personal quality to the traditional rigid teacher-student relations.
In 1995/96 there were slightly over 5,000 foreign students in Poland; in 1990/91 there were 4,300 of them. That was a small group within the total number of university students: 512,000 in 1990/91 and 956,000 in1995/96 (Statistical Yearbook 1998; 599). It can be inferred the current Polish system of education based mostly on lectures is not attractive for residents of other countries. Distance education, using good system of communication and information technologies, might result in more foreign people studying in Poland. In my

opinion, the motivation might be diversified from sentimental (descendants of Polish immigrants) and therapeutic (e.g. new Polish immigrants not yet adjusted to their new country) to cognitive purposes.

The motivation and emotions supported towards the computers by the Polish teachers and their students

One question that should be asked now is whether Polish teachers and students are ready for distant education employing advanced computer technology. Are they well motivated to communicate e.g. over the Internet? What emotions do they declare on the prospect? What do they feel when they are about to sit behind the computer? Is it trust or fear? Monika Kostka and Irena Pulak conducted their survey in Malopolska region of Poland in 1995-1997 (1998). The survey covered about 306 people: 170 teachers (more than a half of whom were primary school teachers) and 136 students of arts and pedagogics. The teachers declared their practical ability to use tape recorder (96%), video recorder (89%), television (89%), slide projector (85%), computer (44%), writings projector (37%), and less than 20% admitted their ability to use other equipment like episcope, epidiascope and CD player. The teachers most often use tape recorder (80%), video recorder (78%), television (74%), slide projector (63%), computer (44%), writings projector (37%), and less than 20% admitted their access to other equipment like episcope, epidiascope and CD player. The teachers would like to use also computer (75%), video recorder (60%), television (47%), tape recorder and slide projector (44%), CD player (36%), writings projector (25%). Teachers/students would like to use computer (75 / 87%), video recorder (60 / 97%), television (47 /87 %), tape recorder (44 / 89%), slide projector (44 / 72%), CD player (36 / ?%), and writings projector (25 / ?%). Only 19% surveyed teachers had any contact with computers. 7% took a course on using a computer, 3% learned on their own and 81% had not used computers at all. It is interesting to notice nearly one third (29.7%) of 219 surveyed students of political science in Silesian University in Katowice, Poland, declared in January 1998 they had never used computer so far (Gramlewicz 1998; Tab 3 p320).

When I was looking at the title of *How teachers use the Internet* (Serim & Koch 1997) on teachers' experiences with internet, it crossed my mind to survey whether, and to what extend, Polish teachers use the internet. My findings are quoted below, based on my survey of emotions studying teachers have toward computers and the Internet.

In 1998 I surveyed 200 teachers studying pedagogics in Wszechnica Mazurska in Olecko, Poland on their knowledge of basic terminology connected with the use of computers for educational purposes (Górnikiewicz 1998). The whole surveyed group consisted of 3rd-year students who had done a regular course in computer usage before. The results of the survey show their computer knowledge was minute. The recognised terminology was connected with very rudimentary knowledge, not adequate for practical educational use of computers. The students had theoretical rather than practical knowledge of computer terminology that had been mainly heard of and not experienced. The surveyed teachers seldom use computers and still do not use the Internet almost at all. Nevertheless, the reason is not their fear of computers (they declared positive emotions toward computers). The reason is they did not yet realise how important it may be for their job. Given the opportunity of active participation in computer courses and provided with practical computer skills, they are bound to give up the use of their pens and papers or chalk and blackboards in favour of more sophisticated means of conveying information. On the other hand, even in the most advanced countries (Japan, USA, Sweden) chalk and blackboard still play crucial roles in education (*chalk and talk*; see Pettersson 1997). Hence, it seems most Polish schools still have a long way to go from traditional handbook to electronic one, regardless of the recognised drawbacks of the former (see Wiœniewski 1996).

First Polish institutions using the Internet for teacher-student communication

First Polish institutions using the Internet for teacher-student communication are presented below. They comprise schools and other establishments co-operating with their American partners for promotion of the idea of education over the Internet. One of them is PAM Centre in Lodz assisted by University of Maryland; another is Internet for Schools (IdS), which has particularly contributed to promotion of advanced information technologies in education in Poland. The results of IdS actions prove its effective use of American foundations' financial assistance it is offered. In found the Polish institutions offering distance education mentioned above in the Internet by means of Internet Explorer. I used Polish Infoseek, Polish and English Wirtualna Polska and Alta Vista, and Yahoo search. I also used Webcrawler. I used both Polish and English keywords like *distance education, distance learning,* or *distance teaching*. Polish servers provide different amounts of information. Wirtualna Polska provides merely several links, e.g. 2 links to *studia na odleg³oœæ* (WSiP publishing house and CKU in Tarnow); 2 links to *distance learning* (e.g. SITA Learning System) and 1 link to *distance education* (Doctor Q Cenrum Edukacyjne *alias* Lotus Authorized Education Center, which runs computer courses). On the

other hand, Polish Infoseek provides plentiful information on the subject (e.g. 2,391,625 links to *studia na odleg³oœæ*).

There are several centres for open education in Poland that are interested in distance teaching. Those institutions are often called Continuous Education Centres (Centrum Kszta³cenia Ustawicznego; CKU) or Distance education Centres (Centrum Edukacji Niestacjonarnej; CEN). They are usually connected with universities or technical universities. The ones whose WWW sites are relatively easy to access are the establishments in Bytom (Regional CKU in CKU), Gdansk (DECTUG and CEN), Cracow (CKU at AGH), Kielce, Krosno (CKU), Wroclaw (CKU), and Zielona Gora (CKU). Below are two examples.

Kielce establishment belongs to Swietokrzyska Technical University. It runs distance courses in computer architecture, AutoCad 13, English, management, economics and finance (http://www.tu.kielce.pl/~cku/). Other courses are interpersonal communication (30 hours) and 3-level language courses (80 hours each). The institution provides also post-degree courses (280-290 hours), however they are not available in the distance education system. Students of Management and Marketing have conducted an Internet survey for the institution mentioned here to gather opinions on Internet virtual universities and estimate potential interest in such forms of education.

The centre employs four administrative workers. It is worth mentioning CKU is not operating by itself; it belongs to European Distance Education Network (EDEN).

Distance Education Center at Technology University of Gdañsk (DECatTUG) assumed the task of promotion of Open Distance Learning (ODL) methods in its local environment and organisation of ODL training within EU programmes of PHARE, Leonardo, and Socrates. Moreover, the institution partakes in realisation of various Internet-based educational projects like PASÇAL, EE-DEC, TTT, ENGTUS, ThinkQuest, I*EARN, and National Geographic Kids Network. The centre was established in 1997 within Phare Multi-country Programme in Distance Education (Establishment and Operation of Regional Phare Distance Education Study Centre). This is an experimental educational institution conducting educational projects connected with the use of computer networks and multimedia technologies. The project of *Join Our English Language Club* (http://despina.advanced.org/17844) was admitted to a contest final in Washington in 1997. In 1998, the project of *The Ways of Communication* (http://despina.advanced.org/17844) was realised.

Distance Education Centre at AGH in Cracow introduces elements of distance education to realisation of chosen regular courses by the use of videocassettes and diskettes, without the need of Internet teacher-student communication. The centre runs various professional courses and ones preparing for university examinations. In 1997 a seminar was held in Dom Goscinny in Cracow, Poland, on Information about Possibilities and Conditions of University Distance Education, which initiated a series of Open Learning seminars.

CKU at Technical University of Wroclaw runs optional courses for students, computer courses, and seasonal "schools" and seminars, however it does not partake in practical promotion of distance education forms and methods. Among the optional subjects, students are offered classes in language culture meant to teach the art. of self-presentation in front of cameras and presentation of a given topic.

International E-mail Tandem Network is a highly interesting form of Internet education, providing opportunities of both teaching (one's partner) and learning a foreign language (from one's partner). The system is based on co-operation of two universities speaking different languages and located anywhere in the world. Helmut Brammerts from Bochun University, Germany established the Network in 1992. Polish Jagiellonian University, Cracow, partakes in Polish-English and Polish-German subnets.

Post-Graduate Distance Education Centre run by Lodz University and Polish American Management Center (PAM Center) and Virtual University at Mila College in Warsaw are two examples of the most interesting projects on application of DE in Poland.

PAM Center located at Department of Educational Science at Lodz University, Poland started enrolment to new Distant Education School in 1997. The course consists of 300 hours conducted partly in the distance teaching system and partly as meetings. The use of modern multimedia communication means of voicemail, email, BBS, online communication via WWW pages and compressed video is assured. The Center is co-operating with University of Maryland University College (UMUC), USA. The course lasts two semesters from October to June, providing its graduates both certificate of completion of the course and PAM Center certificate. The course provides education to people of various professions: the learners are not only teachers but also physicians and office workers. PAM Center also runs MBA and MiniMBA studies, which are MiniMBA Management School and Human Resources Management School. The graduates belong to the Alumni Club. PAM Center web site administrators introduced noteworthy amount of links to WWW sites. Those links are connected e.g. with distance education in Poland and several other countries (the list is reduced to barely a few links among many possible ones) and sites that can be useful for teaching (a relatively long list).

Virtual University (www.uniwersytet-wirtualny.edu.pl) is an educational experiment conducted by Professional Training Institute of Mila College (http://www.mila.edu.pl) in co-operation with several other Polish universities. Mila College offers lower and higher degree studies of computer science, economics, business

management, data processing management, finance and accountancy, and tourism and recreation. Mila College is advertised on its WWW site as "the first Polish Internet school". The college co-operates with De Monfort University, United Kingdom and has been operating for seven years. It is well equipped with computers and has its own 1 Mb line as well as its own Virtual Library that is also described as the first one in Poland. After paying the initial fees, each student is provided their free personal email accounts. Co-operating with Regional Education Centre in Polkowice, Mila College has long experience in distance education, which is currently unique in Poland. This experience was the basis for the establishment of Virtual University, which has broadened its undergraduate computer studies offer by undergraduate and post-graduate studies of European integration. Virtual University currently has approx. 50 students from all parts of Poland living in small towns as well as in big cities and aged between 20 and 43. The university maintains virtual contacts with its 2000 ex-students who still have the right to keep their school email accounts and use the school library resources. University consists of 20 teachers and 5 administrative workers. It is worth mentioning Professional Training Institute applies Virtual University technology to its courses for the disabled in Adult Education Centre of Tczewo and Professional Promotion Agency of Gdansk. The disabled are thus given the opportunity to learn the economic profession.
Institute of Teaching Technology at Department of Pedagogics, Copernicus University in Torun is another vital institution among the pioneers of DE promotion (and promotion of practical use of advanced information technology for educational purposes) in Poland.

There are many new initiatives in Poland on the use of computer technology for distance education purposes. One of the latest is foundation of General Internet Gymnasium by Polish educational reform advocates working in Educational Initiative Centre (CIO). Both teachers and promoters of culture assemble in the Centre, which is lead by celebrities of Polish science and culture (e.g. Andrzej Wajda, Henryk Samsonowicz, and Andrzej Janowski). The main objectives of Internet Gymnasium are to present advanced multimedia technology to teachers and help them apply it to their work. Another endeavour to promote distance education is the project of Wszechnica Mazurska, a non-state school of higher education in Olecko, based on the idea of individual Internet studies. The project would comprise high school older students and would enable them to take chosen university courses in advance so that they have less work at university afterwards (provided they choose to study at Wszechnica Mazurska). The initial connection between students and college is highly desirable. Moreover, the project would also cover soldiers in service and any other individuals forced to postpone their education.

The current forms and methods of using the Internet applied by the Polish educational institutions in the light of Fromm's concept

Distance education is merely emerging in Poland: so far it is connected more with providing knowledge rather than creative individual development. In terms of Fromm's creativity concept, DL greatly develops productive rather than destructive orientation. It is also focused on being vs. having mode and develops individual skills (see Fromm 1994). This kind of education provides students the choice of time, place, and frequency of their contacts with tutors and other university staff. It gives them free access to the world's information highway and contact with the whole world, or at least its electronic presentation.
The use of Internet seems particularly important in the light of Fromm's concept. The system of retrieving information is even more important here than its availability as such. Users check various browsers looking for clues where to follow; they try new links uncertain of the result and explore various sites. This is their mental journey. The net users can feel liberated from their bodies and limited only by how much faith in their actions they have or how imaginative they are. The Internet makes them move across continents and through space with the speed of their thoughts. (Or is it the speed of their fingers?) The eternal conflict between the human will and the limitations of the human body seems to vanish.
Surfing the Internet can also be compared to journey within one's dream since the net user experiences a specific kind of logic there. This logic allows travelling through time, recognition of graphic designs as meaningful symbols, and admitting more importance to things that feel more intensely. People use the language defined by Fromm as the only universal human language whose knowledge is the key to learn about oneself (Fromm 1972), which in turn is a necessary condition of personal development. Such journey involves challenge, hope of learning new secrets and finding new solutions, and changes of moods from confidence to uncertainty. This is work and fun, adventure and inspiring or exciting way of spending one's free time. It fuses work with fun and rejects the gap between the "useful work" and "idleness", implied by cultures. It is also worth mentioning that although the Internet employs but two senses of sight and hearing it employs them to a substantial extent.
Success of DL is greatly subject to inventiveness and commitment of tutors, well exemplified by work of Jonathan Dron for and with his students at Brighton University, UK (Dron et al. 1998; 1999).

Conclusion

To sum up: in my opinion it is far too early to estimate how useful specific forms and methods of Polish educational institutions may be for moulding creative vital orientations of involved teachers and students. Nevertheless, theoretical possibilities of the Internet and experiences of more advanced countries in distance education allow optimism on the subject. Thus, we hope to witness similar success in Poland in the near future provided distance education develops in our country and becomes sophisticated enough to serve more purposes apart from delivering information or developing technical skills.

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Romanian Internet Learning Workshop: Building an International Community of Experts on Learning in the Internet

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Abstract: In the summer of 1999, the "Romanian Internet Learning Workshop" (RILW) took place for the third time. The main goal of the conference was to build and maintain a community of Romanian and international experts as a framework for exchanging domain knowledge and developing practical, collaborative projects. The presented papers of the workshop were grouped in three sections: (1) Theoretical and practical perspectives of learning on the Internet, (2) The Internet as a learning environment for schools, universities and adult education, (3) Internet tools for teaching. This paper concentrates on the projects and issues discussed at RILW.

The conference has been successfully held for three consecutive years and it is planned to continue and to be extended with other related projects such as a summer school to the same subject area in the context of the European Socrates/Erasmus project.

Why RILW?

This summer (1999), the "Romanian Internet Learning Workshop" (RILW) took place for the third time, organized by the cultural society "Polygon" (NGO). What were the needs which lead to the idea of this conference? What were the goals?

As learning with the Internet is still a new topic in educational science there is a scarcity of literature (i.e. research reports and best practice examples) and not enough to satisfy the needs of researchers and teachers. In addition, the situation in Romania is special, there have been recent changes in the political, social and economic system which has necessitated fundamental changes in the educational system. This is why initial and professional continuing teacher education in Romania must be able to offer teachers a sound technical infrastructure accompanied by up-to-date factual information as well as training in modern didactical methods, including the use of New Media and the Internet. Consequently, there is a large demand and interest in this subject area.

Goals of the RILW Project

In this context, one of the most important goals of RILW is to build and maintain a community of Romanian and international experts as a framework for exchanging domain knowledge and organizing collaborative projects. Further, it is an opportunity for foreign participants to confront their knowledge and practical experience with the particular context of Romanian schools and universities as well as to explore new possibilities of cooperation.

The Nature and Substance of RILW

RILW has taken place annually since the beginning - in July of 1997. At each event, some 20 to 30 papers were presented and 4 to 7 round panel discussions were held. Because the RILW organization team is spread throughout Europe, a large part of the organizational work in preparing the conference has been carried out using the Internet. The conference is represented on the Internet by its homepage (http://www.itim-cj.ro/rilw/, mirrored at http://rilw.emp.paed.uni-muenchen.de and also at Hungarian, Spanish and American sites) as well as by a mailing list.

In the following, we shall outline the most relevant topics discussed at RILW. The accepted papers were grouped in three sections:

(1) **Theoretical and practical perspectives of learning on the Internet**. Papers included in this category were engaged in defining a broad theoretical context or practical background of learning on the Internet. According to these authors, new communication technologies will radically change the way people learn. Universities are becoming more flexible in what is being offered to students, the times and frequency of course presentations and the nature of new student cohorts (opening access to a greater diversity in level of ability, age and geographic location). Traditional values are being challenged and a growing global market competition are putting pressures on educational institutions to change. These changes are enabling a way of learning which is not restricted to the time spent in schools and universities, but extends into a life long process (Clayton 1999).

From a theoretical perspective, knowledge is viewed as actively constructed by the learner. As a consequence of this, learning on the Internet is seen as a process of constructing knowledge cooperatively and at a distance. The design of an Internet-based learning environment should offer learners the opportunity and the resources to support this process (e.g. Gallenberger, Gruber, Harteis & Stamouli 1999). The connection between this theoretical position and practical educational work is illustrated among other works in Nistor (1998).

Taking another perspective, some authors regard learning in the Internet in the context of the particular economical, social and cultural changes of the last ten years in Romania. The technical infrastructure is poor; in Romanian schools, there is less than one computer available for 170 pupils; thus, the use of computer and communication technologies is not yet part of the educational culture. Authors from Romania as well as from Western-European countries show the need for cultural and structural change in the educational system (Clark 1997; English 1999; Jalobeanu, Platon & Predescu 1999).

(2) **The Internet as a learning environment for schools, universities and adult education**. A large part of the papers presented describe examples and case studies of Internet-based learning environments in schools, universities and further institutions for adult education. In traditional campus-based universities as well as in specialist distance learning universities, the usual courses are being successfully extended by the addition of virtual courses (Berz, Erdelyi & Hoefkens 1997; Ribold & Weber 1998). Besides researchers' interest for virtual learning environments, important reasons for the use of the Internet in education are the need to reach isolated geographical areas (Lindsay, Ion & Murdoch 1997; Yrker & Uzer, 1997) and to enable people to communicate at a distance e.g. as a vehicle for cultural education by interacting with people around the world (Platon 1997; de Presno 1999; Smith 1999). An important question regarding virtual courses is how are they to be evaluated? This has a dual meaning – what are appropriate assessment procedures? And how can the course as a whole be evaluated with the aim of making improvements for the next presentation. These issues are discussed in several papers (e.g. Harteis, Gruber & Gallenberger 1999).

(3) **Internet tools for learning**. Online learning requires special tools adapted to the particular needs of the learners or to special didactical concepts. At RILW, several Internet tools for learning were presented such as tools for automatic generation of educational WWW pages (Trausan-Matu 1999), a tool for cognitive mapping on the WWW (Ertl 1998), or various applications of artificial intelligence in virtual learning environments (Florea 1999; Majumdar, Majumdar & Banerjee 1998).

Round panel discussions about educational and technical topics have been a regular feature at all the meetings of RILW. In this way issues have been prioritized and problems along with potential solutions have been considered. One particularly valuable proposal under discussion last year involved the task of designing and delivering new courses to be offered on a networked study-center system in Romania. The known existing issues were first acknowledged: local and individual initiatives did not always have support from the authorities; legislation of this form of education is very recent; accreditation is still being defined and developed; quality assurance methods need priority attention to overcome a previous lack of rigor;

strategies are needed for study centres to co-operate with each other and the type of students to be targeted as well as form of media to be used for delivery needed consideration. The outcome of the discussion highlighted issues that are pertinent to anyone who has the task of designing new courses for extensive use:

- Courses are more likely to be successful if there is a perceived need by the student for the subject and if the students are very well motivated and thus highly committed.
- Ease of access to equipment and facilities is very important
- Preparation may be needed in IT skills training for students and tutors
- Choice of media for delivery should be based on the required didactic method used in course presentation
- Regarding a target group – evidence suggests that post-graduate level distance courses have the highest demand and success rate. In which case, existing teachers would be an appropriate group to start with and there was a need for continuing professional development in this area.
- Support from higher authority is not always present but this should not prevent the design of new courses taking shape.

Other round table topics have been: The impact of the Internet on children's civil education; Virtual libraries vs. virtual universities; Universities and international cooperation; Electronic distance education: The development of DE centers in Romanian Universities and Teachers' Houses. A common frustration that has been frequently voiced is how the heavy weight of bureaucracy and the feather-light touch of financial investment has thwarted many creative initiatives in Romania. The continuation of RILW as a platform for inspiration and collegial support is, therefore, all the more essential.

Results & Perspectives

The conference, now aged three, is based on the enthusiastic and permanent participation of a core number of specialists from different countries like Germany, Great Britain, New Zealand, Spain, USA, and of course Romania. Other participants have been mostly university professors but has also included under-graduate, graduate and doctoral students from Romania and abroad. The participants found the papers and discussions and the informal exchange of experience and knowledge to be most interesting and fruitful. Though our cultures and contexts are different, many of the difficulties and problems that arise regarding the new methodologies and features of learning on the internet, are familiar. A particularly satisfying outcome of these workshops are the lessons we have learnt, often repeated in different contexts, about internet-based learning. Regular findings include:

- Suitable pedagogic designs involving student-centered learning, problem-based learning and 'real-life' contexts and activities
- The need for staff development training in an on-line learning environment
- The need for students to be prepared with 'learning skills' training (team skills as well as IT skills)
- The need for constant monitoring, evaluation and improving of virtual courses

There were many factors that contributed to building the community of experts. Of course, the most important of them was the scientific exchange due to presenting and discussing papers at RILW. A lot of cooperative work between the experts took place before the conference, while intensively communicating via e-mail, reviewing papers, organizing the conference, publishing all the information in the WWW. Also during the conference days, there were many informal discussions between the participants, between experts and students - in the conference rooms as well as while visiting interesting places in Romanian towns and villages or trekking in the Carpathians (involving hill walking and cave exploration).

Social and cultural events during all the conferences have not only given flavor and character to these meetings but have also enabled meaningful professional relationships to develop by sharing real-life experiences (as mentioned above). Together with the opportunities given for the silent sharing of musical and artistic performances, we have learnt far more than words could possibly offer. It is due to the vision and practical help of the Polygon Society (joint organizers) that RILW has been enriched with a mixture of culture, arts and science. This vision stemmed from oppressive earlier days when communication between disciplines and between countries was very limited. Now through the freedom of the Internet, we have organized, traveled and participated in scientific, social and cultural events mutually benefiting from the resulting knowledge and friendship gained.

A very important development that indicates a successful outcome of the RILW is the growing level of attention that Romanian authorities and newspapers are giving to the use of the Internet in education. Since

the beginning of RILW in 1997, communication via the Internet has been included in political decisions and reform proposals of the Ministry of Education. More new distance education centers are continuously opening and Romania is now involved with international educational projects like I*EARN or KidLink which include many school students.

An additional perspective for the future has recently been developed - starting from 1999, the RILW was extended by a summer school in the same subject area within the context of the European Socrates/Erasmus project. A book is planned to integrate the most relevant theoretical contributions and practical examples presented at RILW. Finally, as a result of RILW, several projects are being initiated in cooperation between Romanian and Western European institutions.

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The teacher`s attitudes towards computers in education of young children

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Abstract: The paper presents a research on attitudes towards computers and educational technology in education of young children age from 7 to 11 in few public schools in Subotica (Yugoslavia). The research included over 100 inservice teachers, and was undertaken in September 1999.
The research aimed at:
- the teacher's attitudes towards the usage of computers in education of young children,
- the teacher's computers skills, and
- the teacher's attitudes on implementation of computers in the education.

The research has showen that very few inservice teachers are actually "computer literates"; the teachers don't see the possibilities of applying computer technology in their work, but are very interested and willing to advanced in that direction.

Background

By the end of the 60's and during 70's the problem of the computerization especially in the field of education had emerged and has been debated over ever since in the Yugoslavian pedagogy. World tendencies are being followed, foreign and domestic authors related to the issue are being published, articles as well, many debates and courses are organized. The new projects in introducing the newest technology as a way of improving and modernizing the education were at the time: D. Frankovic: Development of technology and contents in SFRY education, 1972; V. Muzic: A computer in contemporary education, 1973; V. Pilic and co-authors: Cybernetics, computers and education, 1975; N. Soljan: Computer assisted education, 1972; Computer assisted programmed education, 1973; M. Bakovljev: Theoretical basics of programmed education, 1972; P. Mandic: Innovation in education and its' pedagogical meaning.

The status of the students and teachers in educational process is being debated over as well as their inter-relations in the student-teacher-education technology triad. Emphasize is put on 'thought activation', problem solving, learning through discovering and the individualization of the learning process. Computers take the important place in the theoretical consideration of modernizing the education. However the theory proved different to the practice, and very few things have changed since then. 20 years ago B. Vlahovic examined attitudes of teachers towards changes in education in sense of modernizing it and involving new techniques, and determined the importance of those attitudes in further development of education. It is interesting to mention that as early as then enthusiasts spontaneously have tried to initiate innovations in the educational process (Kaurin, 1999, p.431). Even in the early 80's the information revolution shock is present and it is openly feared that the gap will enlarge - between the present status in the computer science and the needs that will for sure in the future be developed thanks to computer itself (Nadrljanski, 1986 p. 10). The experiences from abroad are being accepted and the computers are being integrated into schools very intensively. In the republics of former Yugoslavia different projects are developed but based on sole experiments and not on a mass scale. We can set apart some projects as Electronic study-rooms, School mediatheques, SIS – School Information System. Initiatives as 'The Computer in School'-1984, 'Computer Aided Education', 'The Computer on University'- 1981-85. The

possibilities are discussed: Computer education in primary and secondary schools as well as college students and thus related qualification of teachers and staff needed.

Golden Age of pedagogical theory of computerization of schools tends to decline at the time it was supposed to develop even more. In the early 90's the number of schools equipped with computers, which is a positive trend so far keeps getting bigger, however it is all up to individuals and their pedagogical intuition, ability and creativity. The most common pattern of computer equipment integration into schools are computer study-rooms and cabinets, equipped with several computers which can be used by scholars but in most cases only older scholars (7th grade and upper) may use it, during computer classes. Until that time scholars manage on their own - experimenting if they own a PC or which is the case nowadays – enroll in the specialized private computer schools, because public schools can't meet extremely high demands for computer literacy among the children of different age.

In such conditions we decided to undertake a research which should help integrate computers in everyday school life and make it possible for all scholars to use them freely. At the same time we take the teachers as the basic carriers of computer literacy. Logically, many questions add to this problem on a multi-level scale; starting from the aims and goals of the education in general, status and the role of schools in acquiring those aims, financial and technical platform in educational technology planning all the way to the capabilities and qualifications of staff needed to realize these programs. However, the readiness to use highly motivational media as a computer, touches the very person of teacher as well as technical capabilities of a school in which one teaches.

What we need to emphasize is that never before a research with this or similar theme was undertaken in this region. This fact has determined this research as a exploration study or a pre-condition to a wider inspection into teachers' attitudes, but in the time to come, educators' attitudes, as well, towards computers in the education of younger children.

The Research

The research intended to inspect the attitudes teachers have towards computers in education of children aged 7-11.

It related to 3 groups of assignments:

a) data of computer experience of the teachers (self-estimated level of computer skills; type of computer training and years of experience with computers)
b) determine the existence of computer training in schools (evaluation of technical capabilities in schools; level of computer training and the age it starts)
c) determining the level of expression of teachers' attitudes towards computers in the education of younger children and how they relate to pre-determined perimeters expressed in previous groups of assignments

The basic hypothesis of the research was that teachers already have a positive attitude to begin with towards computers in education and that they can perceive the benefits the computers have being integrated in the process of education. The research can be described as a correlated study helping us acquire data on presence, direction and level of correlation between teachers' demonstrative attitudes as a dependent variable and independent variables such as gender, age, years of working experience, owning a computer and a computer experience. For the needs of this research an analysis of correlation between certain teachers attitudes and computer experience. The research instrument used was a questionnaire constructed for this purpose, consisting of two parts. The first part is an interview, which gives us basic data of a person examined. This includes gender, age, class the one is teaching and the number of children in class, as well as the information connected to the computers (estimated level of experience, length and type of training, usage of Internet and e-mail, estimated number of colleagues and scholars who own a computer, their willingness to equip the schoolroom with computers, level of school's technical equipment. The second part of the questionnaire' is a scale of a Lickert's type divided into several sequences:

a) the role of computers in improving society and mankind
b) stereotypes about computers
c) the fear of the computers
d) motivation to use a computer for a personal and professional development
e) the influence computers have on psychophysical development of a child
f) the vision of the role computers have in school reform

Specimen description:

The research was undertaken at the end of 1999. in 12 public primary schools in Subotica (Vojvodina), the city with a long tradition of institutionalized education of the children of all ages, on an intended sample, of an improbable type made up by teachers from 1^{st} to 4^{th} grade (No=135). Gender structure is 120 females and 9 males excluding six examinees who didn't answer the question, expressed in valid percent 93% females and 7% males. Here is the graphical description of the sample given for some independent variables expressed in valid percentage.

The analysis of the results related to the computer competence of teachers

The analysis of frequencies and percentages of dependent and independent variables gave the following results: A large number of examinees (78.8%) doesn't own a computer. More than a half doesn't know whether their colleagues own a computer (58.3%), a small number estimates that a few colleagues (up to 5) own a computer (32.6%), while 9.1% thinks that more than 5 colleagues own one. The global opinion is that it is very rarely spoken about this issue in the school. Somewhat different is the estimation of the number of scholars who own a computer – 72.5% of teacher thinks that up to 5 scholars in the class own a computer, 23.7% doesn't know while 3.8% thinks that up to 10 scholars own a computer.

Special care was given to a teacher's computer skill self-estimation – computer competence related to the profession. Only two of the teachers (1.7%) have evaluated their skills as excellent; a small number (14.4%) as good; 24.6% as satisfying while more than a half rate their skills as weak or insufficient. This data is consistent with the other one about length of computer experience. 87 examinees (64.4%) said that has never used a computer, 19 of them (14.1%) uses it for a few months, for a year 11 (8.1%), between 2 and 4 years 10 of them (7.4%), while 8 teachers (5.9%) use it for more than 4 years. The largest number of those who can use computers said they learned the skill through self-improvement, while the number of those who attended courses (whether institutionalized or private) is insignificant. Very few teachers – 12 of them works on computer literacy of their scholars in classes. A group of questions referred to the Internet; more than half (79.2%) has never used any Internet service, and the remaining minority (20.8%) uses it for personal needs. Similar ratio refers to E-mail service as well. At the end of this analysis let us mention two more interesting facts. More than a half of teachers doesn't know if their school has issue related literature or if the school is subscribed to any specialized magazine, domestic or foreign, about educational technology. The other one is tied to technical equipment of the schools researched. Only one school of 12 has more than 10 computers, and the Computer science there starts in the 3^{rd} grade of primary school at the age of 10 (approx.). In the remaining schools the number of computers in use goes from none to 10, and in most cases the training starts in 7^{th} grade as a non-compulsory subject and is not available to all scholars.

Analysis of teachers' attitudes towards computers

The general attitude, which was calculated as a central value of all attitudes towards computers as a media in education, is positive, which confirms the basic hypothesis of the research. However, the attitude is not extremely strong, as seen from the results (statistic analyse was taken in SPSS for Windows).

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Variable  General Attitude General Attitude Towards Computers in Education

Mean            3,749                   S.E. Mean          ,044
Std Dev          ,506                   Variance           ,256
Kurtosis        -,036                   S.E. Kurt          ,414
Skewness        -,311                   S.E. Skew          ,209
Range           2,404                   Minimum           2,439
Maximum         4,842                   Sum             506,079
Valid observations -       135         Missing observations -       0
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This fact is encouraging, taken previous results, which tell us about a relatively low rate of computer literacy of the examinees. Also, the fact that the research was undertaken in an urban environment has to be taken into account. It is supposed that there was a greater interest for the issue. We inspected the relationship between the self-estimated computer competence and the general attitude towards computers in young children education. With Pearson's coefficient 0.2544; $p < .05$ but $p < .01$ importance as well, we can accept a hypothesis that as the computer competence grows so does the positivity of the general attitude towards computers. Also, the expression

of the attitude is stronger with the persons who have had a bigger computer experience, than with those who have had it little or none. It seems there is a strong causal relation between these two variables.

When a rate of accordance in single attitudes inside every sequence is being observed, the following can be concluded:

- data show that teachers rated very positively attitudes on role of computers in education. Leading attitude would be "Computer competence is very important in the society we live in" (X= 4.60, SD= .52) while the weakest rated "Computers stimulate human productivity" was also very positive (X= 3.77, SD= .89)
- referring to other subsequences given in the description of the research instrument, we can see that teachers have a high rate of accordance with the attitudes concerning the influence computers have on psychophysical development of a child. The rates range from the minimum value for "Children should use computers" attitude (X=3.02, SD=1.03) to the maximum value for "Computers stimulate a child's ability to solve problems" (X=4.08, SD= .69)
- a high rate of accordance is expressed related to the role computers have in education reform. The maximum values regard the following attitudes: "Involvement of computers into schools means a greater possibility for school modernization" (X=4.38, SD= .75); "Computers in class can make education both more interesting and stimulating for scholars" (X=4.31, SD= .73), while the minimum value concerned the attitude: "The number of computers in schools will triple in the next 5 years" (X=2.70, SD=1.07). These results fit in generally accepted situation in our schools, where chalk and the board still represent the most dominant hardware a teacher uses in the process of education
- attitudes from the "motivation of teachers to use computers for professional and personal development" group were rated very high. It seems that teachers, even with the very low financial motivation to do their job, are interested in further improving both professionally and personally, and unavoidable instrument on that way is a computer. It is encouraging to see that they globally think of themselves as persons who need to know how to properly use a computer, and to pass on that knowledge to their scholars. Besides, they consider computers as a mean to get rid of some routine duties, and as a helping hand in thinking of new ways in education and realizing those programs in the classroom. One of the highest rated teachers` attitudes was: "I think that it is very important for me to know how to (better) use a computer" (X=4.24, SD= .79). "The computer competence is a significant characteristic of an educational worker" (X=3.29, SD=1.26) as seen here was highly rated as well, even though the accordance is more dispersed than in the previous case.
- Attitudes concerning fear of computers (anxiety) weren't specially expressed neither negative nor positive and take up central values. "Computers don't scare me at all" attitude has a highest level of accordance in this group but the highest level of deviation from the central value as well
- A low level of accordance dominates among the attitudes in the group of stereotypes, and it is important that they have sunk down to the bottom of the list of attitudes. The last attitude was rated lowest on the list, but with high deviations between examinees is the attitude: "Men handle computers better than women" (X=1.82, SD=1.07)

Instead of Conclusion

Which characteristics, abilities and skills distinguish our inservice teachers? Which characteristics, abilities and skills are desirable? There are some indications which give the teachers of new era the role of a selfconfident, creative, cooperative, active, innovative...creator. Results have shown that teachers are ready and eager for changes. They need support, a well worked-out integration modelof education technology in school as well as material support, since at the turning point into the new millenium, the question of computer literacy is the same importance as basic literacy is in life and work of a modern man. And all these start with the education of the youngest generation.

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A Discussion on Integration of Educational Technology into Turkish Educational System: Is It a Tool or Aim?

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Abstract: The purpose of this study is to discuss the new skills and knowledge that the students in Turkish primary or secondary schools will be furnished with through the integration of educational technology into the educational system. In order for attainment of the major national intentions listed on the paper by Ministry of National Education (MONE), there is a need of determination of the student learning outcomes in Turkey. The determination of the student learning outcomes will help to define that the students, achieving the national goals, will be like what after passing through the technology integrated educational system.

Introduction

"Education is critical for economic growth and poverty reduction. Changing technology and economic reforms are creating dramatic shifts in the structure of economies, industries, and labor markets throughout the world. The rapid increase in knowledge and the pace of changing technology raise the possibility of sustained economic growth with more frequent job changes during individuals' lives. These developments have created two key priorities for education: it must meet economies' growing demands for adaptable workers who can readily acquire new skills, and it must support the continued expansion of knowledge" (Priorities and Strategies for Education by World Bank, 1995). To respond these priorities, today, most agree on use of technology in education. Industrialized and developing countries around the world allocate a considerable amount of money and energy to integrate educational technology (technology is used interchangeably with computer) into their own educational system so that (Information Literacy Standards for Student Learning, 1998) "the student who is information literate:

- Accesses information efficiently and effectively
- Evaluates information critically and competently
- Uses information effectively and creatively
- Pursues information related to personal interests
- Strives for excellence in information-seeking and knowledge generation
- Contributes positively to the learning community and to society by recognizing the importance of information to a democratic society.
- Contributes positively to the learning community and to society by participating effectively in groups to pursue and generate information."

The goals, mentioned above, of the integrating technology into education are drawn from a developed country's –Canada- standards of information literacy for student learning. However, the same intentions can be traced in the policies on the use of technology in education of developing countries where annual per capita income does not exceed US $4,000. Two concrete examples are Chile and Costa Rica. These two Latin American countries (Alvarez et al.) "provide a valuable opportunities to analyze two approaches to introducing computers "into developing-countries education systems. Both are democratic, middle-income countries; both have focused their computer-based education programs on schools in low-income urban and rural areas; and both intended that computer use would enhance children's cognitive abilities and prepare teachers and students to participate more fully in the Information Age… with the intent that the computers could be used to promote cooperative learning, higher level thinking, data management, and communication skills."

Similar intentions are shown in the countries like Canada and Israel where annual per capita is much higher than the two Latin American countries mentioned above. The main purpose of integrating technology into the Israel's educational system is "to match each individual student to the program of instructional activities appropriate to his/her cognitive development and preferences." In Canada, also, the intention behind the use of technology in education is to (Information Literacy Standards for Student Learning, 1998) "prepare students to locate, analyze, evaluate, interpret, and communicate information and ideas in an information-rich society. Authentic practice of these skills enables students to realize their potential as informed citizens who think critically and solve problems, to observe rights and responsibilities relating to the generation and flow of information and ideas..."

The quotations, taken from different income level countries, on the subject of determination of policy on the integration of educational technology into the education systems show that all nations view technology in education as a tool to prepare the coming generations for the needs of 21st century. This tool will "equip the new generations with the critical thinking, problem solving, self-learning, and communication skills they need to participate fully in the economy and society."

Turkish Case

As a developing country where, also, a great deal of money and energy are reserved for the integration of technology into her educational system, Turkey has almost the same overall intentions with the other nations about the use of technology in education. These intentions (Ministry of National Education, 1999) "are based on three major points:

- Given the widespread use of technology in almost all professional areas in the next century, it is one of the primary tasks of the Ministry of National Education (MONE) to provide individuals with computer skills.
- Since one of the tasks of a school is to prepare the individuals for the community, integration of changing and developing technologies into education not only will improve the quality of education and will also support social and economic development.
- Technology can enrich learning environment and be an effective tool in increasing students' motivation, their retention, and improving their problem solving and critical thinking skills.

To complete these overall national tasks, MONE started the Computer Experimental School (CES) project in 1985. With this project, educational opportunities were opened up to a wider population and accelerating human capital development. Since the beginning of the project, the broad range of knowledge and skills required meeting present- day job market needs have been aimed to give the students in these schools.

The Skills Required by Present-day Job Markets

Present-day job market needs (Information Literacy Standards for Student Learning, 1998) "information literate people who know how to learn. They know how to learn because they know how knowledge is organized, how to find information in such a way that others can learn from them. They are people who are prepared for life-long learning, because they can always find the information needed for any task or decision at hand." So, today's schools should aim to teach the young generations how to *access* the information, how to *evaluate* the found knowledge to understand whether it is the proper one, and how to *use* it to solve the real life problems, to extend their own knowledge on any subject, and to communicate in an "information-rich society."

Accessing Information

As mentioned at the beginning of the discussion, the rapid increase in knowledge and the pace of changing technology force the individuals in all professions to update their own knowledge in short intervals. To satisfy this need, one has to know how to gather the required knowledge in the shortest time. Today, to access various kinds of resources around the world, the cheapest and the fastest tools are computer and Internet technology. Many educational courseware and reference materials are available on diskette, CD-ROM, and Internet in multimedia formats. Only several clicks and pressing keys may put anyone into the center of the biggest library in the world. Therefore, in an educational environment where computers connected to the Internet are installed, the first task should include

teaching the students how to find the required information from different kinds of resources. This practice maybe named as the first step of the "resource-based learning."
"By bringing telecommunications applications into the classrooms, teachers are able to create environments where students can... come in contact with a rich array of information sources that broaden their horizons. Chile currently runs one of the few successful educational wide area networks of any country in the world... It was designed as a computer network project in which participating primary schools were given the opportunity as one of the first in Latin America to use computers for on-line communication" (Alvarez et al.).
On the other hand, in the Computer Experimental Schools in Turkey, information resources related to computer technology are on diskettes or CD-ROM's. Unfortunately, the Internet connections of these schools are very limited due to the economical and geographical constraints. However, connecting these schools to the world using Internet is one of the primary tasks of MONE in coming several years. Today, the students in CES use the educational and instructional software like games, Engmatic for English and Edunetics for math, biology, physics, and chemistry to find information in a computerized environment.

Evaluating Information

After gathering the information from different resources, the students need taking an evaluation step to understand whether it is the proper one to use. The children will have to filter a great deal of information accumulated from various kinds of resources, because there is no any control on the information gathered from especially Internet. Therefore, the schools, using computer technology in education, have to give the students critical thinking skill so that they can analyze the information at hand, and select the proper ones to use.
In conventional educational systems, one of the important resources for information gathering is teachers, and the students accept what a teacher says as true and sacred without analyzing and criticizing. However, after integration of the technology into the classroom, (Alvarez et al.) "the teacher is no longer the wise man... the teacher's role has changed to one of providing guidance to the groups. It is sort of a consultant's role, advising on how to the work is done and making suggestions when something is missing. The child feels that he/she is creating and originating his/her own work and managing his/her knowledge, and this has changed the mentality of the children to be more responsible and to meet work demands on schedule...they learn much more by navigating alone." The technology in education today does not change only students. The changes in different concepts of education as a result of restructuring schools with technology (Knapp & Glenn, 1996) are:

	Conventional Schools	Restructured Schools
Learning	Students learn by absorbing information and skills presented through listening to teachers' lectures and reading textbooks.	**Students learn by constructing their own knowledge through inquiry, experience, teachers, textbooks, and other resources.**
Teaching	Teachers introduce information and skills, provide exercises to practice skills and memorize information and check students' ability to remember these lessons.	**Teachers engage students in activities that require them to think critically, solve problems, and seek answers to their own questions. Teachers serve as model learners, mentors, coaches, and resources.**
Classrooms	Classrooms are primarily isolated settings where teachers deliver information, and students practice skills and answer questions. The focus is on individual and competition.	**Classrooms are multipurpose rooms where learners engage in research and problem-solving activities related to specific topics of study. The focus is on cooperation and team building.**
Technology	Educational "technologies" have traditionally included pencils and paper, chalkboards, textbooks, manipulatives, and other resources that help students develop basic skills, concepts, and generalizations.	**A variety of technologies are now available to assist learners in the creation of knowledge and skills. Many of these technologies can support research, analysis, problem-solving, and communication processes more effectively than the traditional resources.**

Today's students must be able to (Information Literacy Standards for Student Learning, 1998):

- "Judge quality and usefulness of resources for the specific task
- Question the messages presented in the mass media
- Adapt and transfer strategies for seeking information among various technologies"

to be functional in the 21st century.

Without having the abilities given above, the children will have been like rubbish bins filled with useless, even harmful information.

Using Information

The last important skill for children is how to use gathered and evaluated information to solve real life problems. To solve real life problems, because (Ministry of National Education, 1999) "one of the tasks of a school is to prepare the individuals for the community."

The schools using computer technology in education teach students (Potashnik & Adkins, 1996) "to use a variety of computer productivity tools widely used in business and commerce" like word-processing, spreadsheets, databases, and Internet tools. The basic reason to teach the children such tools is to furnish them with "marketable skills for employment." Computer laboratories, installed in some developing countries like Mexico, and Belize, serve for "preparing students for employment in private business and government."

Computer related tools provide the children with the ability to:

- Create products using the knowledge accessed also from computer related resources
- Use systematic processes to create products
- Communicate information and ideas through products and presentation.

Conclusion

Related to the incredible advance in technology, information in today's world is in a various kinds of formats. The educational institutions using information technology aim to give the students skills of accessing, evaluating and using the information. An individual using these skills will be able to:

- think critically,
- solve problems in real life,
- learn himself / herself,
- communicate in an "information-rich" society.

Moreover, (Information Literacy Standards for Student Learning, 1998) "authentic practice of these skills enables students to realize their potential as informed citizens...to observe rights and responsibilities."

To conclude, information technology in education is only a tool to prepare the new generations for the demands of today's economies and societies. With the use of information technology in the classroom, the students will have the ability to find, to evaluate, and to use information, which is the most valuable means of production required by the modern business world.

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What Computer Education & Instructional Technology Means to pre-service teachers: A case study of a Turkish State University

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Abstract: The purpose of this study is to examine the students' perception in a Turkish State University about the mission that the Department of Computer Education and Instructional Technology conveys. This study also investigates the students' beliefs about the effectiveness of their 4-year curricula to successfully achieve their goals and missions. Data was collected through a questionnaire containing open-ended questions related to the department's mission, aims and goals and about the meaning of the terms "Instructional Technology" and "Computer Education". The findings showed that although most of the major goals were stated by the students there was no consistency among the perception of the students with respect to the minor goals. The students also had difficulty in defining the basic terms.

Introduction

Effective use of technology in the classroom has received much attention in education, and teacher-training programs are expected to produce computer literate teachers. As a result of the wide dissemination of computers in Basic Education schools, the Turkish Council of Higher Education has restructured state schools of education in 1998. A new preservice teacher education program named as Computer Education and Instructional Technology (CEIT) was established to meet the national educational needs such as: upgrading the curricula and instructional materials for the Turkish educational system, improving the teacher training process, training high-qualified people with the broad range of knowledge and skills required for the 21st century's job market. Additionally, these new departments are expected to train computer teachers for K-12 and to furnish those teachers with adequate computer skills and the understanding of instructional technology to help other teachers in enhancing their teaching practice with technology. Even though these two major goals shape the primary mission of these new departments, students of these new departments may have a different perception of their main missions because of that these two terms; "computer education" and "instructional technology" are fairly new concepts for the Turkish preservice teacher training system.

Computer Education & Instructional Technology Department (CEIT)

At the undergraduate level the CEIT Departments aim particularly to equip students with up-to-date knowledge and practical skills required for K12 computer teachers. Computer laboratories are available to enrich the theoretical background of prospective teachers. An important objective given a high priority by these departments is to provide its teacher graduates with relevant contemporary information, training, and prerequisite skills. Graduates

of these departments are qualified to teach in basic education schools and high schools. The graduate program of the Department is designed to prepare graduate students instructional technology experts, and supervisors, curriculum consultants, test and evaluation specialists in instructional technology education. Computer education and instructional technology departments of all universities as well as the Ministry of Education and private schools employ the graduates of these Departments as academicians, teachers, supervisors, inspectors, curriculum consultants, test and evaluation specialists in computer education and instructional technology.

Methods and Data Sources

The target group of the study was a total of 158 students from 1st class to 4th class of the Middle East Technical University CEIT department. As the data source a questionnaire was developed. Qualitative data was collected with the help of the General Expectations and Awareness Questionnaire (GEAQ). The GEAQ, consisting of 5 open-ended questions about the department's missions, goals, curriculum and basic concepts and skills, together with student interviews intended to understand the differences in the expectations of students and the teaching staff from the CEIT Department, and to which extent the students are aware of their professional goals. The students received the questionnaire at their laboratory hours throughout the Spring semester of the 1998-1999 school year. To proof the collected information, 25 randomly chosen students from those who could answer the Questionnaire were interviewed with the same questions. In order to get a clear picture about the ideas of the students about instructional technology and computer education, the data from the GEAQ and the interviews were grouped into categories driven from common answers of students to the questions. The findings showed grade difference in the perception of the students in their understanding of the department's goals and basic concepts studied (e.g. instructional technology and computer education), were discussed with the faculty members and students with a seminar at the end of the school year.

Results

The findings for each question in the Questionnaire and the interviews can be descriptively summarized as:

1st question: According to your opinion, what are the foundation aim, mission and major goal(s) of your department?

1. % 46 of the 1st grade students, %67 of the 2nd grade students, %53 of the 3rd grade students and % 58 of the 4th grade students are not exactly aware of the major goal of the department.

2nd question: What are the minor or specific goals of your department?

1. %19 of the 1st grade students, %10 of the 2nd grade students and %30 of the 4th grade students can not distinguish the minor and the major goal of the department.
2. % 10 of the 1st grade students, % 8 of the 2nd grade students, % 9 of the 3rd grade students and %22 of the 4th grade students have no idea about the minor goals of the CEIT department.

3^{rd} question: Do you believe that your department's curricula fit its goals? Are there any skills and subjects that are not included in the curriculum but you think should be?

3. % 10 of the 1^{st} grade students, % 17 of the 2^{nd} grade students, %23 of the 3^{rd} grade students and %11 of the 4^{th} grade students believe that the CEIT department fits its goals.
4. Students who don't believe the CEIT department fits its goals emphasise the following points:
    1 Biology and chemistry courses are not so important (%35 of the 1^{st} grade students, %34 of the 2^{nd} grade students and %29 of the 3^{rd} grade students).
    2 Science and math courses should be in introductory level and should last only one semester (% 14 of the 4^{th} grade students).
    3 There should be more computer-related courses (%28 of the 1^{st} grade students, % 9 of the 2^{nd} grade students, % 23 of the 3^{rd} grade students).
    4 We would like to have some courses that were not offered in the previous curriculum (%19 of the 4^{th} grade student).
    5 There should be more programming languages (%18 of the 1^{st} grade students, %26 of the 2^{nd} grade students, %17 of the 3^{rd} grade students).
    6 There should be more powerful languages like C++, Java or Perl (% 11 of the 4^{th} grade students).

7 Students find the computer-related courses as insufficient. % 28 of the 1^{st} grade students, % 9 of the 2^{nd} grade students, % 23 of the 3^{rd} grade students say that there should be more computer-related courses.

4^{th} question: What do you understand from "Instructional Technology"? What do you understand from "Computer Education"?

8 There is a considerable number of students don't know the meaning of instructional technology. At the 1^{st} grade %29, at the 2^{nd} grade %23, at the 3^{rd} grade %10 and at the 4^{th} grade %10 of the students doesn't have any idea about what the instructional technology is.

5^{th} question: According to you, which skills and abilities a person graduated from your department should possess?

9 1^{st} (%39), 2^{nd} (%21), 3^{rd} (%14) grade students believe that their department should posses programming skills. However when the grade level becomes 4^{th} the percentage decreases to % 9.

10 As for the teaching skills, %16 of the 1^{st} grade students, % 4 of the 2^{nd} grade students, %12 of the 3^{rd} grade students and %18 of the 4^{th} grade students emphasize that their department should possess this skill.

Conclusion

The variety in the perception of major goals of the department decreases with the increase of the grade level. 3rd and 4th grade students are aware of more specific and realistic goals. Homogeneity in terms of sharing common ideas of the goals of the department increases from 1st to 4th grades. The main goal of the department is shared as "to train teachers for computers in the classroom". The way they perceive the mission and goals of the department shapes the way they define the minor or specific goals of the department. Although most of the major goals are stated there is no consistency among the perception of the students with respects the minor goals.

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Until the 3rd grade the students first concern is the science courses. In the 4th grade they are more concerned with the quality of the instruction. 1st, 4th and especially at the third level there is a great variety of definitions for the instructional technology. On the other hand, at the 2nd level students concentrated on only two different types of definition. Some students cannot distinguish the difference between instructional technology and computer education.
At the 1st and 2nd grade the programming skills are perceived as the most important skills while at the 3rd and 4th grade computer literacy and computer using skills have the greatest percentage. Students at different grade levels emphasize the great variety of skills that should be possessed by a person graduated from their department.
Observations in the environment of the department it was seen that some of the CEIT students were trying to define the identity of their department. They were trying to find an answer for the question "What am I going to be when I graduate from this department?" From interviews with students it was seen that the computer (hardware and software) and Instructional technology sides of the department were favorite to educational side of the department by the students. There was a spontaneous interaction among students towards searching the identity of their department.
In the light of this finding it would not be wrong to say that there is a need for the formulation and dissemination of the departmental goals and mission. This will help the students in finding answers the question "who am I" and "what am I going to be". There might be an orientation program for the 1st grade students.
The orientation program might include the information about

- Major goals of the department
- Minor goals of the department
- Meaning of the computer education
- Meaning of the instructional technology

For further research interviews may be done with the department head and related instructors about the rationale of the courses, which are perceived as irrelevant by the students.

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Furnishing Turkish Preservice Teachers with IT Skills: Hope or Hype?

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Abstract: There is a growing demand from the schools that prospective teachers be computer literate. New teachers are expected not only to have necessary skills for using computers but also to use computers effectively to enrich their classroom teaching. These expectations have pressured teacher education institutions in Turkey to redesign their teacher education curricula. In order to respond to these pressures, the Turkish Council of Higher Education (YOK) has developed a new teacher-training curriculum for schools of education in Turkey. According to the new curriculum, a computer literacy course became a must course for all preservice teachers to fulfill the requirements for teaching credential. The main purpose of this study is to introduce and to discuss the efficaciousness of the new preservice technology-training program in Turkey.

Introduction:

Existence of high expectations from the application of new technologies is not new. Ever since people first began to use new tools and innovative methods to extend their own limited abilities, they have been confronted with the need to adapt themselves to create effective working and living environments. Especially, with the advancement of new information technologies, the way people communicate and perform at work has changed dramatically. Not only have the emerging technologies of information made possible new forms of communication and interaction in every aspects of our lives, they have also unleashed strong forces for educational reform. Now, educational institutions are primary responsible for preparing individuals for the new millennium in which IT skills will evidently have a decisive role.

Many researchers in such diverse fields as economics, sociology, organizational psychology, and education have long recognized the importance of information technology for national and institutional development. However, the term "IT" has different meanings and functions for different areas of study. For example, IT in education is perceived as not only a tool to be used for enhancing teaching and learning but may be a change paradigm in the classroom or in the educational system. Over the last three decades, instructional technology has progressed from its early emphasis on the protection and use of media and instruments of communication technology to its current concentration on the systematic approach to solving instructional problems based on theories of learning and instruction (Seels & Richey, 1994). As a result, provision of information technology in education is assessed on the bases of its efficaciousness in providing new ways of learning for both teachers and students. For instance, Means & Olson (1993) reviewed research related to use of technology in the classroom and concluded that technology:

- Often stimulates teachers to present more complex tasks and materials
- Tends to support teachers in becoming coaches rather than dispensers of knowledge
- Provides a safe context for teachers to become learners again and to share their ideas about curriculum and method
- Can motivate students to attempt harder tasks and to take more care in crafting their work
- Adds significance and cultural value to school tasks

Computer Literacy Courses for Teachers:

A number of institutions, organizations and state agencies have attempted to create sets of guidelines to determine what computer skills are necessary (or should be required) for prospective teachers. As a result of these extensive attempts, now a number of different guidelines exists.

Luehrmann, for example claimed that, "One who is truly computer literate must be able to do computing to conceptualize programs algorithmically, to present them in the syntax of a computer language, to identify conceptual bugs, and to express computational ideas with a high degree of organization and readability" (Luehrmann, cited in Troyer, 1988, p.144).

At the other end of the continuum are those who are not in favor of including computer languages and programming into the content of computer literacy courses. Berger & Carlson (1988) criticized current computer literacy courses for heavy concentration on technical information rather than focusing on learning and instructional design theories and methods to integrate computers into the curriculum. They propose a pre-service course that is aimed at teaching the connection between instructional strategies of computer assisted instruction and the theories of learning and instructional design. Similarly, Martorella (1984) predicted that teachers do not need to know computer programming to use computers effectively as an educational tool. That view is shared by Rundall who expressed his opposition to those who are at the other end of the continuum by using the automobile analogy: "We can run a computer, just as we can run an automobile, without knowing how it works" (Rundall, 1985).

Davis (1992) developed a list of outcomes for teacher training that focuses on how to utilize technology in the classroom. Davis believed that a teacher training program should focus on increasing teachers' competencies to utilize technology effectively rather than promoting their programming skills. He further proposed that pre-service teachers should be able to:

1) make confident use of a range of software packages and information technology devices appropriate to their subject specialism and age range;
2) review critically the relevance of software packages and information technology devices appropriate to their subject specialism and age range and judge the potential value of these in the classroom;
3) make constructive use of information technology in their teaching and in particular prepare and put into effect schemes of work incorporating appropriate uses of information technology;
4) evaluate the ways in which the use of information technology changes the nature of teaching and learning (Davis, 1992).

Finally, there is an emerging perspective, which tends to view technology as a way of promoting innovations emerging from other fields of education such as curriculum development, instructional design or the theory of learning and teaching. Willis & Mehlinger (1996) think this perspective will frame the decisions and debates of the 1990s because this approach reflects a maturing perspective on educational computing.

> It does not treat all uses of computers in the classroom as equal as did so many of the research reviews published in 1980s. In addition, it does not treat educational computing as something separate from other aspects of the classroom such as the curriculum, lesson plans, and instructional design...Although this is very desirable, it will make discussions about computers in the classroom much more complex. (p. 1006)

In light of these different approaches, it is evident that the term "computer literacy" remains an ambiguous term because it means different things to different people. Tremendous development in the computer industry is also making the issue become much more complex. Even though outpacing of technology in teacher education programs has been too slow, the computer industry has been promising and providing more advanced technologies for instructional use simultaneously. Ongoing debate on the definition of "computer literacy" and guidelines for student teachers' computer competencies creates a serious debate on the contents of computer literacy courses. Each scholar determines the content of such courses based on their view of perceiving the term computer literacy resulting in confusion and lack of agreement.

Troyer (1988) reviewed a number of sources giving recommendations for the content of computer education for teachers. He noted that three topics are most frequently recommended for inclusion in teacher computer literacy training: (a) computer operation and structure, (b) educational applications of computers, and (c) software/courseware evaluation. (p. 145). Troyer (1988) also found that early emphasis on knowledge of the basic elements of programming has been losing its attractiveness among the scholars:

> Teacher computer literacy training now directs teachers to consider the methods of utilizing the computer effectively in the classroom, to evaluate available software, to use the computer as a tool in accomplishing record-keeping and managerial tasks, and to consider the larger impact of computer technology on society and education. (p. 146)

There is a number of researchers who firmly believe that computer literacy is a matter of individual organizational need. These scholars claim that we should focus on what is important to student teachers rather than pondering the glut of computer skills available. Moont (1987), for example, criticized that we are spending too much time and effort on the definition of computer literacy rather than teaching. Sheffler (1986) summed up the philosophy of computer literacy when he claimed "the challenge confronting teachers is to adapt whatever advantages computer use may be shown to offer, while holding fast to their independent vision of educational values" (Sheffler, cited in, Kay, 1989).

Higdon (1994) claims that each school for teacher training develops its own criteria of proficiency level in computer literacy and these imposed computer proficiency levels are achieved by pre-service teachers for credit but are not necessarily functionally learned. He further proposes that the pre-service teacher needs to be impressed with the social, economical, and cultural factors along with the empowerment that come with computer literacy. (p. 436).

Constructivist theory defines learning as a dynamic and continues process that must be sustained and strengthened by a multiplicity of experiences from which students then construct their own experiences and explanations (Jonassen, 1994). As constructivist approach receives wider acceptance in the field of teacher education, some teacher education institutions attempt to increase the emphasis on experience in the schools and decease the emphasis on lecture/discussion and computer lab components of the course by promoting student teachers' field experience (Burson, 1995).

Rodriguez (1997), for example, suggested that some of the general guidance in constructivist literature can be applied to technology training for teachers. Rodriguez proposed five constructivist strategies that can be used in technology training. First, he believed that constructivism and cognitivism complement each other and these two approaches should be merged. He further suggested requiring students to exert their mental effort in support of generative learning while providing explicit instructional support to avoid information overload in short-term memory. Second, he emphasized the importance of focusing on learners and their needs. He advocated that keeping students engaged through active participation and maintaining students' sense of relevance concerning course activities are critical. Focusing on the essence is another strategy that Rodriguez proposed. He argued that grasping the essence, students can then literally accomplish more complex tasks with the instructor's guidance, thus developing their understanding as they grapple with more complex problems. Fourth, he advocated that learning under the constructivist view is a communal activity. Even though teacher trainees need time to develop their technological skills on an individual basis, they often enjoy providing informal assistance to each other. Finally, the last strategy concerns reflexivity-learners' awareness of their role in constructing knowledge. He suggested that the instructor's role is to be one of ". . . engaging the student via questioning and prompting so that the student assumes responsibility for acting to solve the problem. Reflection and action, then, support construction of new knowledge" (p. 1309-1311).

Keizer and Wright (1997) describe how a basic computer course should be designed by using constructivist strategies, which are proposed in the previous study. First of all, the researches suggest that the course should be redesigned with a shift from whole-class to small-group instruction, from individual to tutorial instruction, from lecture to coaching, from summative evaluation to performance assessment, and from isolation to cooperative learning. The curriculum should be based on major concepts rather than a long list of objectives; it should focus on competencies rather than meeting externally imposed criteria. The classroom is to be more learner-oriented and less teacher-centered. The basic framework for the course should be changed from large group lecture and individual practice to teaching practice based on coherent themes, reflection, and relevant contextual experiences. Finally, faculty should give students guidance but not step-by-step instruction so that students can explore the computer applications through tutorials at individualized speeds and engage in authentic, real-word projects (p. 210).

It is obvious that the term "computer literacy" and "the content of computer literacy courses" have been modified according to developments in the field of technology and teacher training. In its beginnings, computer literacy addressed an understanding of hardware and software development. The student was expected to know the parts of the computer both internal and external. In addition, the student was required to become conversant in programming languages since it was necessary to know the language to get the computer to do many required tasks. As user-friendly computers and software become more available in education, the term computer literacy became more application oriented. Accordingly, an evolutionary change also took place in outlining the content of computer literacy courses. Computer literacy courses became more application oriented and the learners were prepared to use computers and software rather than to learn how to program them. Finally, computer literacy is now perceived as a tool for teachers to reform the way they teach.

Characteristics of Effective Preservice Technology Training:

Teachers will play a decisive role in how successful the integration of technology will be in education. It is evident that the investment in technology cannot be fully effective unless teachers receive necessary training and support to become fully capable of using these technologies.

A large body of research points out that technology should be integrated across the entire teacher education curriculum to be effective. Most teacher educators admit that one required computer literacy course for educators is of limited value if it is isolated from the rest of the teacher education curriculum (Yildirim, 1999; Yildirim & Kiraz, 1999). For example, Novak & Knowles (1991) examined beginning elementary teachers' use of computers in classroom education. They discovered that computer usage was not emphasized in their first year of teaching experiences because new teachers viewed computers as "extra" and "special," not as general tools to enhance the instructional process. This study supports the position that technology training needs to be integrated into the entire pre-service teacher education program so that pre-service teachers accept it as a means to enhance teaching and learning.

Effective technology training has four common characteristics that can be traced in the literature:

(a) educational technology training needs to be integrated into the entire teacher education program so that effective technology integration is modeled for pre-service teachers;
(b) the training should link technology with curriculum;
(c) the training should provide hands-on practice so that teachers become comfortable with them; and
(d) the training needs to be in-depth (Dell & Disdier, 1994).

Integration of IT into Preservice Teacher Education Programs in Turkey:

The Turkish Council of Higher Education (YOK) is responsible for the planning, coordination, and supervision of higher education in Turkey. Parallel to the international practices in reforming preservice teacher education for the new millennium, the Turkish Council of Higher Education has developed a new teacher training curricula for schools of education in Turkey. According to the new curricula, a computer literacy course became a must course for all preservice teachers to fulfill the requirements for teaching credential. This new course is designed to improve and enhance teachers' IT skills.

The main purpose of this course is defined in the new curriculum as to teach basic computer skills and introduce teachers to several commonly used computer applications such as word processing, spreadsheets, databases, telecommunications, and presentation programs. However, as described in the curriculum, preparing teachers for the use of these technologies into their classroom teaching is not among the course goals. Even though earlier practices of preservice technology training clearly ascertained that one computer literacy course is not of a high value unless computers are integrated into the whole teacher education program.

Even though this computer specific course is the first attempt at preparing Turkish preservice teachers to use computer technologies in the classroom, this effort should go beyond only training the teachers on basic computer skills. If the Turkish Council of Higher Education is to prepare teachers for the 21st century, the Council should recognize the need for providing other courses concentrating on instructional strategies to promote teaching with the computer in the classroom. In addition to that the content of "Methods of Teaching" courses can be reorganized to introduce new teaching methods including those incorporating the computer. As a result of this reorganization, schools of education will not only be training preservice teachers on technology but they will also be training preservice teachers on teaching with technology.

It is a fact that teachers teach as they have been taught, and it is unlikely that they will integrate computers into the classroom teaching unless they see their faculty using computers to teach. Therefore, it's also of the essence for faculty to promote "teaching with technology" in their classrooms.

Conclusion and Recommendations:

It is obvious that requiring a computer literacy course for preservice teachers to fulfill the requirements for teaching credential is an important step for the Turkish Council of Higher Education. It is because this required computer literacy course will make teachers more at ease with using applications, help them gain more confidence in using computers, increase their awareness of computers and its applications. However, the related literature on the preservice technology training indicates that "teaching with technology" is more than "using technology." Therefore, preservice teacher training programs of Turkey should be reorganized in accordance with the following principles.

- technology should be infused to entire teacher education program,
- technology should be introduced in context, and
- students should experience innovative technology-supported learning environments in their teacher education programs (Davis, 1999).

In order for the Turkish Council of Higher Education to successfully redesign preservice technology training programs, the following recommendations are offered:

1. Even though every preservice teacher is now mandated to take this required computing course, the value of this course is limited unless computers are integrated into the entire teacher education curriculum. Therefore, the Turkish Council of Higher Education should take the initiatives to employ new policies to incorporate technology into teacher education curricula outside of computer literacy or instructional technology courses. One of the most effective policies for incorporating technology into the whole program would be the integration of technology in teaching methods courses.
2. Needless to say, faculty of teacher education programs will play a decisive role in how successful the integration of technology will be in education. Therefore, they should demonstrate their competency and willingness to use technology in teaching. They should be role models for prospective teachers in integrating technology into the classroom teaching.
3. However, faculty of teacher training programs will need constant assistance from the educational technology experts in developing their hardware and software skills. Therefore, the Turkish Council for Higher Education should develop new policies to make this assistance available.

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PRESERVICE TEACHERS' PERCEPTIONS OF COMPUTER: TIME DEPENDENT COMPUTER ATTITUDE SURVEY

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Abstract: The purpose of this study is to determine time dependent computer attitudes of preservice teachers at the College of Education at Karadeniz technical University, Trabzon, Turkey, in an entry-level computer course. The focus of this study is to determine whether the gender and length of computer usage influence attitude of preservice teacher toward computers. Our results shows that gender do not appear to significantly influence attitudes toward computers. However, the length of computer usage do influence attitudes toward computers.

Introduction

One of the great challenges facing today s education system is the computer revolution in education. There is a need for preservice education programs, which emphasize integration of computer use in subject content areas and individual curriculum units. Beginning in 1982, Turkish Government introduced a series of funding initiatives to promote the use of information technology in schools. Applying information technology to effective learning and teaching all keys learning areas is the current Turkish education policy.

Teacher education faculties in Turkey have grappled for years with the challenge of preparing teachers to integrate technology using a variety of different approaches. Some components of the knowledge and skills required for teaching with technology are assessed with reasonable confidence. These include technical skills such as the operation of hardware or software and knowledge of relevant curriculum and policy documents. These teacher education faculties have been giving graduates with these capabilities for several years. However, this capability does not translate into more or better integration of computer technology into teaching. There are factors other than technical knowledge and skill, which contribute to teachers success at technology integration in their teaching.

Positive teacher attitudes toward computers are recognized by researchers as a necessary condition for effective use of information technology in the classroom. (Poling, 1994) asserted that students feel as if they are dragged, kicking and screaming into the realm of computers. Hakkien evaluated how a computer course affected the anxiety level, computer attitude, and feelings about computers of 29 first year education majors (25 females and 4 males). Sinclair s results indicated that as familiarity with the computer increased, computer anxiety levels decreased and attitudes improved. The other study compared education students in a computer course with a control group. Students who had taken the computer course had lower anxiety scores and higher self perceived ability than those who had not (McCoy & Baker, 1994).

At the College of Education at Karadeniz Technical University (KTU), Trabzon, Turkey, all education majors take an entry-level computer course entitled as Introduction to Computers . This course covers basic computer concepts, word processing, spreadsheet, and database. The course ensures that all educators can use information technologies to improve student learning, support effective teaching, and enhance overall teacher productivity. Students in all majors of college of education are required to take this course. However, many enter the course with anxiety due to limited use of the computers. Researches suggest that negative attitudes and unfavorable perceptions of computers adversely affect computer literacy.

The purpose of this study was to investigate preservice teacher s time dependent attitudes and perceptions about computers in an entry-level computer course. This study attempted to address the following questions:

- What are preservice teachers general attitudes toward computers?
- Do variable such as gender effects preservice teachers attitudes toward computers?
- Do length of computer usage influence preservice teachers various attitude domains?

Method and Instruments

Participants were pre-service teachers who were enrolled in undergraduate entry-level computer course in the spring program at the college of education in 1999. The study examined the computer attitudes of 78 preservice teacher majoring in science education in an eight-week computer course. Further, these attitudes were studied in relation to gender and length of computer usage.

The instruments used in this study were a) Interview Questionnaire, and b) Computer Attitude Survey.
a) Interview Questionnaire: Participants were interviewed to gather data and to determine their computer experience and preferences. This survey was given to students at the beginning and at the end of the computer class.
b) Computer Attitude Survey: To determine preservice teachers attitudes toward computers, subscale of Computer Attitude Measure (CAM) (Kay, 1993), was translated to a Turkish version and utilized in this study. These attitudes included personal attitudes and also application of those attitudes to teaching situations. This survey was given to students every week to determine weekly changes in attitudes toward computers. The following is the CAM subscale:

ATTITUDE ABOUT COMPUTERS

Please mark an X on the line, which closest indicates your choice.
Computers are:

1-	Unlikable	_ _ _ _ _ _ _	Likable
2-	Unhappy	_ _ _ _ _ _ _	Happy
3-	Bad	_ _ _ _ _ _ _	Good
4-	Unpleasant	_ _ _ _ _ _ _	Pleasant
5-	Tense	_ _ _ _ _ _ _	Calm
6-	Uncomfortable	_ _ _ _ _ _ _	Comfortable
7-	Artificial	_ _ _ _ _ _ _	Natural
8-	Empty	_ _ _ _ _ _ _	Full
9-	Dull	_ _ _ _ _ _ _	Exciting
10-	Suffocating	_ _ _ _ _ _ _	Fresh

Computer Course

The required computer course was taught in a computer lab by an experienced computer instructor. The content covered in the computer course include basic computer literacy tasks: 1) knowledge about computer hardware and software, 2) skills of using and exploring programs, and 3) ability to apply software features to produce the desired result.

The computer application classes are structured so that participants are engaged in hands-on activities to gain insights about how computers can be used to improve teachers efficiency and productivity.

In the first week students were introduced to basic computer terminology and gained knowledge about computer hardware and software.

In the second and third weeks students are required to demonstrate their skills in several word processing tasks. These included creating a word processed documents, retrieving and editing a file, setting new margins, changing the size, type, and style of fonts, and aligning text. They were instructed to change a document s line spacing, center a line of text, move text, and insert or delete text where necessary. The final tasks were to print the documents and save them as files on the diskette.

In the forth and fifth weeks, to demonstrate competence with spreadsheets, students were asked to create a spreadsheet file. After the spreadsheet was created, the students had to increase the width of a column, edit a cell, use a function to calculate the average, and create a bar graph. The students were printing a copy of the spreadsheet and save their work on the diskette.

In the sixth and seventh weeks, in the database section the students were required to create, edit, and sort a database records. Students were directed to create a database using the fields and data that were provided. They

were then instructed to edit a record, delete a record, sort the database according to specific criteria, and print the records. The students were then asked to create and print a report and save their databases on the diskette.

In the last week, students were instructed to use presentation program, Power Point. They were asked to create a new slide, add a color, picture and animation, and apply styles to their slide. The students were then directed to create a slide show. The final tasks were to print slides and save their work on the diskette.

Procedure

At the beginning of the computer course the purpose of the surveys was explained to the students. They were told that their responses would facilitate course revisions as well as provide a measure of the effectiveness of the course. Interview Questionnaire was administrated to participating students prior to and after eight weeks and data about their computer experiences and preferences were collected. Interview questionnaire contained short survey about basic technology competencies that are needed by educators. The students are asked to give an overall rating of their competency within each of the five domains (1) basic computer operation skills; 2) word processing; 3) spreadsheets; 4) databases; and 5) media communication). Participants are instructed to self-assess using a four-point scale (Very competent to Not competent).

On the computer attitude survey respondents were asked to indicate the degree to which they agreed or disagreed with each statement by circling the appropriate number from 1 to 7 (number 1 indicated negative attitude and number 7 indicated positive attitude toward each statement). This survey was give to students at the end of every week to determine weekly changes in attitudes toward computers.

Results and Discussion

Results revealed that 8 of 78 students owned a computer, 35 of 78 students were female and 45 of 78 were male.

The results of Interview Questionnaire that is administrated at the beginning of the computer course showed that students assessed themselves Not competent. Overall rating of their competency within each of the five domains ranged from 1 to 1.57 as it is shown in Tab. 1. After the computer course students self-assessment scores increased.

Computer Competency	Pretest	Posttest
Basic Computer Operation Skills	1.57	2.19
Word Processing	1.28	2.89
Spreadsheets	1.19	2.8
Database	1.11	2
Media Communication	1.04	1.3

Table 1. Results of Interview Questionnaire

The results of weekly variations of attitudes about computers are shown in Fig. 1 for both boys and girls. The weekly variation of each attitude is presented from (a) to (j) in Fig. 1. The following general observations can be done about Fig. 1: In general, both boys and girls responded positively for each attitude it seen from Figure. So, students (boys and girls) think that computers are: likable, happy, good, pleased, calm, comfortable, natural, exciting, fresh and full. There are some weekly variations of these answers as it seen from Figure. In general, for every week students responded more positively to all attitudes except in the third week and the week before last week (in the seventh week). In these weeks there is a slight decrease in the positive responses. The reasons for this can be attributed to the homework that was assigned to them at the end of the second week and the final exam, which was announced the week before last week. Again the differences between the responses of boys and girls are not significant in general. But Fig. 1 shows that the assigned homework at the end of the second week affected boys more than girls which is seen as a sharp decrease in boys graphics in Fig. 1. On the other hand the Figure shows that the final exam effected boys and girls almost the same.

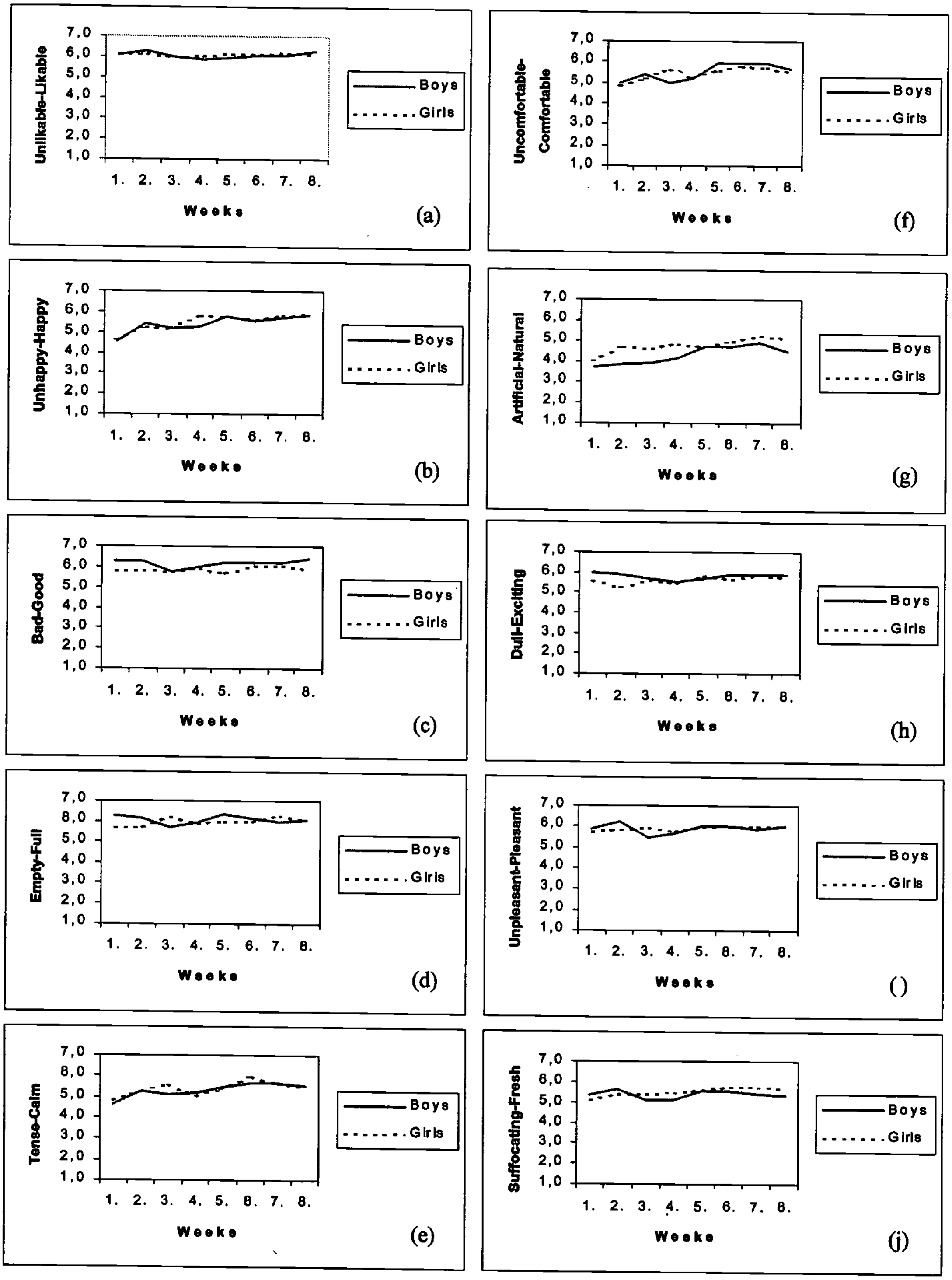

Figure 1. The results of weekly variations of attitudes about computers

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Ukrainian Teacher Education in Transition: What Role Can Technology Play?

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Abstract: The paper presents a critical analysis of teacher education reform in Ukraine. The author discusses the educational legacy of the Soviet period, major changes in teacher education, which resulted from general educational reform, and current needs of Ukrainian teacher education. The author argues that teacher education reform has so far succeeded in correcting the most obvious vices of the inherited education system. Further development of the reform should be aimed at altering the fundamental ways in which the system is organized. The successful accomplishment of this task is possible only on condition that all central dimensions of the teacher education reform, namely, teaching materials, teaching approaches and bėlief systems, undergo profound change. The expansion of teacher education reform can be ensured through the use of technology, which has a potential of becoming an important means of altering teaching strategies and beliefs.

Introduction

Like other countries, which emerged after the collapse of the Soviet Union, Ukraine is living through a period of profound transformation. Formerly part of a totalitarian state, it is slowly but steadily acquiring its own identity. A central role in this process belongs to education. The new Ukraine needs people who have been trained in the ways of the new social and political environment. Therefore, creating an educational system, which can help young people meet the challenges of the new, emerging democratic society, is a goal of utmost importance. Success in achieving this goal depends, to a great degree, on the quality and commitment of the teaching force.

This paper will focus on the current state of pre-service and in-service teacher education in Ukraine. Beginning with a brief description of the Soviet period legacy, the paper will shift to examining the major changes in teacher education which resulted from the implementation of the national policy in the field of education. It will then describe current needs in teacher education in Ukraine. Finally, the paper will consider the role, which technology can play in building up teacher education system, which will produce thoughtful, creative, independent specialists, who have clear understanding of inherent values of education for democracy and are willing to participate in the renewal.

The Soviet Period Legacy

A reform is correction of a wrong, of errors. Therefore, we shall start our analysis of changes in teacher education in Ukraine with a description of the Soviet period legacy.

The structure and content of teacher education in the Soviet Union was mainly shaped during the late 20s and underwent but rather insignificant changes during the Soviet period (Webber, Webber, 1994).

Pre-service teacher training in the former USSR was realized in both higher and non-higher, or secondary, educational institutions. Most secondary school teachers were prepared in higher educational institutions: pedagogical institutes and "classical" universities. These institutions also trained teachers for schools for physically and emotionally handicapped children , as well as children with learning disabilities. Most primary school and pre-school teachers received their training in non-higher educational sector, the so called pedagogical schools and technikums, though a substantial proportion graduated from teacher training

institutes. Higher educational institutions admitted applicants who had completed secondary education, pedagogical schools and technikums could be entered by people with either complete or incomplete secondary education. In the latter case students received their secondary education along with teacher education.

Most higher educational institutions offered five-year programs, which prepared for teaching two subjects. Many of them also offered courses by correspondence, evening courses or both. Students taking such courses had to take an additional year to study and unlike the full-time students prepared to teach only one subject. Pedagogical schools offered two- or three-year programs for students who had completed secondary education and three- or four-year programs for students with incomplete secondary education.

The curriculum in both higher and non-higher teacher education institutions was fairly standardized. The elementary and pre-school teachers took compulsory courses in Russian language and literature, mathematics, history, natural sciences and teaching methods. Pre-school teachers did language development, singing, sculpting, and drawing. Students of pedagogical schools also learned to play musical instruments.

The curriculum in pedagogical universities consisted of three interrelated components: content area, social disciplines (scientific communism, Marxist-Leninist philosophy, political economy and history of the Communist Party of the Soviet Union) and pedagogical disciplines (pedagogy, history of education, educational psychology, school hygiene and methods of teaching the student's particular content area). Also all student teachers had to take physical education and nursing (female students) or military training (male students).

An integral part of the curriculum in both higher and non-higher teacher education institutions was practical application of what the students learned. In the first years of study students were involved in extra-curricular activities at schools and worked in children summer camps. Later they did full-time student teaching under the guidance and supervision of teacher educators and on-site secondary or primary school teachers. Prospective teachers of biology, chemistry, and physics also had to do an industry practicum.

Upon graduation teachers were assigned to schools where they were required to work for at least three years before they could move to another job.

The in-service teacher training was realized in Institutes for Higher Pedagogical Qualifications and Institutes for Teacher Development, which offered short courses dealing with a specific content area and with certain topics in pedagogy. Teachers were required to have such retraining every five years. The participation in these courses was a necessary prerequisite for improving teaching qualifications.

This system of teacher education ensured significant educational accomplishments, for example very high literacy levels and great successes in the sciences and technical education. However, being designed to serve the needs of an authoritarian state with its command style economy it emphasized the values, which were opposite to those characterizing a democratic society. The major features of the system may be summarized as follows:

- State monopoly in the field of education. There were no private or denominational educational institutions in the USSR.
- "Rigid uniformity" (Webber, Webber, 1994). The system was universal with no diversity in region with markedly different history, culture and traditions.
- Heavy politicization. It was considered that the teacher's primary role was that of ideological educator (Webber, Webber, 1994), which explains, for example, why social sciences carried more weight in teacher education programs than pedagogical disciplines.
- Centralization. It was a hierarchical bureaucratic structure, in which all curricular, methods, objectives were issued by the Ministry of Education.
- Subject-centered approach. Teachers saw their aim in imparting and students in memorizing factual subject matter. Therefore, the system emphasized didactic and expository methods of instruction and paid little attention to building up higher cognitive skills.
- Low quality of philosophical and pedagogical culture. Pedagogy was separated from philosophy completely. This accounts for insufficient attention to the development of student teacher personality. Teacher education was concerned in the first place about preparing students with encyclopedic knowledge of different subjects and emphasized conformity rather than developed independence, leadership, creativity, critical attitude, willingness to take risks, tolerance to different opinions or responsibility.

The political change in 1991 generated fundamental social and economic transformation of the society and stressed the need for a different type of educational system, which could provide young people with the knowledge, attitudes and skills to be flexible, adaptable, and self-reliant.

Ukrainian National Policy in the Field of Education: Major Outcomes

Ukrainian national policy in the field of education began taking shape soon after the country proclaimed its independence. Its main directions were first defined in the Education Act of Ukraine adopted in June 1991 and were later instantiated in the Law on Education of Ukraine (1996) and in the Law on Secondary Education (1998). From the very beginning Ukrainian national policy was directed towards improving considerably the quality of education, integrating it with international educational practices, and reviving the people's national identity. Now, nine years later, we can see concrete results of its implementation.

The most visible aspect of change is a structural reform. The past decade has been marked by the establishment of private education institutions and the development of fee-paying higher education. Many teacher education institutions have changed their status, for example, according to the Law on Education of Ukraine former pedagogical schools now provide basic higher education. A number of pedagogical institutes have been transformed into pedagogical universities. This process was accompanied by considerable course diversification, which was motivated not solely by teacher training considerations but by student demands and needs of local and national economies.

Recent years have also been marked by the development of a multi-level system of pedagogical education. Now teacher education students may receive incomplete or basic higher education at Bachelor's level and complete higher education at Specialist's or Master's level. Pedagogical colleges offer programs which lead to Bachelor's degree, pedagogical institutes run Specialist's degree programs, and pedagogical universities grant Specialist's and Master's degrees.

Although higher education system of Ukraine is still regarded as highly centralized (Savchuk et al., 1997), higher education institutions have been given certain amount of autonomy. Subject matter and course structure are still decided by the Ministry of Education, however, teacher education institutions can now offer courses of their own choice, in accordance with the possibilities, which they have at their disposal, and regional peculiarities. Teacher educators also enjoy more freedom to choose textbooks and teaching materials.

Another result of educational reform is depoliticization of teacher education. Heavy ideological orientation of the system and rigid ideological control were brought to an end. New courses have been introduced, for example, sociology, logic, history of Ukraine. The content of the existing courses has been significantly updated.

National educational policy has also led to a wide spread of complexes, which consist of universities and gymnasiums or/and colleges, where different phases of teacher education are brought into closer contact with one another.

The scope of changes achieved in a relatively short period of time is impressive. However, this immediate correction of the most obvious faults of the inherited teacher education system is no more than a beginning of educational reform. To ensure its success more comprehensive mechanisms of change are needed, above all, careful strategic planning.

Have We Learned Our Lessons?

During the Soviet period there were two attempts to substitute the authoritarian, content-based education system with a humanistic, student-centered one. The first attempt was initiated by the educational authorities under Anatolii Lunacharskii immediately after bolcheviks came to power in 1917. The second one was advocated by the USSR Ministry of Education during the years of Perestroika. Both initiatives were enthusiastically met by broad-minded educators in the former USSR and abroad, but neither brought the desired results. It would be oversimplification to assign the failure of the reforms to a single factor. But it is not an exaggeration to say that an important part in burying these bold initiatives was played by lack of attention to the task of preparing agents of the reforms. In both cases reformers did not understand, did not

take seriously or overlooked the problem of resistance of the teaching force. They obviously acted from naïve theories of change, believing that long established practices could be altered through sanctions, exhortation or new courses in the curricular. Reforms were conceived not as multidimensional processes (Fullan, 1991), but rather as single events. Such an approach explains the choice of strategies of change which neglected addressing all three dimensions, which M. Fullan considers central to any educational reform, namely, materials (regulations, curricular, technology), teaching approaches (teaching strategies, activities, techniques), and beliefs (pedagogical assumptions, theories, which serve as basis for new programs) (Fullan, 1991). Although implementing just one or two of these dimensions, for example, introducing new courses without altering teaching strategies, or adopting new techniques without understanding the conception which underlie them, can accomplish certain educational objectives, but it cannot lead to fundamental change of the education system. Issuing new regulations, developing new materials and providing new resources are the most visible part of the reform and at the same time the easiest to imply, but they allow no more than improving the quality of what already exists. Changing teaching approaches and belief systems is much more difficult and requires continuous application of efforts. However, it is the development of the new teaching skills and provision of conceptual understanding of reasons for and main objectives of educational reform that makes the reform irreversible.

The lesson to be learnt from the two unsuccessful attempts of educational reforms mentioned here is that a precondition of a successful general educational reform is a reform of teacher education. The latter requires special attention and should be regarded a task of utmost importance if general educational reform is to have a chance to succeed.

Current Needs

The changes in teacher education achieved so far have resulted from the implementation of the general educational reform. Although these changes provided correction of the most obvious faults of the educational system, which Ukraine inherited from the USSR, they have not altered the fundamental ways in which it works. Therefore, there is a need to back up building a system of teacher education for democracy with a philosophy of change which would address both the content and the process of teacher education reform. It is important to ensure that educational change moves beyond issuing new regulations or revising materials. This does not mean that structural reform has achieved all its objectives. On the contrary, teacher education is in great need for new textbooks, curricular materials, computer hardware and software. But new laws or modern technology do not necessarily translate into significant improvements in pedagogy. They work or fail depending on whether or not they are based on changes in conceptions and teaching strategies. This means, for instance, that teachers need to be brought to grips with the inherent values of a democratic system and the nature of the teaching process in a democracy. They need to learn how to develop courses, which would fuse content learning with the development of student cognitive skills. They need to acquire practical skills in organizing and running schools in a democracy.

An important characteristic of the present reform is the enthusiasm and willingness to change felt by the majority of teachers, which is revealed, for example, in increasing numbers of "alternative" schools. This positive motivation for change needs to be fostered and teachers who struggle to ensure the success of educational reform should be provided with necessary skills and competencies as well as administrative support and resources.

The past few years have been marked by the development of a new tendency in teacher education map in Ukraine, namely, growing importance of provincial universities in pre-service and in-service teacher education. More and more school graduates who consider teaching as a career and people who already have higher education but want to be retrained as teachers enter provincial rather than central teacher education institutions (Gluzman, 1997). The faculty in provincial teacher education institutions also demonstrates greater commitment to their profession, while teacher education institutions located in big cities are becoming more like general universities, often dropping the focus on teacher preparation entirely. This brings forward the need to turn provincial pedagogical universities into regional centers for pre-service and in-service teacher education. The implementation of this strategy requires careful planning and state funding as unlike the advanced central higher education institutions most provincial universities have seen very little change recently as far as modernization of teacher education is concerned.

This list of need is far from being complete. I have just described those, which, in my opinion, require immediate attention.

What Role Can Technology Play in Teacher Education Reform?

Most teacher education institutions, in particular those, which are located in provinces, have but limited technology resources. Nevertheless, these resources could help to achieve an important breakthrough in teacher education reform, provided they are put to good use.

As has already been emphasized, educational reform is a multidimensional process. Change in materials is relatively easy to employ, changes in teaching strategies and belief systems present immense difficulties. However, if fundamental educational change is to be achieved, it is essential that all three dimensions - what teachers use as well as what they do and think - be altered in actual practice. It is in expanding educational change to cover up teaching strategies and beliefs that I see the primary role of technology in teacher education reform. Technology can ensure reform expansion in a number of ways:

- Providing continuous personal access to new ideas, which is a necessary condition for becoming aware and following up on innovations (Fullan, 1991).
- Providing opportunities for open ongoing interaction among teachers focused on educational reform implementation. Interaction is regarded the prime basis for social learning (Fullan, 1991). Expanding the scope of interaction, letting it go beyond one school or district may accelerate the acquisition of new concepts, new behaviors, new skills and new beliefs considerably.
- Letting external facilitators into the educational reform. Educators in Western Europe and in the USA have considerable first-hand experience of education for democracy. They may provide invaluable assistance helping Ukrainian teachers become aware of the existence of new approaches, choosing among a range of new practices, deciding on suitable evaluation. This interaction may provide Ukrainian teachers with important insights into the nature of education for democracy.
- Providing access to innovative educational materials (sample lessons, teaching tips) and resources.

While technology is not the only factor affecting educational change, it may play a key role in its successful implementation.

Conclusion

Analysis of teacher education reform in Ukraine gives reasons for optimism as well as for pessimism. On the one hand, there are obvious successes in dealing with the faults of the inherited education system. On the other hand, we face lack of strategic planning for educational change, which may eventually allow the system to remain essentially untouched. Whether teacher education reform will end up at the structural reform phase or move beyond it depends on a number of factors. One of them is technology. Hopefully, its potential will be used to its fullest.

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TEACHER EDUCATION IN RUSSIA: HISTORY AND TRANSITION

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Abstract: To say that Russian educational system is currently in transition is an understatement. More than ever before higher education in Russia and teacher training as its integral part is responsive to societal changes. The massive pressure of the technology revolution has created conditions that have greatly transformed the nature of academic life, the content of learning, and the roles of educators. The paper presents an effort to analyze the current situation in Russian teacher education considering both external and internal forces affecting the system. It also focuses on the issue of educational technology within the system of teacher training.

Introduction

To speak about changes and transformations the Russian teacher education is facing today is better through examining and analyzing its basic features from historical and contemporary perspectives. The following aims to track both the traditional Soviet and the reformed Russian teacher training system.

Teacher Education in Soviet Russia

Pre-service education

The structure of pre-service teacher education in the former Soviet Union resembles that of systems in many Western European countries. Traditionally a university diploma has been a license to teach. However, teacher training in the Soviet Union was not limited to university level: only 10 percent of teachers were prepared at the universities.
By the early 1990s, pre-service teacher training in the Soviet Union had been provided by three types of educational institutions:

1. specialized pedagogical schools,
2. pedagogical institutes,
3. universities.

Pedagogical schools still function in Russia today, specializing in preparation of preschool and elementary school teachers. The admission to pedagogical schools is based on either nine or eleven years of study in secondary school. The curriculum is mostly focused on methods of teaching and study of education. The course of study varies from four to two years, depending on the educational background of the students. Nearly three fifths of the course is devoted to core subjects and methodology of teaching them Theoretical professional training is combined with practical work during the first years and a teaching practice in the final year.
Pedagogical institutes, which were equivalent to university level institutions, and some departments of *universities* originally trained the students intended to teach in secondary schools. The course of study in both institutions was five years. The major *difference* between institutes and universities was in the curriculum, in other words in the existing balance between subject matter and educational studies. Traditionally pedagogical institutes paid greater attention to methodological and educational issues and provided more in-service training than universities did. The emphasis was placed on the preparation of professionals qualified to work as teachers. The universities focused on preparation of scientists and researchers rather than educators. The common feature for both types of higher educational institutions was that the variety and number of courses taken by students were based on the standard curricula and were mandatory.
In the 1970s departments for training preschool and elementary school teachers were established

in pedagogical institutes. It was an attempt to provide elementary schools with higher education institutions graduates. This implied that specialized pedagogical schools would be gradually replaced by pedagogical institutes, but it didn't happen. In spite of the differences between the ways future teachers were trained in pedagogical institutes and in pedagogical schools some school principals believed that elementary school teachers graduating from pedagogical schools were better prepared for their work than those graduating from the institutes. (Holmes et al. 1995). The former had more practical experience in their work than the latter due to the fact that in the institutes theory courses dominated the curriculum. Thus, by the early 1990s the above described institutions provided all Soviet schools with teaching personnel.

In-service Professional Development

In-service teacher training has been traditionally a significant part of the entire educational system. Every five years elementary and secondary school teachers had to take refresher courses, provided by teacher development institutes. These courses focused on specialized and advanced study in each core subject, as well as innovative teaching methods. Similar courses were organized by professional development departments for university faculties.

School teacher qualification system responded to teachers' academic background, professional accomplishments and teaching experience. To be promoted to the higher category, which would result in salary raise, they had to pass challenging examinations in educational studies and subject area, present a teaching portfolio and conduct a series of demonstration classes.

Teacher Education in the Reform Period

The international trends to raise the status of teacher training to a professional level became one of the decisive external factors in reorganizing and restructuring the existing types of teacher training institutions.

Since early 1990s Russian institutes have been gradually reorganized into universities, and pedagogical schools into colleges. Besides, an ever increasing number of new private educational institutions have emerged.

Today's financial crisis in Russia has seriously effected its academic life. All over the country pedagogical institutes merge with technical institutes into classical universities. The main purpose of this reform is to reduce the number of higher education institutions in order to survive in crisis. Thus, by August 1994 among 141 newly established universities, 46 were classical (Lugachyov et al. 1995).

A great concern here is that under the crisis and reduced finding from the Federal Government such transformations can lead to teacher education downgrading, due to the introduction of new programs, other than teacher training, but based on student fee. To survive and successfully compete with those, teacher training programs should be significantly reorganized.

Internal forces for change have been equally important. In newly established universities the teaching staff has been given greater freedom to design the curriculum. Having preserved national standards as unified test model, the universities are trying to take complete control over curriculum development and introduce new independent research topics and students' choice.

Moving Towards Technological Society

Russian teacher education system is currently in transition. One major shift that can be already seen is the greater focus given to preparation of educators for the future.

As the 21st century approaches, emphasis on technology has increased. It is known to improve opportunities for learning, to enrich teaching, and to strengthen the society. Unfortunately, teachers' acceptance of educational technology is not increasing as rapidly. Thus, Russian teacher training system has been slow to respond to the potential of the technology now available. Despite its importance to teacher education, technology has not become a core part of the teacher training programs in most institutions. There is an urgent demand to substantially expand the use of technology in teacher training curriculum, which will help future teachers to become technically literate to be effective in the classroom.

These demands for the broad integration of technology into the teacher training system are increasing throughout the world. Some nations, e.g. the United Kingdom, respond to them by including the use of technology in core subject

teaching within Teacher Training National Curriculum (Davis 1998). Such initiatives tend to emerge everywhere. Also exemplary is the experience of US higher education in incorporating technology in teaching . Such international parallels are a matter of comparative study and might help Russian teacher training .

Technology and Russian Teacher Education

Although no solution for financial and social problems of Russian educational system , technology plays a crucial role in its restructuring and updating.

The integration of technology into Russian teacher training curriculum would allow:

1. to meet the requirements of today's "information society";
2. to resist in the struggle for surviving with non-teacher training departments;
3. to update currently existing curricula and create a richer learning environment for students;
4. to improve teachers' professional efficiency.

The challenge to implement these changes into Russian teacher education is great, but so are the advantages. The expansion of advanced technology of all types in technological universities and departments of sciences and business created favorable conditions for those institutions to compete in fast-changing community. It is no secret that although today's education students have more access to computers than did their counterparts five years ago, colleges and university departments of education are often behind the rest of the campus in available hardware and faculty expertise. The education institutions have seldom received large equipment donations from federal or local budgets that other institutions have. They can hardly purchase the equipment by their own, as the business departments do, since they have no fee-paying students and as a result of it no financial support from this source. Besides, education faculties have usually not received systematic training in technology use. All these factors suggest that trying to infuse technology into teacher preparation curriculum remains a difficult task.

Another problem is connected with availability of computers in elementary and secondary schools. Although computers in Russian schools are widely distributed and access to them by students has increased, the vast majority of schools still do not have enough of them to make the computer a central element of instruction. Lack of funds continues to be a serious problem, identifying one of the powerful obstacles to increase use of technology in teaching. In fact, Russian public schools experience full computer laboratories and classrooms with no computers. Use of email is also not realistic choice for many students yet.

On the other hand, computer use in most of the schools is limited to a Computer Science course , the main purpose of which is to provide learners with computer skills for general purposes, and for business and vocational training. The teachers in traditional subjects hardly use computers in their instruction. The most popular technology tools used by teachers in the classrooms are videocassette-recorder (VCR), an overhead projector, a slide projector. Such single use of technology doesn't allow to exploit the enormous potential which it offers. Teachers need a hand to understand this for helping students solve problems, think for themselves and collaborate with each other.

In this sense an increase in the amount and capability of technology in schools will be required once the technology fully realizes its potential. The level of support from regional authorities might be also enhanced by emphasizing and demonstrating the cost-effectiveness of educational technology, applied to all disciplines.

Even so, availability of technology cannot alone solve the problem. According to E. Willis (1997), "Change from the static perspective of knowledge to that of dynamic...cannot come from the technology itself... Change must come from educators . . . "(E. Willis 1997). Since computers though powerful are not self-implementing, it is the teacher, who plays the crucial role in the educational technology classroom implementation.

However, the vast majority of Russian teachers have had little or no training at all on how apply technology in teaching. In spite of traditional for educators desire to develop professionally and do their job better, they feel left behind the time, since they are not adequately prepared to integrate technology into their teaching. For this to happen they need special training, which could cover both: technology training (learning how to use computers) and technology education (learning about computer and its capabilities). The focus should be placed on both pre-service training and in-service professional development. Unless teachers receive fair training and support, investments in technology cannot be fully effective.

Pre-Service Technology Education

A Brief History

In the Soviet teacher preparation curricula educational technology used to be represented by a course on Technical Aids of Teaching (TSO), comprising one semester either in the first or in the second year of study. The 38 hours of instruction combined both lectures about technology tools and practical training on their use. The subjects of study were the then technologies for classroom use, such as the movie projector, the old type overhead projector, the slide projector, etc.

By now, since most of these artefacts have been out of use, the course became outdated and has been extracted from the curriculum. For some time, it had not been replaced with any other course in educational technology. Recently colleges of education have incorporated a basic computer literacy course into their curricula. Normally, such a course offers 9 hours of lectures and 36 hours of hands-on computer training. Nevertheless, despite the course offerings graduates of teacher training departments do not feel prepared to use computers in their teaching. Since the training is provided by computer science departments or computer centers, the instructors focus on technology issues rather than its applications in education. But teacher training in technology must go beyond learning about formatting disks. It should be authentic and functional.

What Has to Be Done.

There has been considerate research conducted on instructing pre-service teachers how to use technology in classrooms. Many students currently entering the universities have at least minimal experience with the computer. So scholars agree that today's major issues are related to instructional strategies, instructionally appropriate software (J.Willis 1993) and advanced technological pedagogy. Oliver (1994) found that students express a strong need for computer education as an integral part of teacher training, particularly for courses including issues of curriculum and strategies for classroom implementation. Other studies reveal that providing a comfortable learning environment, promoting students participation and supporting them in constructing their own learning enhance their future use of computer technology. Activities facilitated by computer use supply the prospective teachers with the expertise how to enhance creative learning and collaboration in the classroom. With computers students can work on problems individually or in small groups, sharing more responsibility for their own learning. They find that technology is no longer a teaching device, but a learning tool which they can interact. They get convinced that computer skills are very important for successful participation in the educational environment. Furthermore, interaction of the medium requires a shift in the teacher's role from an information presenter to a facilitator of student learning. These need a lot of demonstration and modeling. Unfortunately, undergraduate instruction in most of Russian education schools lacks exemplary teaching models. There is an urgent demand for concrete examples of what technology integration looks like to prepare future educators to teach with technology. The most effective way to get these examples is through *teacher educator* modeling. In fact, use of computers in teaching requires knowledge of computers as well as that pedagogy to support their use. That is why instructors in computer integration courses need to be experts at teaching with technology. They need to show their trainees how to change their teaching style to incorporate technology, or to demonstrate how technology can meet their pedagogical approaches. Ideally, methods instructors in all core subject areas should introduce computer related activities into existing education courses. This would give pre-service teachers continuous training during the entire course of study.

Another way to model educational technology is through *internship* or student teaching practice. Here a teacher intern can see technology promise and problems in real settings. That provide collaboration between new and experienced teachers. The teacher who uses technology creatively and regularly could become a good model for a beginning teacher. Conversely, a student teacher can help bring technology to the experienced classroom teacher, who has not worked with computers previously (Power On! 1989).

Thus, training pre-service teachers in how to integrate technology in their teaching is not successful unless three prerequisites are met: computer literacy applications and computer programming, as an option; faculty to model using technology in the course; and field experience with supervising teachers using learning technologies in their classrooms (Wetzel 1993).

Teacher Educators As Change Agents.

Since pre-service teachers' education is focused on learning how to use technology as a teaching tool, it is teacher educators who must be prepared to address that issue. The instructors from computer science departments, currently conducting the courses, tend to use highly technical language in their teaching and focus on sophisticated technological issues. They fail to provide knowledge how to use technology in teaching, due to the lack of expertise in pedagogy and subject matter. In this way teacher educators can become change agents and build bridges between teachers and technology. Since communication is the essence of their job, teacher educators can bridge communication gaps between the highly specialized language of the instruction and that of the learners. However, there are many teacher

educators who lack the skills to model technology uses in their classrooms. The lack of effective training for teacher educators has been a barrier to technology utilization. Therefore, change in technology use must begin with teacher educators.

The research on the use of technology by education faculty comes to the same conclusions as that regarding in-service teachers. Barriers to greater use of technology by both counterparts include lack of equipment, inadequate training, anxiety about technology, and time constraints. To eliminate these barriers faculty and teachers need appropriate preparation, support for experimentation and innovation, and time for learning and practice. The latter is perhaps most valuable of all.

Very often, though proficient in their area of study, faculty feel uncomfortable with technology use. Initial fears about technology need to be overcome by revealing the myth that only "technical people" with large technology expertise can get good results. To achieve this, educators need opportunities to practice with the computer, as well as constant support from instructors, administrators and technology advanced colleagues. Those able to use technology on personal level show best results in implementing it in their teaching. Teaming up with the instructor on identifying topics in the subject matter and then using technology as a teaching aid helps make faculty' experiences more contextualized and meaningful. An innovative approach described in recent studies (Thompson et al. 1996; Gonzales 1999) is a way to accomplish this. It is based on reciprocal mentoring where students mentor faculty on how to integrate technology into their courses and the faculty mentor students on the academic process and teaching itself. Teacher educators empowered as change agents can greatly contribute to the adoption of technology innovations at all levels. For this to occur they should be prepared to invest considerable time and efforts , while university departments should provide support and commitment.

In-Service Technology Education

In-service education plays an important role in technology training. While pre-service education is important in giving future teachers facility with the computer, it only serves as an introduction into the field. Teachers need continuous training, as the technology changes and its applications vary widely, and as more is learned about learning with technology. The advanced training, based on teachers' specific classroom experience and needs can then be provided through in-service and continuing education.

The effective in-service training programs require: first, the system of an ongoing professional growth continued throughout a teacher's career. School administration in Russia has traditionally encouraged teachers to gain new skills and qualifications by providing higher pay for advanced category. In today's transition period, Russian teachers need even more encouragement. The environment of support for experimentation and innovation has to be formed in schools. Second, training workshops for teachers should address specific goals and be based on previous experience and knowledge. As a number of studies report, teachers prefer learning about technology from those who understand the settings in which they work. They appreciate and learn from good modeling on the part of the trainers. Third, appropriate balance between lecturing, discussion and hands-on practice during training should be observed. "Doing" an activity or seeing a teaching strategy modeled does not insure understanding of its possibilities" (E. Willis 1997). Fourth, follow-up support and guidance can make a significant impact of training. Teachers would get back together, report on their use of technology applications, and share experiences and ideals.

The use of technology makes teaching more challenging. Very few teachers have adequate time for planning and preparing for using technology in their classes. They need attending conferences and professional meetings after formal courses taken. Isolation is one of the basic problems teachers face. Workshops provided by professional development institutions are scarce and do not meet the needs of all prospective clients. One of the possible solutions might be long distance learning. Among a large number of Russian higher education institutions, only a few provide long distance education programs, and they do not specialize in educational technology. However, they might be a future investment to provide Russian teachers with opportunities they deserve.

Conclusion

As the 21st century approaches, the demands that society makes on teachers have increased. Trying to respond to these, the Russian teacher education system is being modified and restructured. In addressing these drastic changes, technology training is not the only solution, but it can be one piece of it . The teacher education reform provides the opportunity to consider new roles for teachers and ways for technology to fit in.

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The experience of a teacher educator on the use of IT
in primary classrooms

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Abstract: This paper shares the personal experience of a teacher educator in Hong Kong who took the opportunity of lecturer attachment to a local primary school to field-test the application of information technology (IT) in teaching a primary school subject in Hong Kong. This is with the aim to get herself familiar with the application of IT in teaching primary pupils, as well as to initiate more discussion and demonstration in promoting the use of IT to the pre-service teachers. The paper also reports on how the teacher educator planned, implemented and evaluated her teaching, along with the difficulties encountered. The paper concludes with practical suggestions for teacher educators and pre-service teachers in Hong Kong on how to implement IT effectively in primary classrooms.

Background

Computer technology is employed as a tool that supports and extends student's understanding of the pertinent concepts, processes, and themes involved. (Moersch, 1995). In his maiden Policy Address in 1997, the Chief Executive of the Hong Kong Special Administrative Region pledged a five-year strategy to promote the use of information technology (IT) in enhancing the effectiveness of teaching and learning. However, schools in Hong Kong at present vary considerably in terms of their awareness of the need for the paradigm shift, willingness and ability of teachers to teach through use of IT, availability of IT facilities, or even the feasibility of school sites to install computers, and the exposure of their students to IT (Education and Manpower Bureau (EMB), 1998). On the whole, there is a lack of strong IT culture in the school campuses, especially in primary schools. Though it is stipulated in the Five-year Strategy (EMB, 1998) that 60% of the primary schools have each been given 15 computers in 1998, many schools put all these 15 computers in special rooms

shared by about 20 classes of pupils. Such arrangement does not facilitate pupils' access to the computers.

Teacher Enablement of IT Use

It is also pledged in the Five-year Strategy to provide various training courses to meet the varying needs of teachers. It is also suggested that in addition to the training provided to serving teachers, pre-service teacher education should take the responsibility to equip the future teaching force with necessary knowledge, skills and attitude.

With the high degree of IT application in the tertiary curriculum, it is believed that pre-service teachers are at least IT literate when they graduate from the teacher education institute. However, it is found that the issue of using IT to enhance the effectiveness of teaching has not yet been fully addressed in the current teacher education programs (EMB, 1998). There is a similar situation in other parts of the world, many of today's pre-service and in-service school teachers are not adequately prepared to utilize computing, communications, and other technologies to support teacher-facilitated technology-based learning experiences for school students (Handler, Andris, Moran, Bievenue, Waugh, Payne, Levin & Brehm, 1998). It is recommended in the Five –year strategy that "active steps to assist teachers transit to the new mode of teaching" (EMB, 1998). Emphasis should be placed on how the contemporary mode of teaching can diversify to include elements of IT.

It is common that educators are often asked to develop computer-assisted-instruction (CAI) programs out of whole cloth, using secondhand descriptions or sketches developed by universities or consulting firms that have not tested the innovations themselves (Kohl, 1996). To effect the paradigm shift mentioned in the previous paragraphs, teacher educators should take a more active role to demonstrate the effectiveness of teaching using IT, on the one hand, by fully utilizing IT in their lectures, and on the other hand, by trying to expand the pre-service teachers' knowledge on the application of IT in classroom settings. Moreover, the importance of models of good practice in IT should not be underestimated. It is hard to create new CAI programs if one has not observed relevant examples in action. This is what might be called the paradox of large-scale innovation. Without models, people are left anxious and directionless, innovation fades, and things remain unchanged (Kohl, 1996). Teacher educators' experience in applying IT in primary teaching provides a very good model for pre-service student teachers.

Methodology

This paper describes my experience as a teacher educator who took part in a lecturer attachment scheme and was allocated to teach in a local primary school. During the attachment period, I conducted a small action learning project. My study aimed to field-test the use of technology in the teaching of a primary school subject, in order to initiates a more convincing discussion and demonstration in promoting the application of IT to pre-service teachers.

In this initiative, there is collaboration between academic staff and supporting staff, including staff from the Instructional Development and Media Production Section of the Centre of Learning, Teaching and Supervision in the Teacher Education Institute, who helped produce a series of CAI programs. A total of thirteen programs in two topics were developed. Six weeks of eight lessons of teaching are videoed and analyzed. I studied the eight videoed lessons to reflect on the interaction between the pupils and me, and activities conducted in the

lessons. The analysis of the present study was based on three data sources: my reflections during the preparation of the computer-assisted teaching program, as well as obstacles and difficulties encountered; and journals of my own teaching with the use of IT during the attachment period.

Findings and Discussions

The level taught was primary four and the topics covered were:

1. *The Earth* which included the topics of "The shape and structure of the earth", and "Continents and oceans",
2. *The Geographical Setting and History of Hong Kong* which included the topics "The geographical position of Hong Kong", "The relief of Hong Kong", and "History of Hong Kong".

Since most of these topics were factual information, the teaching could be very dry. It was a great challenge for me to design meaningful teaching to arouse pupils' interest to learn. The analysis reported below was organized into three major parts and was supported with data (from the transcription of lessons, reflective journals).

Preparing for the Lesson that Incorporate the Use of IT

Designing Computer-Assisted Instruction (CAI) Programs

In preparing for the lessons that teaching was supported by CAI program, a detailed lesson planning was the most important point to start with. The followings were some reflections of my journals during lesson planning:

> "An extra column "Instructions and resources required for the CAI programs" was included in the lesson plan to illustrate my ideas to design the program. This column recorded the ideas together with a list of information and resources provided for Jacky to design the CAI programs."

Would the education technology officer be able to read my mind by reading a few lines of descriptions? The written instruction in the extra column did not seem to provide sufficient information for the education technology officer. Face-to-face discussions were then conducted so that I could explain my ideas more explicitly, how I came up with the ideas, and the expected effect of the program. However, I was inexperienced in writing the CAI program, some of my ideas were not practical and feasible. The technological ideas provided by the education technology officer were useful for me to modify my ideas of teaching and for my planning.

> "The lesson plan was forwarded to Jacky for action, I hope he could translate what I had written into electronic form".

> "Jacky phoned me this morning and asked me to explain in detail to him what I had written in the column, ... His suggestions to put into practice of my ideas was wonderful that I had ever thought of."

Not many Hong Kong schools have started using IT in teaching, the school that I was attached to was no exception. There was a lack of facilities and internet service in the school. The information and photos I got from the world wide web to support teaching had to be put in the CAI program.

> "I phoned Jacky this morning and told him that I found some useful information and photos about earthquakes on the www, he told me to download the photos if possible, well, this is my first time to download photos from the web!...."

During the trial stage of the program, I found that the headings and descriptions always came before the pictures/diagrams or videos, and all the labels of a diagram appeared together at one time. Though this was common in most other CAI programs, I found that such design did not match with the constructivist view of teaching.

> "....it seemed logical to have the headings before displaying the information and photos, BUT this was NOT my way of teaching, what I believed, the constructivistic view of teaching was that pupils should be involved in exploring, observing or studying some phenomena before they are introduced the concepts.....Fortunately, Jacky understood my philosophy of teaching,...."

A thorough discussion during the trail use of the program allowed both the education technology officer and me to have a better understanding of each other's expectations. And it seemed that the design of CAI program by the technical staff alone would probably be a little more than a computerized presentation. In order to have the CAI well articulated with a learner-centred teaching, the involvement of teachers who could provide a clear message of their conception of teaching in the design process was desirable.

Creating Conditions for Using IT in an Ordinary Primary Classroom

In using CAI program in the classroom, several facilities were indispensable: a computer, a projector and a screen. The following showed the resource constraints and difficulties I faced in transporting the equipment to and setting it in the classroom.

> "Mary, the school head, asked me whether I needed a bigger room for my teaching using IT, if I wanted, she could swap the classrooms by having P.4A moved to P.5B classroom, which was a bigger classroom. In fact, I was very grateful for Mary's arrangement but I preferred to field test the use of IT without causing too much trouble to the pupils and school."

> "How clever I was to use a trolley that had all equipment fixed onto it so that I could carry the equipment with ease to the classroom. ....There were only 35 minutes each lesson, including setting up the equipment and teaching...."

An examination of the facilities available in the classroom and a trial of the setting-up of the equipment were the essential step towards a successful implementation. The followings were my feelings about my first visit to the classroom.

> "How dense the class of pupils was! Fortunately, there was a screen hanging in front of the blackboard. .... There was only about a foot of gap between rows of seat, three feet between the screen and the first row of seats,.... we needed to move the third and fourth rows of seats further apart so that the trolley of projector could move a little bit further away from the screen to make a bigger projection image on the screen."

> "Kin, the supporting staff from the Education Technology Unit, took only a minute to have all items set up on the teacher's bench, but no matter how hard I tried, it took me at least five minutes to complete the task."

Enhancing the Quality of Teaching and Learning

Improving Teaching and Learning with the Incorporation and Assistance of IT Elements

It seems that the use of IT can help to transform the way in which education is delivered in primary classrooms by breaking down the traditional boundaries of teaching and learning, from a largely textbook-based teacher-centred approach to more interactive and learner-centred approach.

> "The program was so powerful that it illustrated very clearly the seven plates on the earth surface. When a pupil moved the cursor around the earth surface, he could identify the different plates by himself." (Lesson 2)

> "The interactive activity for pupils to place each of the historical sites to its exact location served not only help pupils to identify the locations, it also helped pupils to revise previous knowledge of the different districts in Hong Kong" (Lesson 10 and 11)

The use of IT also helped to link up pupils with the vast network world of knowledge and information to enable them to acquire a broad knowledge base and a global view.

> "Pupils were able to observe the change and extension of Hong Kong's coast line by clicking the button, that is fantastic for pupils to make a comparison between the present and the past. The magnifying effect of the scene of the harbour showing how ships entered Hong Kong surprised pupils" (Lesson 8)

> "The videos of the different historical sites in Hong Kong provided an eye-opening experience for pupils, like touring around Hong Kong electronically." (Lesson 10)

> "It took me a lot of time to search for photos and pictures about old Hong Kong from about twenty books in the library (some of them were for reference that I could not take them out) and websites. Surprisingly when all these were put together in the program, it presents a very interesting and attractive story of the development of Hong Kong." (Lesson 12 and 13)

Moreover, there was evidence that IT had the potential to liven up classroom life by making teaching and learning more dynamic, interactive and innovative where pupils could become more motivated and inquisitive, to bringing about more effective teaching and learning.

> "The effect produced by the computer assisted teaching was wonderful, when I wanted to talk about "ASIA", I just needed to move the cursor to the exact place and it automatically flashed, this was very useful to focus pupils' attention" (Lesson 4)

> "The animation of a plane flying from Hong Kong to San Francisco aroused pupils' interest to solve the problem of time lag". (Lesson 5)

> "The interactive activities designed in the program provided a very good opportunity for pupils to use the computer, all of them were actively involved in making guesses to the answers.....How strange it was! About half in this class have never touched the computer before this lesson, ... I felt the girl's hand was shaking when I taught her how to use the mouse to select her answer." (Lesson 8).

Incorporating with Other Teaching/Learning Activities

There has been government target of having 25% of the school curriculum taught with the support of IT (EMB, 1998). To achieve this 25% target, it is necessary to bring about changes to the current school curriculum and the existing mode of teaching and learning. This can proceed gradually by first enhancing the level of awareness and meaningful use of IT in the existing curriculum with incorporation and assistance of IT to liven up some other learning activities. In other words, this is reconstructing teaching and learning with IT rather than replacement of the existing mode of teaching and learning with IT elements.

> "Though the use of the computer program is effective, some demonstration with teaching aids (foam plate and water) to illustrate the floating of plate on the larva is very helpful for pupils to experience it." (Lesson 2)

> "The programme gave an introduction to pupils on how earthquakes happened and showed pupils the damages caused by disastrous earthquakes. The group activities are very useful to help pupils to identify the seriousness of earthquakes which are of different scales and to identify places that usually have earthquakes are situated at the edges of plates." (Lesson 3)

> "Though I did not use computer program in this lesson, the use of scanner and colour printer in re-producing the maps for the activities, to me, was also a very effective use of IT." (Lesson 6)

> "Besides having a happy time with observing the videos of different historical sites, the activities requiring pupils to identify the history of the sites helped pupils to have better understanding of the history behind." (Lesson 10 and 11)

Conclusion

This paper aims at evaluating neither the effectiveness of the teaching and learning process nor the student learning outcome. It is noted by Dwyer, Ringsraff and Sandholtz (1992) that "The use of technology does not guarantee fundamental change in teaching-learning process and consequently in learning outcomes". It is hoped that the analysis provides a better understanding of the process of planning and implementation process, as well as the issues and concerns in teaching with the use of IT in Hong Kong primary schools.

Moersch (1995) found in the current use of technology that most of them are used for isolated activities unrelated to a central instructional theme, concept or topic. My experience in the present study also suggested that the incorporation and assistance of IT elements and other activities could make teaching and learning more meaningful. Such experience concurred Cuban's (1997) saying that 'the overall goal was to create different forms of learning and teaching with the help of technology, not have technology determine what was to be learned or how it was to be taught' (p.xiii). Hence IT should be incorporated into and complement the conventional instruction. Though the level of technology implementation demonstrated in the present study is only at level 4A - Integration (mechanical) among the six levels suggested by Moersch's Level of technology implementation framework. My experiences addresses the resource constraints in using IT in schools, it also provides insights to the teething problems in building up an IT culture in schools.

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Gender-Related Differences In Computer Anxiety Among Technological College Students In Taiwan

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Abstract

This study investigates gender-related differences in computer anxiety and the variables related to male and female students' computer anxiety. Participants were 549 college of technology students, each was administered a revised Computer Attitude Scale. MANOVA results indicate that male students had significantly greater confidence and lower anxiety than female students. Male students' computer anxiety was influenced by their own locus of control and total number of computer courses taken. Female students' computer anxiety was influenced by the same two variables as well as by their subject majors. Age and grade level, however, showed no significant influence on these students' computer anxiety. Standard deviations were relatively large, suggesting there was a great variance among students responses.

Gender as a differentiating variable in college students' computer use has been examined in a number of studies during the past two decades. Most of these studies are centered on students in colleges of liberal arts or teacher colleges. For example, Busch (1995) examined college students and documented gender differences in perceived self-efficacy regarding completion of complex tasks in both word processing and spreadsheet software, but not in simple tasks. Harris & Grandgenett (1996) found that gender is an attributing variable to teachers' anxiety in their use of networked resources. Very few research studies, however, have been specifically focused on students in technological colleges, assuming that these students receive adequate training in computer and technology, and are therefore least fear of using computer. It is important to understand the actual perceptions and needs of technological students and some influencing variables like gender on their computer use. Unrealistic assumptions may interfere the provision of educational programs that address their unique needs. Therefore, the purpose of this study is to investigate gender-related differences in computer anxiety, and to determine the variables related to male and female technological students' computers use.

Methods

The participants of this study were 549 college of technology students. Among them, 100 were male and 449 were female. These students majored in eight subject areas. About 96% of them were age 25 or younger. About 86% of them had computers at home and over 60% of them had been working with computers for more than two years. Nearly 60% of them had taken two or more computer-related courses.

The instrument used in this study is the revised Teacher Computer Attitude Scale (Violato, Marini, & Hunter, 1989). It includes 10 items measuring computer anxiety and confidence on a 5-point Likert type scale. A score of 1 indicates that a student disagrees strongly to the statement and a score of 5 indicates that a student agrees strongly to the statement. The instrument has been found to be reliable and valid in previous studies (Huang, 1997; Huang & Padron, 1995; Liu, 1998). For the present study, the instrument was translated into Chinese for the use of participants in Taiwan. Content validity was verified by reversing the translation of Chinese survey into English by English teachers who had not seen the original English version. No revision was found necessary. The alpha reliability coefficient is adequate at .87. A few questions on students' demographic and computer background were also included in the survey.

The instrument was administered to students in mid of the academic year by experienced researchers. Students answered the questionnaire anonymously. Multivariate analysis of variance

(MANOVA) was used to determine whether if there were significant differences in computer anxiety by gender. Follow-up univariate analysis of variance (ANOVA) was performed to determine where the differences were. A series of multiple regression was used to determine the variables related to male and female students' computer anxiety.

Results

The results indicate that college of technology students generally had above average confidence and below average anxiety in using computers. The item with the lowest score is "Computers make me feel uncomfortable," followed by "I get a sink feeling when I think of trying to use a computer". The item with the highest score is "I am able to do as well working with computers as most of my fellow university students".

MANOVA results indicate an overall significant difference in computer anxiety by gender ($F(10, 538) = 2.71$, $p < .01$). Male students had greater confidence and lower anxiety in using computers than female students. Table 1 presents the ANOVA results. Significant differences between male and female students were found in the following items: (a) I feel confident with my ability to learn about computers ($p < .05$); (b) Working with a computer would make me very nervous ($p < .05$); (c) I am not the type to do well with computers ($p < .05$); (d) I feel comfortable using computers ($p < .01$); and (e) Computers make me feel uneasy and confused ($p < .01$).

Table 1
Differences in computer anxiety between male and female technological college students

Indicator	Male M	Male SD	Female M	Female SD	ANOVA F
I fell confident with my ability to learn about computers	3.57	0.96	3.32	0.95	5.56*
Working with a computer would make me nervous	1.40	0.97	1.64	1.01	4.76
I get a sinking feeling when I think of trying to use computer	1.30	102	1.34	0.93	0.15
Computers make me feel stupid	1.42	1.13	1.41	0.99	0.02
Computers make me feel uncomfortable	1.24	1.06	1.33	0.89	0.78
I am not the type to do well in computers	1.66	1.05	1.94	0.98	6.63*
I feel comfortable using computers	3.58	0.90	3.26	0.79	12.84***
Computers make me feel uneasy and confused	1.46	1.17	1.79	1.13	6.76**
I think using computers would be difficult for me	1.39	0.94	1.42	0.80	0.42
I am unable to do as well working with computers as most of my fellow college students	1.36	0.94	1.42	0.80	0.42

* p < .05 ** p < .01 *** p < .001.

Multiple regression results reveal that students' locus of control of computer use, age, grade, year(s) of computer experience, computer(s) at home, subject majors, and number of computer courses taken have an overall significant effect on male ($F = 9.83$, $p < .001$) and female ($F = 30.86$, $p < .001$) students' computer anxiety. The R square value for male students equals to .43, suggesting that 43% of the variance in male students' computer anxiety may be explained by the seven independent variables. The R square value for female students equals to .33, suggesting that 33% of the variance in female students' computer anxiety may be explained by the seven independent variables. Stepwise regression results show that locus of control and total number of computer courses taken have significant effects on male students' computer anxiety. On the other hand, students' locus of control of computer use, subject major, and total number of computer courses taken have significant effects on female students' computer anxiety.. Table 2 displays the regression results by gender.

Table 2
Multiple regression results of variables related to male and female students' computer anxiety.

Variables	Female Beta	Female p	Male Beta	Male p

Locus of control	.50	.0001	.58	.0001
Subject major	-.13	.0028	-.08	.4071
Age	.00	.9337	-.04	.6730
Grade	.02	.7176	.02	.8619
Length of computer use	.05	.2316	.07	.4361
Computers at home	.01	.7848	.08	.3368
Total number of computer courses	.18	.0001	.19	.0001

Discussion

The findings of this study indicate that there were significant differences in technological college students' computer anxiety by gender. Male students were more comfortable and had lower anxiety using computers than their female classmates. These findings support previous research on the impact of gender-related perceptions on computer anxiety among college and university students (Brosnan, 1998; Liao, 1999). Plausible explanations include that (1) female students majored in different subject areas than male students; (2) female students had taken fewer computer courses, and (3) social stereotype of computer proficiency. Computer and technology have been portrayed in the society as more appropriate for male than for female and thus influence male and female students' self-efficacy in using computers. Because freedom from anxiety has been found to be an attributing variable to computer achievement (Liu & Johnson, 1998), it is important to reduce computer anxiety among female students. This can be done by identifying the areas and sources of anxiety in computer use by female students, and design instructional technique that can reduce their computer anxiety (Ayersman, 1996; Ayersman & Reed 1995-86; Liu & Johnson, 1998; Presno, 1998). For example, Fitzgerald, Hardin, and Hollingsend (1997) developed a course in hypermedia authoring program and provided instructional strategies to help decrease participating education students' computer anxiety.

Findings of the present study have provided a better understanding of gender-related technological college students' computer anxiety, identifying several related variables, such as locus of control and courses taken. Future research need to examine how these and other variables may be used to enhance equity among technological students' computer confidence and achievement.

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The In-Service Training Programs for Primary School Teachers to Use Information Technology in Australia and in Taiwan

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Abstract: This paper describes the in-service training programs for primary school teachers to use information technology in Australia and in Taiwan. The advantages and disadvantages of the training programs in these two countries are analyzed and compared. The Taiwanese government has done an excellent job in setting up the Internet infrastructure and different levels of technical support, and its in-service training programs have good supports for the full-scale implementation of web learning in the primary schools. However, the Australian in-service training program has merit in the setup of the full time facilitators and a good record tracking system to reduce the cost. Thus, a combined approach to take advantage of the best parts of these two in-service training programs is recommended in the future. This approach will help primary school teachers to learn and to adapt information technology in the classrooms more quickly.

Introduction

The advance of network, multimedia, communication technology has made a great impact on the way people work and learn. Today, information technology enables teachers to outreach teaching resources on the Internet, communicate with subject domain experts or other school teachers through the World Wide Web (WWW).

In Australia, the Department of Education and Training (DET) in the New South Wales (NSW) has funded public primary schools to purchase at least one modem and some Internet computers under the Computers in School Policy. Moreover, DET began a statewide Technology in Learning and Teaching (TILT) program in 1996 to promote computer and network literacy of primary school teachers (Training and Development Directorate, 1997).

Similarly, the Department of Education (DOE) in Taiwan identified the importance of information technology in education. In the past ten years, money and efforts have been allocated to set up the network infrastructure, computer laboratories and technical support centers in all levels of government schools. Moreover, from 1 October 1998 to 30 June 1999, the Taiwanese Government has spent a total amount NT$647 million (approximately US$20.2 million) dollars to update computer hardware, networking hardware and software in all levels of schools with a special focus on high schools and primary schools. Also, in-service training courses and local network support centers were provided to build up the computer literacy of the primary school teachers (Department of Education in Taiwan, 1999a).

In-Service Teacher Training Programs in Australia

Starting from 1996, DET in NSW had funded many state universities to run a 2-hours Internet workshop for primary school teachers. Each school in NSW selected one teacher as the Internet Contact Person (ICP) to attend the workshop. Moreover, later in 1996, the DET conducted a statewide TILT program. Approximately 150 teachers in NSW were selected as facilitators, and they were trained so as to be able to train other teachers. The facilitators were paid by their schools, but DET allocated extra money for schools to hire substitute teachers, so facilitators could be released from teaching and administrative tasks. Their major task was to train 70 teachers in the school districts each semester every half year. Each semester, the facilitators ran a thirty-hour workshop which contained six components entitled "Powerful tools to enhance teaching and learning", "Beyond the classroom walls", "Computers and related technologies", "Software", "How can I do this in my classroom", and "Future Directions". Each component lasts for five hours. There is a one-hour video program addressing the key issues, a two-hour hands-on activity using computers and related technology, and a two-hour follow-up activity related to the practical application of skills in the classroom (Training and Development Directorate, 1997).

Roughly one-third (15,000) of the primary school teachers in NSW have participated in the TILT program from 1996 to June 1999. The participants attended the workshops of the TILT program every two or three week after school. During the training period, DET allocated funding to each school to release the participants from the normal teaching loads for three single days or six half-days. They can use the free time to practice what they had learnt or ask the facilitator to do one-to-one tutoring. Moreover, the participating teachers are not allowed to take the same TILT program repeatedly in the future (Training and Development Directorate, 1997). The goal of the TILT program is to train 10,000 more teachers (i.e. up to 55% of the primary school teachers in NSW) to participate in the TILT program by Year 2000.

In 1999, DET in NSW also ran a small-scale survey to trace the participating teachers who attended the workshop in 1996-1998 period. The survey showed that 80% of the participants applied the computer technology in the teaching and administrative work at least once a month. Among which, about 63% of the participants used a computer at least once a week (Training and Development Directorate, 1997). However, there was no real application of network technology in classroom teaching and learning activities currently due to the limited numbers of modems to access the Internet.

In-Service Teacher Training Programs in Taiwan

Before 1995, governmental organizations, universities and colleges conducted in-service teacher training programs regarding information technologies. It was very costly for primary school teachers to participate in the training courses because schools have to pay for the substitute teachers and pay the travel and registration fees for the participants. Usually, the training courses were held for half-day or one-day. Occasionally, there were some workshops that lasted for three to five days. Yet, these short-term training courses did not have a good outcome because when the participating teachers returned to their schools, they sometimes did not have the equivalent computer hardware or software to practice what they have learnt in the workshop. As a result, they usually forgot the training content quickly and could not apply what they learned in their classrooms immediately.

As far as the training of facilitators is concerned, there were a few training programs that lasted for three-months or half-year to train some selected teachers to be facilitators. However, the facilitators' teaching loads are usually not waived. Meanwhile, they were also responsible for the maintenance of computer laboratories because primary schools in Taiwan did not have the budget to pay computer companies to maintain the computers, and there are no computer technicians in schools. As a result, the workloads of the facilitators are very heavy, and there are many complaints about it (Roy, 1999).

Before 1997, not many primary school teachers in Taiwan had been trained to use information technology. The reason for the lower outcome is due to the lack of record tracking of the trained teachers. Usually, those who were interested in learning computer technology would take the opportunity to attend different teacher-training courses over and over again.

To improve the shortcoming of the traditional teacher-training model, a new "on-site, full-scale" model had been applied to train all the primary school teachers in their schools from 1 Oct 1998 to June 30 1999. The DOE in Taiwan also selected some schools in each county to be the technical support centers as well as teaching resource distribution center. The DOE in Taiwan allocated funds to conduct the teacher-training courses with an aim to train 70% of teachers in each primary school (Department of Education in Taiwan, 1999b). There are also selected universities that are network centers of Taiwan Academic Network (TANET) which provide higher level technical supports to the county level technical centers, and they may even provide direct supports to primary schools if needed.

Starting from 1 Oct. 1998, many workshops were run for a semester to enhance the learning outcomes of primary school teachers. Every Wednesday afternoon, there were no classes for all the primary school teachers in Taiwan. The experienced facilitators or university professors came to primary schools and gave a four-hour training course to teach a wide range of preliminary computer and network knowledge and skills.

There were nine units of the basic courses including Windows 95, CAI, Internet application, MS Word, The application of WWW in teaching, Network Multimedia, CD ROM, Computer Maintenance, PowerPoint. Each unit was either four-hours or eight-hours depends on the difficulty of the content or the participants' background knowledge and skills. Some schools provided advanced training courses on Saturday every two weeks. The advanced courses included Homepage Construction (18 hours), Excel (12 hours), MS Outlook (12 hours), Word 97 (12 hours). The new "on-site, full-scale" model of teacher-training programs turned out to be more efficient than the traditional teacher-training courses. (Department of Education in Taiwan, 1999c).

Comparison of the training programs in Australia and in Taiwan

Although the TILT program in NSW, Australia has successfully trained more than 1/3 of the K-12 teachers in three years, the real application of the network technology in the classrooms has not become popular due to the limited numbers of modems, network hardware and software. On the other hand, the Taiwanese DOE has spent more than ten years in training teachers and promoted the usage of email and WWW in primary schools. In the past year, the network and hardware/software have been upgraded significantly. Many centers have been set up in each county to distribute teaching materials, software, CD ROM and other teaching resources developed in the past years. In addition, many WWW web sites have been developed to support the real application of information technology in the practical classroom teaching and learning.

There are some advantages in the Australian in-service teacher-training program. Firstly, Australian facilitators are released from teaching loads, so they can concentrate on running the workshops and provide tutoring to assist the participating teachers. On the other hand, Taiwanese facilitators were very much over-loaded by the tasks of training other teachers in their schools and maintaining the computers on top of their ordinary teaching loads. However, starting from 1998, there are remedies. For example, when primary schools purchase hardware from a computer company, it is required that the company takes the responsibility of the hardware maintenance for three years. Moreover, the teaching loads of facilitators are reduced somehow to compensate their time in training other teachers.

Secondly, the Australian in-service training system keeps records on the participants' names and only takes those who have not attended the TILT programs. In contrast, there is no record tracking in the Taiwanese in-service training system. One of the shortcomings is that limited numbers of teachers who are interested information technology may take different training courses repeatedly. However, the Taiwanese government has changed the strategies of in-service teacher training. The newly introduced "on-site, full-scale" training model works quite well to make sure that most teachers in the primary schools have attended the workshops. Yet, it is very costly for the government to do so, and the new model only last for eight months.

Conclusion

The Australian teacher in-service training program is more cost effective. The ways to release facilitators to allow them to concentrate on training, and the record tracking of the participating teachers have proven to be

effective and economical. The next step to take is the setting up of the network infrastructure in the primary schools and the organizing of the technical support centers in school districts, so teachers and students will benefit from the progress in information technology.

The Taiwanese teacher in-service training programs have better support in terms of the network infrastructure, the setup of the county's technical support centers to promote web-learning and to distribute teaching resources, and development of many web sites to enhance the teaching and learning through Internet in the Taiwanese primary schools. However, both the traditional model and the new model of teacher training programs in Taiwan are very expensive to execute.

Apparently, Taiwanese in-service training programs have better supports for the full-scale implementation of web learning in the primary schools. However, the Australian in-service training program has merit in the setup of the full time facilitators and good record tracking system to reduce the cost. It is recommend taking a combined approach to take advantage of the best parts of these two in-service training systems to help primary school teachers to learn information technology.

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TEACHERS READINESS IN USING COMPUTERS IN CLASSROOM - A STUDY IN MALAYSIA

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Abstract: This paper is a report on a pilot study to find out whether the teachers in Malaysia are computer literate and to explore teachers' attitudes towards using computers in the classroom. Questionnaires were distributed to schools and statistical analysis was used to present the results. The findings of this study show that the teachers are computer-literate, using computers for various tasks from administrative work such as recording students' grades and typing assignments for students to leisure such as playing games and Internet surfing at home. The teachers agreed that computers can be a useful tool in the process of learning for schoolchildren in Malaysia. They have a positive attitude that the usage of computers in the classroom can be implemented and are willing to learn the ways to use computers in the classroom. However, the teachers are not too agreeable or certain that computers are not indispensable in teaching since it cannot take the role of teachers.

Introduction

Malaysia is a developing country that emphasises on the development of information technology. In the early eighties, computers were introduced to schools through the establishment of computer clubs. From then onwards, it has attracted interest in schoolchildren. The Malaysian government through her sixth Malaysian Plan has decided to introduce computer studies as a subject in all secondary and primary schools. In October 1993, Prime Minister Datuk Seri Dr. Mahathir Mohamed urged more schools to use computers as part of their teaching and learning process. Therefore, in 1994, the Ministry of Education decided to further enhance computers usage in the learning process in the classroom by introducing computer literacy subjects in the curriculum.

Teachers play an important role in the classroom. For the usage of computers in classroom to be a success, teachers must have the knowledge and the willingness to learn to use computers effectively before imposing the usage on the students. In 1994, a research investigating the attitude of teachers towards Computer Aided Instruction (CAI) found that teachers generally have a negative perspective towards computer (Zulkifli, A.M & Raja Maznah R.H.). However, this perspective might have changed due to several reasons. First, is that the Prime Minister's Vision 2020 to make Malaysia a developed country through industrialization using the latest technology. Together with the Vision 2020, is the development of the Multimedia Super Corridor that emphasises the development of information technology. The information technology program also leads to the development of smart schools, where computers are used extensively and intensively in the process of learning.

With all the recent development in Malaysia, another research should be carried out to find out whether currently teachers have a more positive outlook towards computer. This pilot research aims at

exploring the readiness of teachers in using computers in classroom to enhance the process of learning. Readiness here can be defined as the teachers having the knowledge to use the computer (computer literate) and as the teachers' willingness to learn and use computers in the classroom. With all the preparation and money allocated by the government to introduce computers and information technology in the classroom, are teachers, as the main figure in the classroom, willing to use computers in their work, or in the classroom as a teaching tool?

Demographic Findings

This pilot study is based on questionnaires that were distributed to 122 teachers from five different secondary schools. Malaysian secondary schoolchildren range from the age of 13 to 18 years old, while teachers must have at least a diploma in education, often with additional bachelor or master degree. The respondents in this study ranged from 23 to 55 years old, with the majority in the 26-35 years old group. Majority were Malay (118), and female (112).

Teaching experience of these teachers ranged from as new as less than a year to teaching more than 20 years. A large numbers (51) taught languages, either Malay or English, while smaller numbers taught Sciences, Mathematics, Religion, History, and Living Skills.

Computer Usage Among Teachers

A huge percentage of the respondents (86.1%) claimed to have experiences using computers, either self-learned, taught by friends, or acquired through courses. Slightly more than half of the respondents (63.9%) have personal computer at home which they used for typing (94.3%), playing games (46.7%), surfing Internet (43.4%), and watching CDs (52.5%).

More than fifty percent of the teachers (66.4%) said that they were directly involved in using computer at school, of which 41.8% used computer for clerical work, 67.2% for preparing exams, quizzes or grades, and only 23.8% for teaching and learning in class. From the 122 respondents, only 5 teachers claimed to use computer in classroom, where as there remaining respondents still use traditional chalk and board method.

In encouraging teachers to utilize the technology in their work, the ministry have allocated computers at schools. Among the five schools surveyed, one school with 118 teachers have 10 computers where 60% of the teachers believed that they have access to only two of the computers. Another school with 90 teachers have 24 computers where many perceived that they could only use from one to about six of the computers. The other three schools have 52, 38 and 48 teachers, each with a total numbers of 20, 14 and 20 computers and majority of the teachers perceiving they have easy access to most of the computers. Table 1 summarizes the utilization of computers in the schools surveyed.

Table 1: School and Computer Utility

School	Total Teachers	Total Computers	Ratio Teachers : Computer
A	118	10	11:1
B	90	24	4:1
C	52	20	3:1
D	48	20	2:1
E	38	14	2:1

Thirteen (13) statements were given to gauge the teachers' willingness to use computers. On a scale from 1 "strongly Agree" to 5 "Strongly Disagree", the results show a positive sign. Table 2 summarizes the findings.

Table 2: Teachers' Willingness To Use Computer

Statements		Mean	SD
1.	I would like to learn more about computers as a teaching tool.	1.36	1.00
2.	I need more information on computers and its applications.	1.39	0.67
3.	With computers, my work will be updated faster.	1.36	0.69
4.	Computer's instructions are easy to follow.	2.40	1.10
5.	I am ready to use computers in my teaching process.	2.85	1.49
6.	I will not spoil the computers when using them.	2.99	2.28
7.	I am not too old to learn.	1.73	1.14
8.	I have the time to use the computer in the classroom.	2.79	1.25
9.	I have the chance to use the computer in my school.	2.25	1.22
10.	I can teach effectively without using the computer.	3.36	1.27
11.	I want to use the computer but I do not know how to operate it.	3.55	1.26
12.	All teachers need to develop some proficiency with computers.	1.80	1.39
13.	A qualified teacher should have mastered the proficiency of computer in order to improve teaching responsibilities and knowledge in computers.	2.02	1.14

A set of fourteen statements that reflect teachers' readiness to use computers as a teaching tool were included in the questionnaire. The respondents show a sign of readiness to use computers in the process of learning. Table 3 summarizes the findings.

Table 3: Teachers' Readiness To Use Computers As a Teaching Tool

	Statements	Mean	SD
1.	I would like to learn more about computers as a teaching tool.	1.36	1.00
2.	With computers, my work will be updated faster.	1.36	0.69
3.	Computers will replace teacher's role in future.	3.03	1.24
4.	Computers are valuable tools in improving the quality of a child's education and creativity.	1.73	0.80
5.	Computers are only useful in Science or Mathematics.	1.95	1.10
6.	Using computer in a classroom is a burden to the teachers.	2.49	1.33
7.	I am ready to use computers in my teaching process.	2.85	1.49
8.	I have the time to use the computer in the classroom.	2.79	1.25
9.	I have the chance to use the computer in my school.	2.25	1.22
10.	I can teach effectively without using the computer.	3.36	1.27
11.	I want to use the computer but I do not know how to operate it.	3.55	1.26
12.	All teachers need to develop some proficiency with computers.	1.80	1.39
13.	A qualified teacher should have mastered the proficiency of computer in order to improve teaching responsibilities and knowledge in computers.	2.02	1.14
14.	Teachers who are beginning to develop their computer skills need a lot of confidence.	1.92	1.06

An analysis of all the statements on the willingness and readiness of using computers among the respondents are given in Table 4. This summarizes the overall attitude of the respondents towards computers.

Table 4: Overall Attitude Towards Computer

	Statements	Mean	SD
1.	I would like to learn more about computers as a teaching tool.	1.36	1.00
2.	Computers need expertise to operate.	1.79	0.94
3.	I need more information on computers and its applications.	1.39	0.67
4.	With computers, my work will be updated faster.	1.36	0.69
5.	Computers will replace teacher's role in future.	3.03	1.24
6.	Computers are valuable tools in improving the quality of a child's education and creativity.	1.73	0.80
7.	Computers are only useful in Science or Mathematics.	1.95	1.10
8.	Using computer in a classroom is a burden to the teachers.	2.49	1.33
9.	Computer's instructions are easy to follow.	2.40	1.10
10.	I am ready to use computers in my teaching process.	2.85	1.49
11.	I will not spoil the computers when using them.	2.99	2.28
12.	I am not too old to learn.	1.73	1.14
13.	I have the time to use the computer in the classroom.	2.79	1.25
14.	I have the chance to use the computer in my school.	2.25	1.22
15.	I can teach effectively without using the computer.	3.36	1.27
16.	I want to use the computer but I do not know how to operate it.	3.55	1.26
17.	All teachers need to develop some proficiency with computers.	1.80	1.39
18.	A qualified teacher should have mastered the proficiency of computer in order to improve teaching responsibilities and knowledge in computers.	2.02	1.14
19.	Teachers who are beginning to develop their computer skills need a lot of confidence.	1.92	1.06

Discussion

This study defines computer literacy as the ability to handle and uses the computers to perform the desired tasks effectively. The findings show that a big percentage of the teachers have experiences using computers. The ability to use computers shows that the teachers are computer literate. The usage of computers is not limited only in their workplace but also at home. Various activities are done through using computers signalling a positive feedback that the teachers are literate enough to manipulate computers to suit their needs. It is very interesting to know that the teachers learn how to use the computers through their own initiatives or through their friends.

Generally the teachers are willing to use and acquire more knowledge on computers but at the same time are quite sceptical about the role of computers in the classroom. Specifically, they don't think in order to teach effectively, they have to use computer. They also feel that they don't have time to use computer in their classroom. This findings should not be viewed negatively since teaching is a two way process which requires natural interaction between two humans, more so with school children.

Overall, the teachers agreed that computers could be a useful, but not practical tool in the process of learning for Malaysian schoolchildren. This is due to the factor that the teachers themselves are already burdened by their teaching preparations and extra curriculum activities. In addition, the current numbers of computers in schools are far from sufficient to cater for schoolchildren in a classroom. Apart from the advantages offered by the computer technology, Malaysia still has to get some basic financial and logistic preparations sort out to ensure that the implementation of computers in classroom a success.

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Advocating Reflective Learning in a Teacher Training Program

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Abstract: This paper evaluates the effectiveness of conducting reflective learning in a teacher-training program, which comprises of TESL (Teaching English as a Second Language) undergraduates studying in Universiti Malaysia Sarawak, through web-based instruction. Findings indicate the perception of the undergraduates, who are taking a CALL (Computer-Assisted Language Learning) course, towards the use of web-based instruction as a medium of instruction, collaboration and reflection.

Introduction

Teachers open the door, but you must enter by yourself.
Chinese Proverb

To survive in today's world of Information and Communication Technologies (ICT), learners require aptitudes in self-learning and self-discovery through reflective thinking. Failures to independently build knowledge and adhering to passive learning interaction limit further development of cognition. Seeing these fallacies in classrooms of the present day, educators are inclined to find alternative strategies to empower the learners and enhance the learning experience. Using web-based technology is one.

To empower learners, Neilsen (1999) suggests some guiding principles to become independent thinkers, readers, and learners:

1. Allow learners to be actively involved in the learning process.
2. Provide consequential contexts for learning.
3. Provide a supportive learning environment.
4. Provide opportunities for learners to collaborate.

With the fluidity of the web, these components can be easily integrated into the classroom instruction. With the emergence of the web in the educational technology realm, the trend in classrooms heads converging different approaches in the teaching and learning process. Web-based instruction becomes a tool to maximize the effectiveness of each stakeholder in the entire learning environment.

Why reflective learning? According to Dewey (Gordon, 1998: 34), "...reflective learning involves resolving an indeterminate, problematic situation." Thus, reflective learning, which comprehends issues in problem solving revitalize the learner to reflect on knowledge and experience. The transformation of an entirely new insight is gained when knowledge is reconstructed (Hullfish & Smith, 1961: 207). The processes of reflective learning consummate through a "conversational framework" simultaneously consist of discursive, adaptive and interactive process of learning. The "conversational framework" defines a structure of an interactive conversation that relates to the content in conditions of a topic goal (Laurillard, 1993:104).

The application of "conversational framework" instead of assisted through verbal conversational dialogue, was conducted on-line in written form. Learners interactively participate in a written form of discussion, done individually or in groups. The flexibility of asynchronous communication promotes reflective thinking when a larger group of interaction requires the retrieval of previous discussion as well as personal views. The capability of computer-mediated communication, which secures group interaction through a security login procedure, gains learners' confidence and builds on their comfort zone to reflect on

ideas and views posted from peers, devoid of temperance of outsiders. In any case, "technology can support and strengthen relationships, but never create or replace them" (Schneiderman et.al.1998).

The Study

A Computer-Assisted Language Learning (CALL) course was conducted for one academic semester (four months) at the Universiti Malaysia Sarawak. The course is one of the core components of a teacher education program (Teaching of English as a Second Language majors) At the initial stages of the course, learners attended face-to-face lecture sessions twice a week (4 hours), complemented with the utilization of a web-based application, made available to all course participants. Course assignments are mostly supervised on-line with asynchronous interaction between the instructor-students and student-student.

Figure 1: A screen shot of the title page of the web-based application used for the course.

The four processes of learning, which are discursive, adaptive, interactive and reflective, integrated in the "conversational framework" (see Figure 3) encourage the participation of learners in this course to freely and interactively share views and ideas related to the subject matter. The model of the "conversational framework" indicated in Figure 1, shows the process of learning experienced by the instructor and students. The instructor manages and guides the on-line discussions, and questions are posted to stimulate reflective thinking. In the beginning, learners given individual assignments are encouraged to share their opinions based on own readings and personal understanding without any guidance from the instructor or peers. However, later, assignments are distributed to different teams formed in the class, and team members are required to brainstorm and share ideas to improve on the task at hand. Initially, learners begin with a team-based interaction that generates ideas and comments with feedback from each team member. Then, each member eventually learn how to think deeper when asked to reflect on the views of others that differs from their own, and when they are asked to utilize the knowledge and perspective to improve on their own understanding. As put by Andrusyszyn and Davie, "the important strategy for the clarification of their own understanding is based on individual reflection on their own values and learning" (1995).

The achievement of individual understanding requires collaboration on theoretical concepts and practical perception on the topic of discussion. "In order to share, learners must first be clear about their own concepts and understanding" (Andrusyszyn & Davie, 1995). It is then that collaboration would succeed in the quest of diffusing vast knowledge and experience beyond the boundaries of traditional text. Teamwork collaboration through web-based instruction interacts in the search for meaning. "Meaning is central in learning and, hence, is central in thinking; it pervades the learning experience" (Hullfish & Smith, 1961). Thus, collaboration supports the process of learning through reflection of discursion, adaptation and interaction.

Findings

Questionnaires were collected at the end of the course with the return rate of 92.86%. The questionnaire evaluates the perceptions of the participant towards the conduct of an on-line discussion course in relation to the use of reflective learning. There are 8 males and 18 females who participated in the study. The t-test and One-Way ANOVA procedures are applied to determine the significance of selected variables.

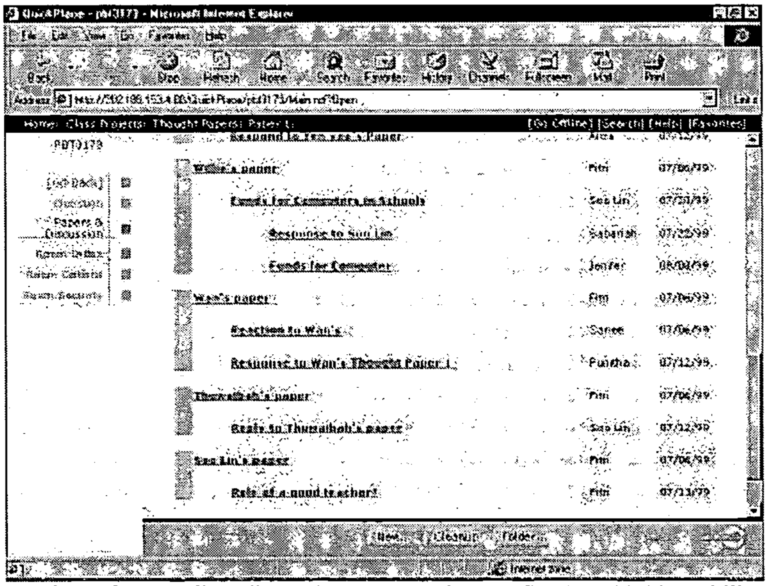

Figure 2: Screen shot of the online discussion room, where reflective thinking skills were put to use throughout the course.

Data from the survey indicated that the group who used the web-based application perceives that it motivates and challenges them in the course development. Most reported that they are able to follow the reflective thinking tasks assigned on the web-based application, and they noted a sense of learner control over the course, as they are able to contribute to the course curriculum through the use of the web-based application. The group also indicated the challenge to master the reflective thinking skills, as they progressed in this course, and the fact that they had to do everything online made the challenge even more consequential, as everyone in the learning environment had access to view each other's development. However, due to spatial limitations for this paper, details of the data analysis will be presented during the conference paper presentation at a later date.

Conclusions

In the beginning of CALL course, many of these trainees were hesitant about publishing tasks and assignments on the web. However, they gradually performed better in the following tasks, particularly those that involved team-oriented discussions. The responses of the students were overwhelming, and the quality of their contribution to specific tasks was notably better than their performance in previous courses. Some of the factors that were found to influence the success of conducting a web-based instruction learning in the teacher-training program, as such reported in this study, include prior knowledge and skills in ICT. Based on the observations and findings from the questionnaire, the web-based platform used to encourage reflective thinking worked for these teacher trainees – they grew to become more responsive toward the subject matter, and they invested more than what they had predicted from the initial stage of the course. Hopefully they will graduate with a better perspective about teaching and learning, as they become more receptive toward the journey of the mind in its quest for knowledge and education.

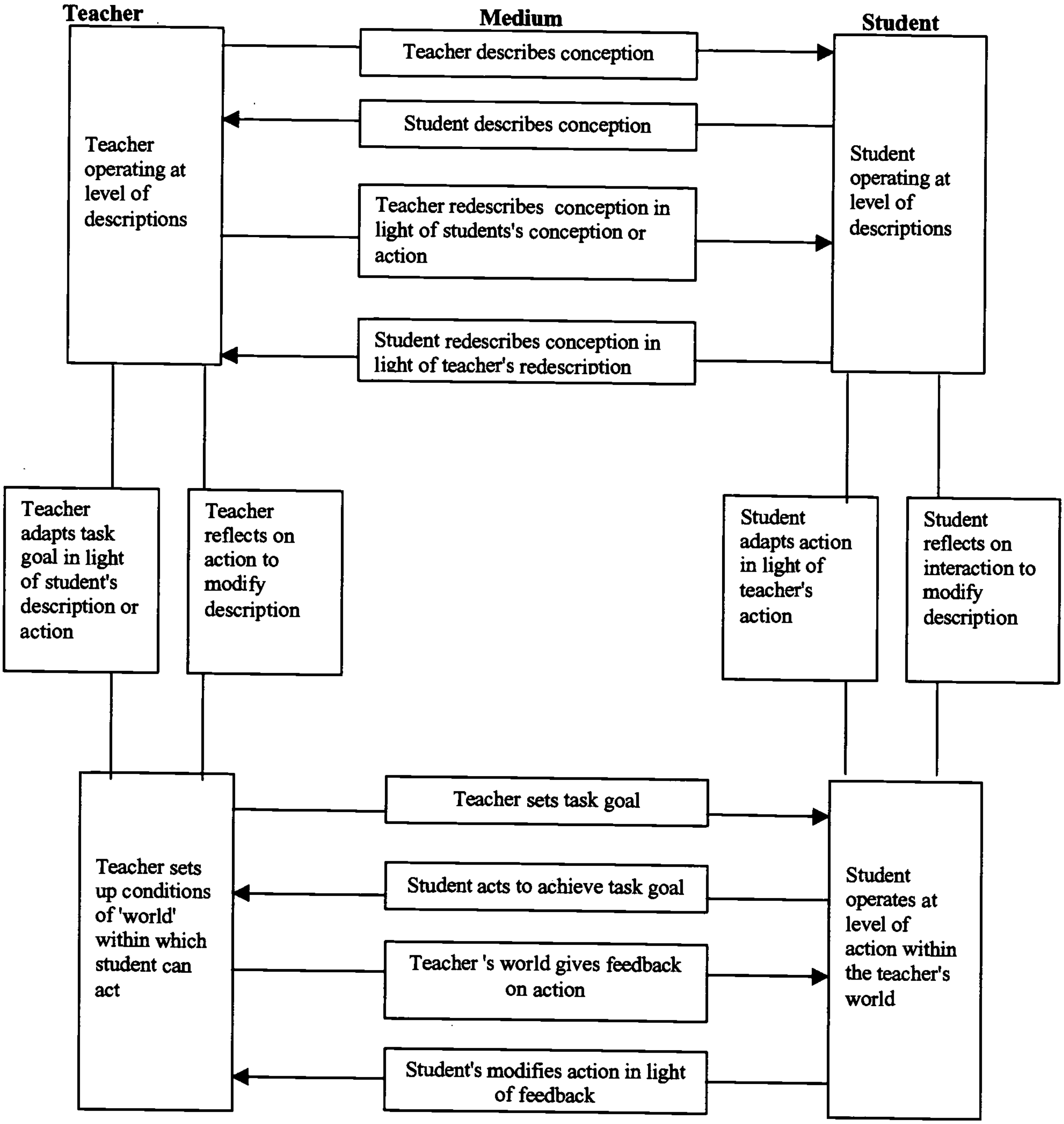

Figure 3. The "conversational framework" adapted from Laurillard (1993) that identifies the activities involves in the reflective learning process.

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DISTANCE EDUCATION BASED ON COMPUTER NETWORKS IN CHILE
UNIVERSIDAD DE CONCEPCION A SPECIAL CASE.

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ABSTRACT:

Distance Education based on digital computers has evolved in the last four years in Chile. The main educational institutions who develop experiences in the field are Universities, some public companies and some group of private firms. The technology used to support distance education goes from www sites, to specifically distance education oriented software. The first part of the paper includes a brief summary of the principal experiences in Chile. The second part describes a very interesting case related to Universidad de Concepción who develop a technological platform for distance education in the early 1998, thanks to a grant for educational development given by the "Ministerio de Educación de Chile". The paper describes this experience emphasizing the capabilties of the system to implement important teaching and learning considerations, such as: Education based on learning rather than teaching, Open learning, Personal and group interaction, Flexibility in teaching support, Discussion and Knowledge space to be shared by students and teacher, Autoevaluation, Learning material distribution and many others. Finally the paper discusses the "new" role of the teacher in this type of environment as a key component to improve the quality of education. The presentation includes a real demonstration of distance education of some courses given during 1999.

1.- Introduction.

Distance education born as a need to extend teaching capabilities to students that could not access the regular education system, due to geographic distances or because of the impossibility to perform time schedules. The first expressions of distance were education based on the distribution of learning materials and instructions by mail. Technological advances such as telephone, fax and later television and electronic mail, introduced significants improvements.

The experiences developed at Universidad de Concepción about this topic, considered Distance Education as a teaching – learning environment based on computer networks, in which participants interact trough a man-computer interface that facilitates the development of their role as a teacher and as a student

The first steps were given at the beginning of 1998, strengthen importantly thanks to a grant for Institutional Development (Education Ministry), the project was conducted by María Inés Solar (Education Faculty) together with José Durán (Engineering Faculty) and the technical support of specialists Mónica Salazar and Paola Pizarro.

2.-State of the art of Distance Education based on computer networks in Chile

2.1 Distance education based on computer networks in chilean universities began less than 4 years ago. The first experiences used the www environment to implement virtual classes, less than 8 Universities could be considered as pioneers using this methodology, A few of them are using rigth now special oriented software for distance education (Learning Space, and in one special case a Proper technological platform : Universidad de Concepción).

Speaking about organization oriented to develop distance education we find different models, the principals are

- Dirección de Educación a Distancia-Teleduc : Aula continua 2000 and Quinto Campus
  (Universidad Católica de Chile)
- Universidad Virtual
  (Universidad Técnica Federico Santa María)
- Programa académico de Educación a Distancia
  (Universidad de Concepción)
- Programa Aula 21
  (Universidad de Chile)

2.2 Distance education based on TV network, the very important experience corresponds to Universidad Catolica de Chile , Teleduc a National organization with 17 Regional offices that operates for more than 15 years.

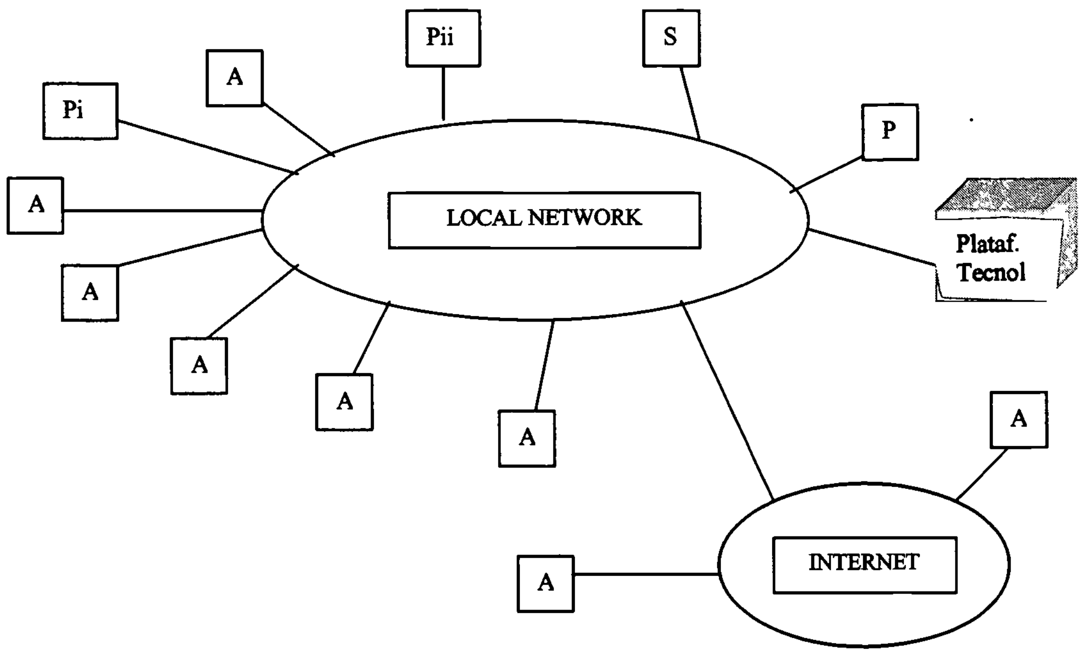
2.3 Distance education based on video-conference (ATM technology) an important group of 9 National Universities are working together around the proyect REUNA II Virtual University, the video conference network has been recently inaugurated.

3.- Modeling of Distance Education at Universidad de Concepción, Chile

It could be explained through the following components

- Technological environment : a set of technical components(Information technologies, computer network, personal computers, complementary equipment,internet connectivity) organized in such a way that they facilitate the development of teaching-learning processes.
- Actors or participants of the educational process :
  Student (as individual or as a group)
  Professor and / or teaching team (main professor, auxiliary professors , facilitators,
  Other professionals, such as : psychologist, pedagogist, sociologist, etc.)
  Technical support for students and professors.
- Technological platform or man-computer interface (explained in detail later on)

PICTORIAL MODEL OF DISTANCE EDUCATION BASED ON COMPUTER NETWORK



4.- Working environment using the technological platform

Technically speaking the technological platform is a computer programming system that support teaching-learning processes in a distance education mode based on networks, to help teachers, students, and facilitators .

The system was designed and implemented at Universidad de Concepción and operates under Internet environment .

The building of the system began in january 1998 and started to be used in april of the same year supporting three undergraduate courses of the Engineering Faculty. The use of the platform increased significantly since then, recently was utilized to support a National distance education course for teachers of secondary level (9th year) that are

facing a national education reform. The initial registration of this course was approximately 5000 professors, connected through Internet along with Chile.

The use of the platform is being used partially by Engineering, Medicine, Education, Economy and Agriculture Engineering.

The functionality of the platform satisfy the following needs :

- Display of norms and academic regulations
- Personal data
- Micro design of the activities of the course (academic planning, instructional material organization, etc.)
- Development of the course activities (execution of personal and group activities, evaluations, discussions, etc.)
- Process Statistics
- Methodology evaluation

The teaching-learning environment displayed by the platform for the teacher and students, according with experiences obtained since 1998 for at least 50 courses at undergraduate and professional level (aproximately 1200 students in total), shows that it is perfectly possible to integrate the following curriculum components :

- Participants Interaction
- Space to make free questions, privately or public, to one or to many participants
- Space to participate in discussions
- Space to find and retrieve knowledge offered by INTERNET
- Opportunities for the multidisciplinary interaction
- Capacity to get dinamic processes in communications, evaluations, collaborating work,etc.
- Flexibility to introduce changes in the degree of pressence or face to face activities
- Resources to introduce adecuate students motivation just in time
- Capacity to make decisions permanently about the teaching – learning processes, from the very beginning (microplanning), to the postevaluation

5.- The role of the professor in the new teaching-learning environment

In this learning environment, the professor accomplish in rather different ways the traditional responsabilities assigned to him, due to the introduction of new tools to communicate, to produce, distribute and present learning materials, he has to change the way things were doing.

On the other hand, the nature of digital electronic information, brings with it, new ways to process, distribute, manage, and operate the information, producing benefits and new problems

Probably the internal learning process of the student in the transition stage does not change but the whole external atmosphere evidently changes.

Practice is showing that the role of the professor changes. Actually the use of the platform during distance classes show that the professor emphasize the following aspect:

- Plan in advance all the activities covered by the course (microdesign)
- Orient, guide, direct, all the educational activities of the students.
- Facilitates the communication processes between students and him, or between students and students, or between students and other participants
- Evaluates the learning processes increasing the scope of evaluation .
  (Co-evaluation, Group evaluation, Autoevaluation, conventional evaluation)

6.- Usability conditions and grade of accomplishment of the platform

The realization of distance education experiences at Universidad de Concepción and the analysis and evaluation of them, validate conclusions about the grade of satisfaction of usability conditions.

- Open, friendly and flexible environment for the participants. Students communicate, ask questions, express their opinions and collaborate efficiently – The following capabilities of the platform help : Asincronism, Network working environment, Discussions site, IRC chat, and interaction trough Internet

- Thinking estimulation, and Creative disposition – Guided and oriented participation of the students during discussions, consults, and assignments using the technological tools provided by the platform
- Open to professor creativeness – Thanks to the new technological resources permanently evolving, the professors have the oportunity to experience new ways to improve teaching (multimedia resources, videoconference, simulation, etc.)
- Apply the best leading style to stimulate participation, develop values, and motivate – Depending on the initiative of the professor the platform itself could help or at least be neutral.
- Promote the collaborative work – Thanks to the facilities of the platform students can develop, coordinate, revise, and build reports or exchange knowledge in benefit of all. (chat, sharing files, compartir archivos, e-mail, etc.)
- Stimulate the metacognitive thinking – The introduction of frequent autoevaluation, the access to the fantastic world of Internet and other resources can influence the personal learning, giving clues to advance, or turn back in the plan of activities.

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Telematics in Professional Training: New Horizons and Possibilities

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Abstract: Todays information and communication technologies have offered many possibilities for activity when applied to education. However, these various applications usually occur in the usual teaching/learning environments (schools, universities, centres of study and research) and are used by operators for whom study is their prime activity. The objective of this paper is to indicate the possibilities offered by telematics as a tool for access to professional training by users for whom access to these resources is not usually easy: civil construction workers. The principle theories and in results obtained in the implementation of a web site directed at the training of civil construction workers in the reading and interpretation of architectural plans are presented employing an interdisciplinary approach involving architecture, engineering, education, psychology, and information technology.

Introduction

The present conditions of technological development do not always provide the necessary professional qualifications for all those who are involved in the different stages of a productive process. In the civil construction industry, the training of planners and designers is guaranteed in various circumstances (universities, technical courses, trades unions) the same does not apply to the workers entrusted with constructing a building. Due to this, in the specific panorama of the countries of the third world, poles of technological excellence coexist alongside a large contingent of workers who remain at the margin of processes of qualification. in these conditions, the professional training of these workers happens in a large number of cases in an informal manner, as technical knowledge transmitted from one worker to another alongside the construction itself. Due to the precariousness and unsystematic character in which it occurs, this model of training has not been shown to be the most appropriate, principally with regard to new constructive processes and techniques where the capacity of anticipation is one of the demanding requirements.

As a solution for this impasse, providing conditions of access to training and qualification for workers is one of the departures in the search for standards of quality compatible with the requirements of those peculiar situations. In that context, continuing education based on current technological resources, appears to be a possible solution to face the new requirements of qualification. In agreement with Cardona (1995), the training of human resources in obsolete technologies can result in an underutilisation of human potential (and later in unemployment or underemployment), as a result of traditional training processes being out of phase with the path of technological development.

The Role of Graphic Representation

Graphic representation by means of technical drawing has been acquiring a larger importance everyday in the field of new industrial technologies, because of its capacity of allowing elaboration, anticipation, control and the checking of solutions to spatial problems, extending into numerous fields of activity (Bessot and Verillon, 1993). Containing information of a spatial nature, plans, maps, diagrams, technical or geometric drawings become indispensable tools for the realisation of numerous professional tasks: to manufacture a machine part, to locate an object, to find one's way around a city, to build a house, are tasks which are optimised when accompanied by information about the spatial nature of activity in question.

In architecture and civil construction particularly, this information comes before the stage of the construction of a building, permitting a control over the whole constructive process and informing all those involved of the procedures to be adopted. In this sense, the correct understanding of the graphic codes of preliminary representation of the architectural space is one of the necessary conditions for a professional performance within the standards of quality demanded by industry and consumers, not only on the part of workers charged with the construction stage, but on that of everybody directly or indirectly involved with a building work.

The absence of this knowledge on the part of the workers is reflected in the whole execution of a building, causing them to constantly request further information, resulting in loss of time and several disruptions to the productive process (Rabardel and Weill-Fasina, 1995). This is without speaking of the losses of material due to waste, caused as much by the use of incorrect amounts of materials as by rebuilding.

The establishment of clear concepts, based on norms of representation of universal acceptance defined by the Technical Rules manifested by Technical Drawing requires a formal intervention, a way of guaranteeing unified standards of understanding and identification on the part of the professionals involved. Due to the restricted opportunities of professional training becoming more precarious in post-war periods, allied with the characteristic mobility of workers in the civil construction industry, these interventions occur in an informal way in the working environment, which is not the most appropriate manner for professional qualification. Unlike the techniques of training in the workplace which are planned in advance and have the necessary resources for an activity of educational qualification (training "on the job"), training on the building site is sporadic and unplanned, raising doubts concerning its effectiveness.

In this way a favourable scenario takes shape for experiences which, using new technologies in a more extensive manner may take care of some aspects of professional training, not only in normal conditions, but also in moments of crisis. To this end, a pioneer project, at least on a Brazilian level, is being proposed, for the training of civil construction workers using resources available on the World Wide Web (WWW), where one aspect of this training is addressed: the reading and interpretation of the graphic codes of representation of architecture.

Telematic Networks For Professional Training

The WWW is now the standard interface in telematic communication (telecommunications + computer science), incorporating multimedia resources - text, sound,

animation, videos - and permitting fast and efficient communication between geographically distant users. Its exponential growth -estimated to be one billion people at the turn of the century - leaves no remaining doubts about the importance of this form of communication , when reaching such impressive numbers, although all the effects (cultural, economic, strategic, social, etc.) of this new form of communication are still not all known (Negroponte, 1995). But they will certainly be significant and profound.

The dynamic and diversified character of the Internet, besides its practically limitless reach - in spite of numerous technical/economic even political restrictions - make it an important means of communication and interaction with potential educational implications. The resources offered and supported make the network one of the technological apparatuses which has been most attracting the attention of researchers from all areas, to the point of classifying it as the most explosive communication phenomenon of the century (Galbreath, 1997), or the invention that has most changed the world since the invention of movable type by Gutenberg (Descy, 1997; Maddux and Johnson, 1997).

The technical resources available on the Internet (animation, simulation, virtual reality, etc.), its wide geographical reach, the more and more friendly character of navigation, associated with the possibility of interaction and cooperation among users, show themselves to be important tools for the construction and/or recovery of the knowledge necessary for a good professional role. Besides this, it can provide support for the necessary requirements pointed out by Roca Villa (1994), for general training and, especially, the professional training or requalification of workers in future years: personalised, flexible, based on resources, interactive, accessible when necessary ("just in time learning") training.

But it is in what Levy (1998) calls a "new relationship with the knowledged" that is found one of the most significant differences in relation to conventional pedagogic practices, to the extent that these new technologies amplify, externalise and modify human cognitive functions, providing new forms of access to information and new styles of reasoning and knowledge. The productive processes are modified by emergent paradigms, in the same way that knowledge is, as new models and spaces of knowledge are created, open, continuous, fluid, not linear, reorganised in accordance with objectives or contexts, in contrast with linear and parallel scales, structured by levels and prerequisites, converging on "superior" knowledge (author's quotation marks).

Simulation, virtual reality, communication on a global network, artificial intelligence, multimedia, interactivity, become the new forms by which knowledge is being made available, symbolised and represented, generating new ways of knowing that develop the imagination and intuition much more than previously. According to Moraes (1998), the amplification of the spaces through which knowledge and the changes of knowledge come and go requires that individuals are made literate in the use of electronic/computer equipment and resources, enabling them to produce, store, disseminate and benefit from knowledge through its new forms of digital representation. It is not, therefore, only a new support, but a new form of connection, construction and production which establishes itself far from the monopoly of the institution/teacher, and open for autonomy and wider participation.

Possibilities For Action And Possible Approaches

The activity of the recovery of the professional qualification of workers finds in the Internet a virtual environment of training compatible with the characteristic mobility of workers, at the same time that it adapts to

the new productive paradigms directed towards professional qualification, seeking to reach desirable levels of quality and productivity. The use of educational sites represents one of the most promising resources offered by the Internet, because the possibilities of interaction and cooperation, through consultation, the exchange of messages, etc.

This perspective implies profound changes in the educational system, once aspects such as personal differences, cognitive styles, learning rhythm, affinities, areas of interest, thought strategies, and motivation, which until that then have been unconsidered, start to have relevance . It implies, equally, changes on the part of teachers, methodology, curriculum, material and didactic resources, evaluation, physical space and timetables, considerably enlarging the range of possibilities of educational activity, so that they can incorporate the resources offered by new technologies.

Based on these precepts, Jonassen (1998) describes the characteristics that he called "significant learning", or the process of teaching-learning based on the constructivist perspective. Arguing that these new technologies can support thought that deals with these qualities, the author describes them thus:

- Active: taking risks, through experiences and actions, supplies solidity for the learning process. The experience acquired in the activity and the manipulation of the tools of change are essential in this type of approach;
- Constructive : meaning is built by means of previous knowledge;
- Reflexive : experience is not enough for learning. It is necessary to reflect and analyse, to articulate the decisions, strategies and answers found. When the student articulates what has been learnt and reflects on the processes of decision adopted, s/he understands more and has more capacity to apply the constructed knowledge;
- Collaborative: explores the abilities of each person, supplying support and approval in the construction of individual and collective knowledge and learning ;
- Intentional : the fixing of goals and objectives articulates and directs thinking, action and learning towards attainment;
- Complex: opposing itself to the apparent simplicity and reliability of the contemporary world, it adapts to its complexity, irregularity and lack of structure;
- Contextual: developed through significant activities in the real or simulated world, they acquire more consistent meanings when transferred or applied to other situations;
- Colloquial : the exchange of opinions and ideas becomes a social activity that can be put to the service of the construction of knowledge .

All these characteristics are interrelated, interactive and interdependent, requiring that the educational activities based on these frames of reference conform with the largest possible number of approaches, because these characteristics are synergetic, that is, their combination results in learning processes broader than the individual characteristics used separately (Jonassen, 1998).

Furthermore, according to the author, the potential of the various technologies mediated by the computer is favourable to the development of new pedagogic focuses that prioritise constructivist frames of reference, in distance learning, as well as the classroom mode. Teaching and working collaboratively, contextually, with interaction, simulation, and virtual engagement with the object have been permitting the development of new pedagogic focuses towards an approach to instruction centred on the subject, no longer emphasising the teacher as the source and arbiter of all knowledge.

The Site

Taking these presuppositions as a base, the site 'The Reading and Interpretation of Plans' is being developed, available at the http://www.ufrgs.br/des/plantas/index (access password available on request from aacc@vortex.ufrgs.br) designed specifically to respond to the needs of civil construction workers. Its aim is to be a virtual space of information, exploration and construction of knowledge, where the basic principles of the graphic representation of constructed space are formalised. Furthermore it becomes an environment for familiarising these users with the possibilities offered by information technology, and the Internet in particular.

Constructed around four thematic axes - drawing, design, the reading of plans, and civil construction - the site employs simple language arranged in short paragraphs, seeking to adapt itself to the characteristic of the subjects. its structure is based on frames as a way of permitting rapid access to all the contents in an order defined by the user him/herself. Furthermore, animations, and applications in dynamic html and JavaScript are other resources employed.

But the principal difference of the site is not the use of the latest generation of technological resources, but the simple manner in which the resources are employed in an approach directed towards users who are interacting with technological resources. Instead of presenting all the content with ready answers, situations are presented in which the user him/herself has to construct his/her hypothesis from situations experienced in the routine procedures of working alongside the construction itself, and reproduced on the screen. A space is also anticipated for the resolution of doubts and exchange of information between participants. The construction of a glossary of words and technical terms employed in civil construction will be made incorporating contributions from the participants. In this way, by recording their contributions, they will be formalising these contents.

These characteristics, allied with the dynamism of the Internet, make the site a place of constant change and up-dating, since each participation can lead to reformations and redirections, permitting a constant updating of contents and/or approaches.

Results

The first results obtained from pilot use give an account of the appropriateness of the means of information technology and telematics in the forming/recovery of knowledge necessary for the professional activities of civil construction workers. Workers invited to interact with the site in an experimental way confirmed data obtained in previous research (Cattani, 1998) which gave an account of the existence of potentially favourable conditions for the employment of the resources of information technology in the training and qualification of these workers. There are indications that the difficulties of use of computer resources on the part of adult subjects with little formal schooling are due more to material conditions (the concrete difficulty of access to equipment) than to cognitive limitations. The fears, suspicions, doubts and insecurities demonstrated by workers were no different from those of educated adults on their first interaction with a computer.

These data permit deductions upon the viability of experiences which employ this technology directed to these specific users, as well as confirming the course followed in the theoretical frames of reference of the development and refinement of the site.

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The Integration University – School in the Development of Colaborative Projects Through Internet

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Abstract: The first experience of the Universidad Tecnologica of Panama and the Instituto Episcopal San Cristobal, in the development of educative projects collaboration through Internet, go back from the year 1994, with the creation of the project "Enviroment and Contaminated Atmosphere", with the fulfillment between educational institutes from Panama and Brasil, with the mediation of the Universidad Federal of Rio de Janeiro and the Universidad Tecnologica of Panama.

The results obtained in the entirely development with the various projects, in addition to strengthen the relation between University – School permit the identification of the group of aspects to consider in the planning and ejecution of educational projects with the medaiator of the netting.

This ponential relate the integration University – School on the development of educational projects with the collaboration through Internet, and presents identified aspects, as a priority to consider in the development of such projects.

Introduction

With the arrival of the Internet Netting to Panama in June 1994, reveled a common reality in the educational system of the region; this is; the use and access of the netting marked on the activities of higher level. The communiction and the facilities introduced with the arrival of Internet emerge out of reach of the scholar institutions of basic and middle teaching. The public schools were in disidvantage because they didn't have the necessary conditions for establishing the use of a net in their installation, since there wasn't a national policy that could suprevise the installation of a net in the educational system.

The Instituto Episcopal San Cristóbal, a private school in the Republic of Panama which attends to students from Pre-School up 12^{Th} grade, in 1994 showed interest in the developing experiences with the Universidad Tecnológica, UTP, with the enclosure of works applied to the process of teaching learning. Due to the fact that the Universidad Tecnológica attends hihger studies and the fact that the time, equipped with Internet, the need to work with school, here or abroad, interested in participating in the project with Panamanian schools, based on the agreement of cooperation between the Universidad Tecnológica de Panamá and the Universidad Federal de Río de Janeiro, we were able to contact a school, in Brasil, which presented the profile needed in order to develop the work .

The experiences began with the project "The Environment and Its Contamination" inteded to develop the practice of distance investigations taking advantage of the use of the e-mail and other resources available through the net of Internet. The general objective that oriented the definition and the development of the project was: to establish the communication and cooperative work, via Internet, between students of different cultural environment, with a present day topic of world interest (Clunie, 1996), with the participation of students from

the 9th grade of high school, between the ages of 13 and 15. The communications were sent in the languages of each country, Portuguese and Spanish.

After the first year of work, the coordinating teams of Panama and Brasil concluded that: (i) the experience was intellectually rich, allowing the exchange of information in both languages and the preparation of the conclusion in relation to topic worked on; (ii) in the social aspect new relationships were established with inter and intra working groups, this is within the working groups of each country and with the colleagues of the invited country: and (iii) the possibility to work with a new technique stimulated, the students work in a spontaneous way. why the integration of University- Schools.

Why the integration of University – School?

Actually it's common to encounter with teaching institute who posses Informatic Laboratory, most of them well equiped and with access to Internet; where the machines "have eternal rest". This situation due to the fact that the faculty and others public employees were not prepared on the adequate use of the New Technology and it's respective application in the educational process and in the educational administration activities (Clunie, 1992). The truth that is frequently found in the institutions is that the resources are installed in the laboratories and abandoned to self-learning of the users, subtracting importance to the process of updating and incentivating the board of educators.

In the process of the university activities, the task of investigations prevail, and it is a necessary condition to continuosly update the board educators. This premise was extensive to all the activities and projects that develops the university, at an intern level or with the participation of outward colaborators. The agreement of cooperation between the Instituto Episcopal San Cristobal and the Universidad Tecnologica of Panama, is based on this last object, on which we emphazise: (I) To promote and to impel the scientific exchange, technology and cultural with the foreign or national institution and cooperates with these last in the solution of the technological problem at a high level, of their ability and, (II) to bond enlargement of the aciton of educational system to the production process, through the investigation of educational technology to fce the problem of the country.

To have as a mark of reference the university poltical, expressed before and considering that in the university there are specialist in technique appliance, it's fundamental for the exit of all experience that entail with the new technology to the educational process, to count with the participation of personal specialized with a mastery knowlodge and qualification of the fculty of the educational center in the use and application of the technique. The agreement of cooperation between the Universidad Tecnologica of Panama and the Instituto Episcopal San Cristobal, in this present case, vialize and guarantee the fulfillment of these objectives planned.

Team Work

Through the collaboration, a model in which the social and the self-esteem coexistence are increased, is being built, with the academic success which can ruly on tools that make the communication and motivation of the participants easier, basing the individual learning through the communication and the search to reach the common objective. The conscencious ness of groups is the catalyst agent that makes the construction of the collective knowledge through knowledge and individual learning possible.

Team work lays the foundation of peer learning, resulting in an alternate way to the traditional teaching process that creates rivalry between the students. Instead of rivalry there is mutual help.

Investigations made with children between the ages of 7 and 8 who were studying in the 2nd grade of elementary concluded that (Lucena, 1997):

- To group children in pairs resulted of great importance and motivation for the development of writing and recognition.
- Peer work, along with the existing facilities, drove the children to acquire mor confidence to: (i) change their troughts into comprehensible writting; (ii) to write with more freedom, without been scared of making mistakes and (iii) increase then self.esteem in the presentation of the works.

Without subtracting from the importance of maturity (operation) as a determiner of the process of human development, Barbosa Goulart calls the attention to cooperation, this is the process of development. Of the operations of the social coexistence confirming that "in the exchange of their equals, individuals acquire autonomy" (Goulart, 1991)

Colaborative Projects through Internet

Investigations in educational technology suggest the use of new sociopedagogical approaches integrated to the technology of the computer nets. The nets facilitate communication for the users, permitting them to communicative and to exchange information. This gives then feeling of participation and responsability for the learning that is being construted. The schools gain more life, and as more students participate actively in the construction of knowledge they gain more autonomy and independence in relation to their knowledge.

The fulfillment of diverses activities and situations of learning in a netting atmosphere establish an excellent opportunity for the individual or exchange groups. The individual can work colaborating in a collective form, investigating, exchanging information developing the crativity, playing, elaborating projects, building knowlodge, learning to learn, or simple, communicating between friends. The timid students in class, find in the netting more liberty to exposed and to test their ideas. This meaning, when it's apply in an adequate way, the use of the netting becomes a very valuable work toal, compatible with the present necessity of educational process.

The Planning and Execution of Educational Projects through Nets

In the mark of an agreement the cooperation University – School, and a result of the experience gain in the development of projects, through Internet, we identify substitute appereance considering the designs, planning and the carrying out of projects through the netting. These are:

- *Foundation:* Every educational project should respond to a determine form of under standing the process of teaching and learning. It should explain why its being done by presenting its stages of development, work methodology goals and limitations.
- *Objectives:* the global objectives and the objectives of each phase should be stated clearly.
- *Population:* the participants should be indentified clearly.
- *Activities:* to get the work done correctly it is fundamental to identify each of the activities that would be done in every phase of the project.
- *Resources:* They are aspects to be considered in order to guarantee the successful development of the project. The human resource participating should be indentified, and be expected to coordinate and help with the work and the computer resources such as the hardware and the software that is used for the project.

During the development of the project the following steps should be followed:

- Every project should have a responsable work group that would supervise and make sure that all of the activities will be done according to the design and work plans.
- A specialist on content should follow up on the project and revise the work done by the students. Enfases should be made on aspects such as occuracy of information that is being worked on. This will give the participants confidence and will give the participants confidence and will give credibility to the project.
- One of the teachers participating in the project should check the information generated by the students checking the Grammar, the vocabulary and forms of expression that do not attempt against the integrity and morale of the partctpants.
- Someone incharge of support should permanently check the proper use and updating of the work resources(hardware and software) necessary for the development of the project.
- The entire grupo should develop dinamics that stimulate the activities in and out of the installation where the projects is developing.

The Experience of University-School Intergration

The united development of projects between the Universidad Tecnologica of Panama and the Instituto Episcopal San Cristobal, surpasses the frontier of the initial project "The Enviroment and Its Contamination". The experience was fortified with the arrival of the Project KIDLINK to Panama, in 1997. From then they have develop diverse project in the mark of KIDLINK with the colaboration and orientation of the Educational Informatic Department. Between KIDLINK, due the nature of work they are developing, they emphazise the activities developed as: (I) Discussion list for Adults; (II) Colaborative individuals projects; (III) Colaboratives projects between collage; (IV) Translation in multiple languages; (V) Children Art in the net; and (VI) Conversation in real time and others. The colaborative projects for individuals or inter school are among the different activities that are done.

Conclusion

From the experience acquired in the setting of the agreement of cooperation between the Universidad Tecnologica of Panama and the Instituto Episcopal San Cristobal, we concluded that:

- The work through the net constitutes new environment of learning that make it easy for free exchange of ideas and favors development of knowledge .
- Internet emerges like a powerful ally in the process of teaching – learning facilitating the access to varied and actualized information.
- The colaborative work is stimulating, it sets the bases for colaborative learning, resulting as an alternative form to the process of traditional teaching permitting the development of important and new characteristic values in youths.

Future View

With the intention to accompany the advances of technology, at the present time we work on the design of new projects that will enrichen the motivation and increase the participation within the setting of the University School integration, we are placed in the phase of planning for the Video Conference project, which refers to the use of the multimedia technology for the exchange of ideas and the development of projects through the net.

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The In-Service Training Programs for Primary School Teachers to Use Information Technology in Australia and in Taiwan

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Abstract: This paper describes the in-service training programs for primary school teachers to use information technology in Australia and in Taiwan. The advantages and disadvantages of the training programs in these two countries are analyzed and compared. The Taiwanese government has done an excellent job in setting up the Internet infrastructure and different levels of technical support, and its in-service training programs have good supports for the full-scale implementation of web learning in the primary schools. However, the Australian in-service training program has merit in the setup of the full time facilitators and a good record tracking system to reduce the cost. Thus, a combined approach to take advantage of the best parts of these two in-service training programs is recommended in the future. This approach will help primary school teachers to learn and to adapt information technology in the classrooms more quickly.

Introduction

The advance of network, multimedia, communication technology has made a great impact on the way people work and learn. Today, information technology enables teachers to outreach teaching resources on the Internet, communicate with subject domain experts or other school teachers through the World Wide Web (WWW).

In Australia, the Department of Education and Training (DET) in the New South Wales (NSW) has funded public primary schools to purchase at least one modem and some Internet computers under the Computers in School Policy. Moreover, DET began a statewide Technology in Learning and Teaching (TILT) program in 1996 to promote computer and network literacy of primary school teachers (Training and Development Directorate, 1997).

Similarly, the Department of Education (DOE) in Taiwan identified the importance of information technology in education. In the past ten years, money and efforts have been allocated to set up the network infrastructure, computer laboratories and technical support centers in all levels of government schools. Moreover, from 1 October 1998 to 30 June 1999, the Taiwanese Government has spent a total amount NT$647 million (approximately US$20.2 million) dollars to update computer hardware, networking hardware and software in all levels of schools with a special focus on high schools and primary schools. Also, in-service training courses and local network support centers were provided to build up the computer literacy of the primary school teachers (Department of Education in Taiwan, 1999a).

In-Service Teacher Training Programs in Australia

Starting from 1996, DET in NSW had funded many state universities to run a 2-hours Internet workshop for primary school teachers. Each school in NSW selected one teacher as the Internet Contact Person (ICP) to attend the workshop. Moreover, later in 1996, the DET conducted a statewide TILT program. Approximately 150 teachers in NSW were selected as facilitators, and they were trained so as to be able to train other teachers. The facilitators were paid by their schools, but DET allocated extra money for schools to hire substitute teachers, so facilitators could be released from teaching and administrative tasks. Their major task was to train 70 teachers in the school districts each semester every half year. Each semester, the facilitators ran a thirty-hour workshop which contained six components entitled "Powerful tools to enhance teaching and learning", "Beyond the classroom walls", "Computers and related technologies", "Software", "How can I do this in my classroom", and "Future Directions". Each component lasts for five hours. There is a one-hour video program addressing the key issues, a two-hour hands-on activity using computers and related technology, and a two-hour follow-up activity related to the practical application of skills in the classroom (Training and Development Directorate, 1997).

Roughly one-third (15,000) of the primary school teachers in NSW have participated in the TILT program from 1996 to June 1999. The participants attended the workshops of the TILT program every two or three week after school. During the training period, DET allocated funding to each school to release the participants from the normal teaching loads for three single days or six half-days. They can use the free time to practice what they had learnt or ask the facilitator to do one-to-one tutoring. Moreover, the participating teachers are not allowed to take the same TILT program repeatedly in the future (Training and Development Directorate, 1997). The goal of the TILT program is to train 10,000 more teachers (i.e. up to 55% of the primary school teachers in NSW) to participate in the TILT program by Year 2000.

In 1999, DET in NSW also ran a small-scale survey to trace the participating teachers who attended the workshop in 1996-1998 period. The survey showed that 80% of the participants applied the computer technology in the teaching and administrative work at least once a month. Among which, about 63% of the participants used a computer at least once a week (Training and Development Directorate, 1997). However, there was no real application of network technology in classroom teaching and learning activities currently due to the limited numbers of modems to access the Internet.

In-Service Teacher Training Programs in Taiwan

Before 1995, governmental organizations, universities and colleges conducted in-service teacher training programs regarding information technologies. It was very costly for primary school teachers to participate in the training courses because schools have to pay for the substitute teachers and pay the travel and registration fees for the participants. Usually, the training courses were held for half-day or one-day. Occasionally, there were some workshops that lasted for three to five days. Yet, these short-term training courses did not have a good outcome because when the participating teachers returned to their schools, they sometimes did not have the equivalent computer hardware or software to practice what they have learnt in the workshop. As a result, they usually forgot the training content quickly and could not apply what they learned in their classrooms immediately.

As far as the training of facilitators is concerned, there were a few training programs that lasted for three-months or half-year to train some selected teachers to be facilitators. However, the facilitators' teaching loads are usually not waived. Meanwhile, they were also responsible for the maintenance of computer laboratories because primary schools in Taiwan did not have the budget to pay computer companies to maintain the computers, and there are no computer technicians in schools. As a result, the workloads of the facilitators are very heavy, and there are many complaints about it (Roy, 1999).

Before 1997, not many primary school teachers in Taiwan had been trained to use information technology. The reason for the lower outcome is due to the lack of record tracking of the trained teachers. Usually, those who were interested in learning computer technology would take the opportunity to attend different teacher-training courses over and over again.

To improve the shortcoming of the traditional teacher-training model, a new "on-site, full-scale" model had been applied to train all the primary school teachers in their schools from 1 Oct 1998 to June 30 1999. The DOE in Taiwan also selected some schools in each county to be the technical support centers as well as teaching resource distribution center. The DOE in Taiwan allocated funds to conduct the teacher-training courses with an aim to train 70% of teachers in each primary school (Department of Education in Taiwan, 1999b). There are also selected universities that are network centers of Taiwan Academic Network (TANET) which provide higher level technical supports to the county level technical centers, and they may even provide direct supports to primary schools if needed.

Starting from 1 Oct. 1998, many workshops were run for a semester to enhance the learning outcomes of primary school teachers. Every Wednesday afternoon, there were no classes for all the primary school teachers in Taiwan. The experienced facilitators or university professors came to primary schools and gave a four-hour training course to teach a wide range of preliminary computer and network knowledge and skills.

There were nine units of the basic courses including Windows 95, CAI, Internet application, MS Word, The application of WWW in teaching, Network Multimedia, CD ROM, Computer Maintenance, PowerPoint. Each unit was either four-hours or eight-hours depends on the difficulty of the content or the participants' background knowledge and skills. Some schools provided advanced training courses on Saturday every two weeks. The advanced courses included Homepage Construction (18 hours), Excel (12 hours), MS Outlook (12 hours), Word 97 (12 hours). The new "on-site, full-scale" model of teacher-training programs turned out to be more efficient than the traditional teacher-training courses. (Department of Education in Taiwan, 1999c).

Comparison of the training programs in Australia and in Taiwan

Although the TILT program in NSW, Australia has successfully trained more than 1/3 of the K-12 teachers in three years, the real application of the network technology in the classrooms has not become popular due to the limited numbers of modems, network hardware and software. On the other hand, the Taiwanese DOE has spent more than ten years in training teachers and promoted the usage of email and WWW in primary schools. In the past year, the network and hardware/software have been upgraded significantly. Many centers have been set up in each county to distribute teaching materials, software, CD ROM and other teaching resources developed in the past years. In addition, many WWW web sites have been developed to support the real application of information technology in the practical classroom teaching and learning.

There are some advantages in the Australian in-service teacher-training program. Firstly, Australian facilitators are released from teaching loads, so they can concentrate on running the workshops and provide tutoring to assist the participating teachers. On the other hand, Taiwanese facilitators were very much over-loaded by the tasks of training other teachers in their schools and maintaining the computers on top of their ordinary teaching loads. However, starting from 1998, there are remedies. For example, when primary schools purchase hardware from a computer company, it is required that the company takes the responsibility of the hardware maintenance for three years. Moreover, the teaching loads of facilitators are reduced somehow to compensate their time in training other teachers.

Secondly, the Australian in-service training system keeps records on the participants' names and only takes those who have not attended the TILT programs. In contrast, there is no record tracking in the Taiwanese in-service training system. One of the shortcomings is that limited numbers of teachers who are interested information technology may take different training courses repeatedly. However, the Taiwanese government has changed the strategies of in-service teacher training. The newly introduced "on-site, full-scale" training model works quite well to make sure that most teachers in the primary schools have attended the workshops. Yet, it is very costly for the government to do so, and the new model only last for eight months.

Conclusion

The Australian teacher in-service training program is more cost effective. The ways to release facilitators to allow them to concentrate on training, and the record tracking of the participating teachers have proven to be

effective and economical. The next step to take is the setting up of the network infrastructure in the primary schools and the organizing of the technical support centers in school districts, so teachers and students will benefit from the progress in information technology.

The Taiwanese teacher in-service training programs have better support in terms of the network infrastructure, the setup of the county's technical support centers to promote web-learning and to distribute teaching resources, and development of many web sites to enhance the teaching and learning through Internet in the Taiwanese primary schools. However, both the traditional model and the new model of teacher training programs in Taiwan are very expensive to execute.

Apparently, Taiwanese in-service training programs have better supports for the full-scale implementation of web learning in the primary schools. However, the Australian in-service training program has merit in the setup of the full time facilitators and good record tracking system to reduce the cost. It is recommend taking a combined approach to take advantage of the best parts of these two in-service training systems to help primary school teachers to learn information technology.

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Teachers and Trainee Teachers Perceptions about Information and Communication Technology Tools during a Multicultural European Activity

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Abstract: The main objective of this paper, is to report the activity of a multicultural and Cross Country European activity : " the communication weeks " focused on three items :

- Teacher Educators and Trainee Teachers needs
- Information and Communication Technology (I.C.T) as educational tools
- Intrinsic qualities and draw back of ICT tools

The specific interest of these communication weeks is that it took place in ordinary situations and give an opportunity to present the point of views of European users working together in order to point out the pedagogical problematic about the use of ICT tools and to illustrate the actors perceptions. We choose to present this paper in actual words of these participants so that their voices are clearly heard.

The users conclusions underline the fact that there is an awareness about their changing role through the use of Information and Communication Technology. They argue for the integration of ICT tools in their pedagogical practices in training course and curricular.

Introduction

Different Institutes of Teacher Education (pre-service education and in-service training) in England, Finland, France, Portugal and Switzerland, decided to carry out " **Communication weeks** " from january to June 1997, in order to develop a network between project partners and users for a limited period of time (two weeks). These Communication weeks aimed at enabling Teacher Educators and Trainee Teachers to communicate about Information and Communication Technology (I.C.T) tools by using synchronous and asynchronous tools such as forums, videoconferencing, e-mail… This collaboration has been held by the research project FETICHE (Formation des Enseignants aux Techniques de l'Information et de la Communication : CHangements et Evolution) within the framework of the European program Socrates[1].

This experiment used the local environment that took place in ordinary situation and circumstances. Small and disparate groups were involved. The priority was to support people's involvement in relevant cross country communication. Observing and analyzing was our second objective in order to identify the lessons to be learned from such an European co-operation. This paper gives a brief description of the setting of this communication weeks (1) and the results of a small scale questionnaire pointing out the users needs (2), The ICT as educational tools (3) and their qualities and drawbacks (4). More details can be found in the full report (Bessiere, Blackeley, Pierrou 1997) and on the Fetiche Web site[2].

1. The setting up

The preparation of such an event required a lot of energy among the Fetiche team in order to coordinate, to organize and to build a global agreement among team members.

Some prerequisite were handled, particularly :

- Basket of technology concretely available and ready to use (specially for the multipoint videoconferencing)
- Choice of an animator "boosting" the process in each country.

[1] This project already finished, would continue for year 2000 (we are waiting for the agreement).
[2] http://ictt2.ec-lyon.fr/fetiche/

- Choice of participants with a minimal training

1.1 Identification of the participants

As we were in a distant context, we tried to give to the participants the possibility to be immediately in contact with this technology not only as observers but as real actors. Therefore, their first task was to introduce themselves before entering the conference (forum) by filling a form. This form was public and we could read 39 presentations. It's noticeable that a half of the participants were mainly Trainee Teachers and had some previous experience of collaboration at European scale. Most of them used to travel in Europe for their professional activities, and half already used e-mails for European Collaboration.
In the Hobbies section, the following are classical entries: *" reading ", " swimming ", " fishing ", " cinema "* but also: *" Telecommunications ", " My favorite hobbies are...going out with friends and lately netsurfing ", " ...Travelling and netsurfing ! ", " Computer ", " surf the net ", but* their personal interests and working life indicate experience using ICTs: *" ...I am in charge of ICT at the IUFM ", " Teacher training in English ICT projects in education (videoconferencing, WWW, E-mail...) ", " ...developing distant learning materials ... ", " I have 4 hours a week with my students in English for 2 years and one of these hours is with the computer "...*
It's clear that they are probably more familiar with e-mail than the average Teacher or Trainee Teacher: this is due to the fact they belong to institutions which are active in this field (thanks to Fetiche and other projects).

If we cross this identification form with the information coming from the questionnaires (48 answers), we can add, that most participants where young (less than 30 years old), mainly woman, and it is the students (Trainee Teachers) who massively answered. This is a positive indicator corresponding to one of our main objectives for this activity " involving Trainee Teachers " with a basket of media.

1.2 Media used

We try to find a basket of technology, mixing asynchronous and synchronous media, in order to give a representative pallet on what we call ICT tools. During the Communication Weeks, we never used the expression "New Tools for Teaching or Learning" or "New Technologies and training". This terminological orientation was for the project team the opportunity to offer a large choice of New technology tools used in different fields and let the participants appreciate if those tools could be used, in a learning or teaching situation : "L'enseignement ne génère pas de nouvelles techniques – affirme Robert Quinot (1986) – de l'audiovisuel à la télématique, elles sont introduites par effractions successives…L'enseignement utilise traditionnellement des aides qu'il adapte, comme les instruments de mesure, (…) les maquettes en sciences physiques (…)"[3] and we could add the new technologies for learning and teaching.
The following summary table shows the overall technologies used.

[3] Translation by the authors : "Teaching doesn't generate new technologies – said Robert Quinot (1986) – from audiovisuals to telematics, they are introduced by successive break-in…Teaching traditionally use some aids which are adapted, as measure instruments, (…) scale models in physical sciences (…)"

Technolgy	Aims
e-mail	90 % of the organisation of the communication weeks was done by e-mail. But it was just used between the team members. The participants, has they had the forum, used it hardly ever.
Teleconferencing "Bring people together to discuss in real or differed time" (Laurillard, 1993, p. 164)	**The forum** was dedicated to the reflexive and collaborative part of the Activity. This conference, called 'asynchronous' - where each participant writes or answers to a message when it is convenient for him – was one way of meeting and discussing. In this forum you found 10 main threads in order to discuss about pedagogy, teaching and learning approaches using new technology.
	The videoconferencing was used for real time and immediate feed-back. Videoconferencing was intended to be one of the project's synchronous tools enabling participants to get to know one another for instance people which whom they communicate at distance in the asynchronous mode on the forum, to discuss at distance on various topics seen in the forum and learn more of how to use the medium.
Web site "The Daily Mirror"	A web site, called Fetiche Web site has been held at first for the project team. For this specific event, a Communication Weeks menu was created. This medium was open to the participants in order to informed them, about different subjects concerning the communication weeks, but also on the aim of the whole project. The web was principally a tool for the circulation of up-dated information but also the "collector" of reactions, thanks to the built-in questionnaires. The participants had to go to the web for filling the initial and final questionnaire.

Table 1 : the basket of tools used during the communication weeks

1.3 Methodological approach and observation tools

The Communication Weeks was an European experiment using the local environment and composed of small and disparate groups. **For these reasons we choose to have a qualitative approach.** We prepared specific observation tools which were handled and used by each field partner, in order to evaluate this event such as : *Automatic files* (e.g.: log files from machines), *individual data* given by each participant (e.g.: individual presentation form) and *two questionnaires* (the first starting individual questionnaire planned to be completed by all participants at the start of the Communication Weeks and the second final individual questionnaire planned to be completed at the end) available on the web server, about the interest and the limits of the pedagogical functions of each medium used and about the Communication Weeks as a whole. As we were in a real situation distributed over 5 sites, different problems occurred for some of the participants : the starting questionnaire (41 answers) and final questionnaire (26 answers) are anonymous and do not allow personal identification of initial and final responses by a given participant. Only overall comparisons are possible. In addition, a number of participants did not complete the final questionnaire. We ensured, by cross-referencing certain criteria (age, sex, country, profession, etc.), that the 26 people completing final questionnaire, had also completed the starting questionnaire. With respect to methodology the "disappearance" of part of the "subjects" is a typical characteristic when observing an experiment under real conditions. So, we had to "temper" the drop-out rate (15 out of 41) of responses in the final questionnaire. We had also, *data*

provided by the coordinators of each site (e.g.: observing the videoconference and writing comments on some key issues) , *group interview*. We built a *specific grid* for the observers of the videoconferencing. This grid is taken from Bales (1950) and adapted for our particular context. Our main objective, with these tools, was to hear the views of users. The following participants remarks concern the users needs. When they spoke of users they think principally of Teachers (Educators and Trainees).

2. Users needs

Participants had plenty to say about the users needs, the outburst of ideas, comments and suggestions are clearly expressed. Judging by the answers, the needs for Teachers can be divided in two basic categories of training : technology and its pedagogical use. But first of all there is a prerequisite : the technology has to be available.

2.1 Emphasising the required equipment

All participants asked for the required or adequate equipment. There is was a disparity concerning the equipment between the north of Europe and the south and it was also between depending from the countries. But, even when some equipment was available, most participants pointed out the difficult access and the complex organization as significant barriers on the way towards a flexible and every day integration in school training.

" *To have access to equipment, to ensure that personal aspects are catered for, especially as regards Distant Learning.* ". Female Trainee Teacher – aged 24.

" *To have free-access to the equipment (to develop the autonomy): but this is still very difficult to organise it in schools* ". Female Trainee Teacher – aged 25.

One participant sums up trainee needs very clearly:

" *basic ICT training at school - enough work stations at school - modern easy-to-use software - ICT integrated in school learning* ". Male Trainee Teacher – aged 25.

2.2 Needs for training in order to use the ICT tools

Their needs concerning training cover different aspects. The first aspect is a technical request in order to have the minimum pre-requisites : " *basic training in the use of ICT l - modern easy-to-use software - ICT integrated in the curriculum* ". Male Teacher – aged 30 , to strip the machine of its mystery : " *You find some teachers who think that they need to be a nuclear physicist to be able to approach a computer, while others just jump in and discover that it's an easy world to navigate in* ". Female Trainee Teacher – aged 26, but also to treat as something ordinary, an additional means of personal advance: " *The teachers could use some extra information about ICT, some advanced computer competencies in order to increase their knowledge, not just for teaching* ". Female Teacher – aged 33.

They are not ready to assume a technical competence and they ask massively for a resource person : " *..Why not let the teachers get on with the job they do best, i.e. teaching and dealing with the communications portion of the exchanges, while the technicians work in the background / sidelines to help them get their job done, by smoothing out the road for them ...* " Female Teacher – aged 34.

" *...It's really like having two legs. Cut one off and you topple over. The technician is one leg and the teacher is the other...* ". Male Trainee Teacher – aged 24.

This request could be perhaps a means to overcome their fear, hesitancy and apprehension.... Their attitudes might be due to what Raub (1981) called the computer anxiety : "the complex emotional reactions that are evoked in individuals who interpret computers as personally threatening" ?

The second aspect is a pedagogical training desire to find points of reference for methodology and analysis : " *To study interaction of pedagogy and ICT* ", " *To know, and analyze different experiences developed by other people* ". Female Trainee Teacher – aged 23.

" *To have preparation in order to use ICT and be able to use it with my students in a comfortable way and also productive* ". Female Trainee Teacher – aged 22

This join the idea of the teacher posture, attitude. Some participants raised the idea to focus the training on the attitudes (rather than ICT skills) of the ICT user. The reason given for this was that the changes in software

and hardware are so rapid that no institution can expect to be able to afford to train its members in every tool and software version use. In this situation it is necessary for people to have an **attitude** which allows and inspires them to take the responsibility of learning to oneself. They conclude saying that influencing ones attitudes through education/training is difficult but the challenge needs to be taken ...

3. ICT as educational tools

The individual opinions offered by the participants reveal two main trends concerning this subject : the role inside the teaching and learning process and the aspects of a social mediated interaction among colleagues

3.1 Teaching and learning issues

In the following summary lines we have grouped answers by participants concerning the merits and limits of ICT for learning and teaching. We have not separated learning and training because the answers we received clearly amalgamate them. An advantage for learning, for instance, is also an asset for teaching.

As we stressed above, participants were convinced of the wisdom of integrating these tools in the educational process and they consider it as an additional educational resource. But they never forget the teacher's role and they stress that those tools are only a complement of the Teaching and Learning process because the person to person contact is always essential. They also question themselves about knowledge, concluding that the ICT tools are now another important vector towards knowledge which bring additional color to the pedagogical palette: " *ICT can be a potential resource to help teaching* " Female Teacher – aged 28; " *ICT can be used to teach but we need to be careful. Pupils can exchange information with other schools, participate in projects, etc..* ". Female Trainee Teacher – aged 24; *"It another educational resource. The teacher's role is important to decide the kind of activities developed by students by the ICT* ". Female Teacher – aged 32. ICT are in the broader context of society: " *Nowadays, more and more people use new technologies, teachers must be aware of those changes.* " Male Teacher – aged 32., " *ICT is used in almost all aspects of life in the society so teaching and learning processes cannot be isolated from the trend. ICT tools give a possibility to enrich teaching and learning.* " Male Trainee Teacher – aged 26.

The emphasis is put also on a more individual approach to teaching: " *With ICT students can construct their own knowledge in their own time. They can discover a world of information* " Female Trainee Teacher – aged 25. In addition, ICT: " ... *will give the learning/teaching process a new view, increasing the stimulus and the motivation* ", Male Teacher – aged 34, and a vector for communicating with other colleagues.

3.2 Mediated social interaction

Interaction and communication with other colleagues seems to be one of the major role of ICT tools. It is to be noted that our participants attach considerable importance to this point and we may wonder whether mediated communication, at a distance, does not represent a richer communication vector, bringing a form of liberty that is in some way "restricted" in a person to person relationship in which less rational forces (such as sensitivity and emotion) may take over. Interest in collaborative work is also apparent: " *We can learn a lot from others' experiences and exchanging information through ICT makes everything quicker* ". Female Trainee Teacher – aged 22. " *As a future teacher I think ICT are a new and very important tool which I can't leave aside. Although I still think we have to be very selective when it comes to the amount of information we can get! Another point is the information exchange we can rely on, thinking that somewhere out there someone is feeling the same we do and probably will help us, it is important* ". Female Trainee Teacher – aged 28; " *I don't like to work alone. Communicating with colleagues gives the opportunity of reflection and try new strategies* ". Female Teacher – aged 29.

4. User appreciation about the Intrinsic qualities and drawbacks of ICT tools

As far as participants are concerned, the tools selected for the Communication Weeks (WWW, Videoconferencing, Forums) seem to be tools that can be used in teaching. On the other hand, no particular medium stands out from the rest. For the participants, the **advantages of ICT** are mainly " *An active method of Training* ", Male Trainee Teacher – aged 26, and to " *Reinstate a presence in Distant Learning* " Female

Trainee Teacher – aged 25, and the main disadvantage is the " *heavy cost of the equipment* ", Female Trainee Teacher – aged 25, and also some **drawbacks**:
" *It's not yet as easy as Desk Top Processing* " Female Trainee Teacher – aged 22. " *Sometimes we can feel lost with so many information* " Male Trainee Teacher – aged 23. "*...Take too much time* " Female Teacher – aged 33. " *The attention focused on technical aspect, may sometimes forgot the content of teaching and learning*". Female Teacher – aged 36.

Despite negligible technical problems for the forum and videoconference, participants were pleasantly surprised to discover the potential for exchange and communication between individuals and groups using synchronous and asynchronous tools: " *The videoconference was an important way of exchanging experiences from different teachers and trainees. Sometimes their experience where similar to our* ", Female Trainee Teacher – aged 25. " *The forum consisted in interactive process of communicating between different teachers and trainees, from different cultures* ". Female Trainee Teacher – aged 23.
" *The two main tools (WWW and videoconference) were a good combination that complemented on one another. There was however a wish for a chatting option in the forum. To some participants the idea of the WWW forum was new and needed some time for getting accustomed to* ". Male Trainee Teacher – aged 25. They also express their pleasure in seeing that someone had replied to a message : " *It's been very rewarding to see that someone answered our message (on the Forum)* ". Female Trainee Teacher – aged 27. The opinion of the groups regarding the choice of technologies reveals two emerging media, which seem complementary: videoconferencing and electronic conferences. It is perhaps worth noting that none of the groups suggest other media that could have been used.

Conclusions

Before the Communication Weeks, none of the participants suggested that in the future, ICT tools would not be part of the landscape of teaching. There was already some awareness among them about the interest of ICT tools but the Communication Weeks played the role of a trigger and open the door for many comments. On the whole they are very optimistic about the future of ICT Tools. All the participants are very keen on teaching and learning through ICT. Also the fact that they have chosen the teaching profession for themselves gives them a solid motivational background for developing their teaching profession. The mention of the obstacles are weak.

This Communication Weeks permitted to produce an analysis of the intrinsic qualities of ICT tools, but also a real commentary on the problems of establishing and maintaining such technical links. The views expressed in the groups and in the open questions highlight some of the abilities and skills required to use ICT properly, offering us the opportunity to sketch out a preliminary "curriculum", but also to point out an awareness about their changing role and a great change in the learning/teaching process being more interactive and open.

The contribution of the multicultural cross country communication, create an identity, a recognition of a European global family. This European dimension could have became a World dimension : " *It would be interesting that the "European dimension" became "World dimension". What do they do in the other side of the ocean? Of course it is important knowing about the ideas and the work each country develops in Europe but everyday we are more and more citizen of the world and we shouldn't forget that* ". Female Trainee Teacher – aged 26.

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MATHEMATICS

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In examining this year's set of papers for the mathematics section I cannot help but be impressed by the growth which this area has seen over the past 10 years. Initially, we were lucky to have papers which showed competence in the use of technology and which tended to be written from a "Golly-Gee-Whiz! It actually worked" perspective. The mathematics in many cases was at a rudimentary level, and often came in second to the computer itself.

We have indeed progressed far since those days. As you are aware, to even get consideration in this year's section you had to be able to submit your papers in electronic form via the Internet. This marks a major transition period for SITE. To this writer it marks the end of the early exploratory era where "Golly-Gee, it works" was good enough. Today you have to be a relatively savvy user of technology to even participate in the discussion. In many ways this is unfortunate, as it means that there will be some voices left out of the dialog. I raise this as an issue because to even enter the SITE discourse from this point on you must already be a fairly high end user.

Although this will certainly raise the bar on the technological sophistication that one might expect within the papers, I will miss the diversity. Part of the excitement of SITE has always been the mix of talents and abilities that it drew. It was common to find novice classroom teachers rubbing shoulders with professional instructional designers and I feel that as an organization we were richer for it. Let's make sure we continue the long-standing SITE tradition of making the "newbies" feel welcome.

As you shall see, we have indeed progressed to the point where we are now getting an abundance of extremely strong papers. In this new wave not only is "Golly-Gee" not good enough, but the papers are written within well-developed and articulated theoretical frameworks for what is being done, a high-end use of technology in some very innovative and creative fashions, and the creation of some new and powerful mathematical tools with which to teach and think. All of these serve as strong indications that this is truly a fruitful area and one in which should see much growth and research over the next few years.

The Papers

This years mathematics papers tended to cluster around three major themes. The first of these themes might be thought of as ***Why do we do things we do?*** Papers that were classified in this area tended to feature the psychological and pedagogical implications of technology. They often were concerned with how we might take advantage of what we know concerning how best one can teach, how best students can learn, and how the technology can be used to enhance existing construction.

The second major theme concerned more content specific issues and might be thought of as ***What should we teach?*** These papers were often very specific regarding their mathematical content, occasionally to the extent of limiting their generalizability to other instructional settings. The central focus of these papers is what is it that we are going to teach. However, they serve as lovely reminders of the extent to which mathematics instruction can be enhanced via technology and a reminder of the growing maturity of the field. In reading this set it is fascinating to see the various pedagogical methods that were adopted.

The third theme was that of tool construction for instruction. This area might be thought of as ***What do we have to teach with?*** These papers describe some truly cutting edge and innovative efforts of interest to all mathematics educators. As I reflect upon the new methods and opportunities for instruction represented in this section I am convinced that a careful reading would make a technology using teacher educator out of the most die-hard critic.

Why do we do things we do?

These papers contained many important philosophical and logistical concerns. Common to nearly all of them, however, is the question of why should we teach in a technologically enhanced fashion and what does this change mean to our teacher candidates and to their eventual students. In Connell and Harnisch we read of the need for strong conceptualization within technology enhanced mathematics instruction - one could easily extend the argument to mathematics instruction in general. This paper describes why it is important that we do not abandon personalized individual understanding of concepts. Upon first exposure to educational computing many teachers

candidates comment that they no longer need to understand the concepts as the computer will bail them out. This is a dangerous perception and is addressed head-on in this paper

The model for interdisciplinary collaboration put forth by LaRose and McDonald reflects awareness of this concern. This paper describes a well-developed effort in using the World Wide Web as a method of instruction. Their rich descriptions of both the day-to-day usage and the manner in which they evaluated and assessed their project reflect a nicely developed set of ideas. In particular, there was an attempt to match the technological method to appropriate methodological approaches. As published here, this particular paper is a work in progress. I would encourage interested readers to attend their session at the conference. It will be exciting to see how their Fall and Spring semester turn out! It should be noted that this paper attempts to meet both the more rigid instructional design requirements and capture the fluidity and dynamic aspects of constructivism and social interaction.

Our next look at why we teach the way we teach is by Charnitski and Croop and offers beautifully developed discussion Vygotskian notions relative to computer enhanced mathematics instruction. Given the tendency of many technologically intensive courses to become depersonalized and machine-centered I feel that this is a very important paper. It describes in easy to understand terms some of the key issues of Vygotsky and his psychological theories. The notion of creating a collaborative learning space within a computer-enhanced environment should be must reading for all teacher educators. This important paper raises issues that we need to be looking at very carefully lest we find ourselves trapped with content delivery systems in lieu of interactive learning environments.

In Slough and Chamblee's paper we read their approach toward implementation of technology in math and science at the secondary level. For those readers who are not familiar with CBAM, or the Concerns-Based Adoption Model, it would be well worth the time necessary for reading their theoretical framework section. The variation of CBAM used in this paper involves the five major stages and reflects the dynamic nature of the change process. A major finding from this paper is that CBAM model does address the perceived concerns of the teachers. We also find further examples of the use of technology to enhance and transdisciplinary work across content areas.

The last paper in this section comes from Pianfetti and Pianfetti and illustrates some absolutely beautiful work using the World Wide Web to teach in a new fashion. The study itself can serve as a template for other researchers and I was particularly impressed by their use of actual students in actual classrooms schools throughout the creation, design, and evaluation of their project. This paper could serve as a model for researchers wishing to field based their work.

What should we teach?

In the paper concerning Actions on Objects, Connell describes a methodological framework for the technological enhancement of mathematics education. In this paper we see examples showing the essential parallelism of this approach, together with the expressed notion that good thinking is good thinking regardless of what tools or developmental level might be used in its' generation.

Bounieav deals with some of the psychological aspects of using information technologies in the second paper within this subsection. In this case to teach a very specific set of concepts from linear algebra. For past readers of the SITE mathematics section you are probably aware of Mikhail's work - Step-by-Step Development of Mental activities (SSDMA). A major strength of this paper lies in its' carefully delineated set of actions which derived from the mathematics itself. The instructions his examples are based upon are quite well worked out, in each case showing the operations underlying the mental activities that will later be built. This paper builds a strong case for the importance of doing some type of structural analysis concerning each new action that is to be developed. I find is to be a healthy suggestion. In some constructivist classrooms there occasionally exists the notion that every construction of meaning is of equal worth.

The next view of why we do the things we do in teaching comes to us from Coffland and Strickland. They report the results of a survey of variables related teacher technology and geometry. In reading this report a noteworthy point is that one's attitude towards use of computers appeared to be independent of other types of characteristics such as a technology awareness, attitude, training or usage. Perhaps it is the case that one becomes an adopter of technology in the mathematics classroom because of other factors not related to formal instruction in educational technology. We also find evidence supporting a reluctance toward use. In particular, almost every respondent stated that technology required more time to learn and implement. Although the field has come a long ways, as we will later see in the tools to teach with section, there is still a need for streamlining the technology preparation process.

A further examination of how technology can be used to deliver course material is offered in Weston's paper. The content in this case is a finite mathematics course and the technological tool was WebCT – an extensive set of tools created by faculty at the University of British Columbia. As we take a look at the types of tools contained within WebCT we see a rich set of communication tools, study tools, evaluation tools and management tools. I would encourage people planning on designing their own online course to take a careful look at this selection. The paper provides important details regarding the nature and organization of these tools well worth examining.

In Galminas and Autrey's paper we read of issues that emerge in the conversion of existing courses into a technology-based or technology enhanced course. The content in this case is that of College Algebra. Given College Algebra's place in nearly every curriculum it is clear that this paper should be read with great care. They correctly point out that technology comes in many different forms and one can be skilled in one form and not another. In planning such conversions it is likewise important to remember the differences in classroom interactions and the impact this plays on the mathematical cultures which is created.

The final paper in this section serves as a true bridge between the content and tools subsections. Knudsen's discussion of the issues dealt with in developing online learning for middle school teachers serves as both a carefully written justification piece for reform based instruction and as a rich description of a potentially powerful resource for mathematics education. In this paper we see a notable example of interactive Web pages that serve dual roles as both manipulative and as resource textbook. It is also possible to observe a keen sensitivity between the mathematics content and the manner in which the technology is used to enhance its instruction.

Together, these papers each have a well-developed reason for teaching in the way in which they do. Technology clearly not just slapped on as an afterthought but is an integral part of the instruction. They serve as evidence to a growing maturation in terms of creating interactive learning environments for both student, teacher candidate, and practicing teacher / teacher educator.

What tools do we have to teach with?

The third and final group of papers deals with the tools which are now available and which technology enables for us to use in both teaching and learning. It is at this level that we often see the true power of the computer in terms of both representation and instruction most fully utilized. Connell begins with two parallel examples showing the student creation of a personally meaningful, computer-enabled, referent for their mathematics. These examples show that the objects we can create to think with significantly impact thinking. This influence is felt not only in what the content is about but also in terms of what might be done in teaching and learning. The concept that these objects can themselves have built-in intelligence is something that should not be lost upon the mathematics educator.

In Campbell and Fonthal's paper we can read how a specific tool was created for use to explore whole and rational number concepts. As examine how this was done it seems to have resulted in a good match between the need of the content and the pedagogical and teacher requirements. Indeed, what sets this paper apart is that the program that was created as a thinking tool was very carefully aligned with what is technologically possible and pedagogically important. I find the recommendations for designing future software packages to be quite informative and helpful.

In the Cannon, Heal and Wellman's paper we see the fruition of a longtime dream which I sure many mathematics educators have shared in the creation of the library of virtual electronic manipulatives on the World Wide Web. These interactive web-based manipulatives are well worth the time it takes to visit. Needless to say www.matti.usu.edu has been bookmarked on my browser and I imagine that it soon will be on yours as well. It's amazing to think that this is just a preliminary paper. I look forward to following this work as it grows over the next few years.

In Ostler and Grandgennett's paper we see how Web pages can be used to teach mathematical modeling. In particular there some nice observations and suggestions in terms of instructional considerations. I find it very helpful to see that care was taken in terms of not only how we can use the computer to teach mathematical modeling, but also how do we teach the students. I heartily recommend this paper for anyone who is considering expanding their own mathematical models and representations as well as those considering the use of Web pages in the mathematics classroom.

In Bernard and Ramirez paper we see a beautifully expanded problem, *The biker and the nearby town*, as it is worked out with three different technological tools – Cabris Geometry, a spreadsheet, and a TI 83 calculator. It's fascinating to observe how each of the tools to think with subtly and some cases quite blatantly influenced the problem solving approach which was taken. This paper offers a rare insight into the manner in which technology influences student thought and problem solving.

The final paper in this section by Katkov concerns a new tool currently under development for the graphing of functions. Although not immediate related to teacher education, per se, it appears to be a powerful tool that looks to be quite extensible. The screen shots and a list of the permitted actions serve to remind us that even at a highly abstract level in the technologically enhanced mathematics classroom it is possible to see a series of well-defined actions taken upon objects of well defined properties. This tool appears to be currently under development and not having had the opportunity of using the tool myself, I would do like to examine its' robustness in an actual classroom setting.

Concluding Remarks

This year's crop of paper serves to illustrate how far we have come in this interesting intersection of mathematics, educational technology, learning theory, psychology, and pedagogy. We are far beyond the early days of "let's plug it in and see what is can do" and are well into integrating the

computer in the mathematics classroom. Furthermore, applications and methods are emerging which are not only pedagogically meaningful but also powerful from a mathematics perspective.

As we look to the future it is easy to envision classrooms where Internet connectivity is taken for granted, where every student has the expertise which was only held by experts in the previous year, and hardware and raw computational ability rivaling those of many research institutions of only five years ago. From this vision it is clear that we are in for some very exciting times ahead. However, despite whatever educational hardware and software we might have at our disposal we must bear in mind that in order for teachers to use these tools effectively they must understand the underlying mathematics.

A Case for Strong Conceptualization in Technology Enhanced Mathematics Instruction

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Abstract. It is extremely important for students to develop strong concepts regarding the nature of the objects they are manipulating and how these objects are to be used mathematically. This is increasingly important when the objects with which one is thinking are themselves active – as is the case within a technologically enhanced mathematics classroom. This serves to further underscore the need for increased mathematical conceptual awareness on the part of our teacher candidates.

Introduction

Mathematics educators have long espoused the use of hands-on manipulative objects as being essential for children's creation of meaningful mathematical concepts. As a result of this long-standing commitment to their use many of these manipulative objects have become widespread and nearly universal in mathematics classrooms around the world. Through the years educators everywhere have come to understand many of the properties of these powerful objects to think with together with many strategies for their effective use and cautions for their abuse.

Today we are seeing the growing awareness and use of technology enhanced mathematical objects, many of which possess considerable "awareness" of their function and capable of offering suggestions to the learner concerning their own use. Little is known, however, of the emerging technology enhanced environment, where the very tools with which one thinks are active as well as interactive. This paper attempts to describe some of the potential difficulties I have observed over the years. I will further argue for the creation of a strong set of mathematically relevant understandings on the part of both teacher candidates and their eventual students in order to be effective learners within this new technologically enhanced mathematical culture.

Two types of mathematical objects[1]

One of the first things which many teachers notice when using manipulatives is that they appeal to the children across a broad sensory array. A set of Dienes' $Base_{10}$ blocks, for example, will simultaneously present to the student experiences with mass, density, smell, color, texture and so forth. And, although this is a part of the manipulatives appeal to the student, not all of these sensory experiences are beneficial to the construction of the eventual concept for which they were selected. Furthermore, traditional manipulatives - such as the $Base_{10}$ blocks – will also serve to illustrate many other concepts than that for which they were originally created and in a similar fashion not all of these will be of benefit to the mathematics classroom.

[1] For a further discussion of this viewpoint see *Symbolic Computers and Mathematical Objects* by *Michael L. Connell* within these proceedings.

This is typically viewed as strength of the material and as an asset to the teacher. In this scenario, we have the potential to generate more than just the mathematical topic of the day. This is a generally a very good situation to have as it provides much flexibility and great linking power in a given manipulative.

Of course this multifaceted presentation of a broad array of experience to the senses is not always a good thing. It is possible that these additional added features are actually seductive details that distract from the core mathematical concepts that we would hope are being developed. This leads to the observation that the narrowing of focus brought about via a sketch is the first step toward the later highly abstracted representations such as those utilized in the algebra. Remember Whitehead in "Process and Reality" when he states that "...every advance in human understanding is brought about via an advance in the symbol systems used to think with" (Whitehead, 1929).

The technology enabled manipulatives and sketches lack many of the multi-faceted features of the traditional manipulative and serve as an important step in such a concentration of focus. For example, I have long suggested that an excellent use of a computer based manipulative is as a Visual Representation of a previously encountered physical manipulative which had been used to teach an earlier concept (see Connell, 1988). In particular, one of the key differences between a computer manipulative and the real world manipulative upon which is based lies in the degree of abstraction that occurs due to the use of the computer to generate the object of thought.

This is not such a strange idea for most teachers and teacher educators. In the case of mathematics quite often we are trying to teach a specific representation as opposed to a broad multiple uses of the manipulative. Thus as a domain we utilize standard representations such as Dienes blocks which are specifically constructed to carry a single meaning at the expensive other potential meanings which the material might be used for.

A Case for Strong Conceptualization

Due in part to this increased abstraction inherent in many computer enabled objects it is extremely important for children to develop strong concepts. There should be well developed understandings regarding what the objects they are manipulating are to be used for mathematically and how these objects are appropriately and inappropriately use. One analogy comes immediately to my mind is the smart wizards we see more and more of in Microsoft applications. I can envision a case where the technologically enabled objects that we provide for the children think with become more and more self aware.

To see how this might play out, let's imagine that we have identified two quantifiable sets that we wish to begin working on. Let us further imagine that we have identified various operations which it is possible to use on these two sets of objects and that they are of the same class such that the operations identified are appropriate. So the student selects a set addition object using the operating software and passes to it the instruction to it to combine these two sets.

The set addition object – which has more then a bit of intelli-sense and wizardry (to use Microsoft terminology for a moment) - does the cybernetic equivalent of looking at the task ahead of it and then responds back to the student, "Are you sure that you really want to do this?" In order to be successful in this new environment the child has to know whether or not this really is an appropriate operation to perform upon these objects, whether or not he's asked the right object to do the job, and how to interpret the results that he or she will eventually receive.

This is not a fanciful example. Such scenarios are becoming all to common and indeed are more than a bit of a nuisance showing up all the time in intelli-sense technologies. For example, you can be writing a letter and before you can even finish the first paragraph the Wizard de jour will pop-up. "Hi there! It looks like your trying to write a letter. How about I help you?" Typically I really don't want or need the help because it doesn't fit with either my writing style or the way I want to put this on paper. After all let's face it as an academician things are written differently all the time. For whatever reason, however, it's important to note that in this scenario I am the expert. I can override the suggestions of any object or Wizard when it's not inline with the tasks that I need to have done.

In this New World I'm envisioning, however, of computer enhanced mathematics and mathematics instruction via active objects this may not always be the case. Let's imagine that we are doing some integration and a wizard makes a suggestion on the boundary conditions over which to integrate which nine

times out of ten would be right. If your problem happens to fit the tenth condition and you succumb to the wizards' advice in the face of your own lack of concept you are in major troubles.

This is problem occurs on a daily basis in computer programs commonly used in the statistical analyses of data. A very real problem has occurred as more and more researchers are getting access to higher and higher levels of statistical programs. In many cases programs such as SPSS and SAS will enable processing beyond the interpretive levels of the users. It is very common to find data sets that are spherical and never checked for, and post-op comparisons that are performed correctly but selected inappropriately. All of this because the tools given for the individual to think with were, in many ways, smarter than the people thinking with them. This trend is one that shows every tendency of continuing and accelerating.

This plays out with a vengeance in the educational arena. We are already able to design and implement intelligent objects with more "number-sense" than the beginning students who will be utilizing them will have. We are very close to being able to come up with objects to think with which are more intelligent then the people who working with them. This is not intended as a callused or a mean comment. We don't expect a tremendously high level of mathematical metacognitive knowledge at the first grade level. After all, the learner is just putting all this stuff together – in many cases for the very first time. So to return to our earlier example, it would be very easy to imagine a set addition object that basically says, "I will take any two numbers you give me and combine them using the operation of addition". In terms of sheer processing power this could easily be at a higher skill level then the child using the object.

If we are to be effective teachers in this new technology enhanced environment we need to make sure that our students truly understand the concepts. If this is not done, all of our lovely correct answers are meaningless. This was a major concern in the calculator based reform effort of 15 years ago, it is even more crucial in the computer environment. Let us see why this should be the case. Using a traditional calculator you still had to plug everything in yourself – much like the old command line DOS interfaces or line-by-line BASIC compilers. The new computer environments and many of the newer calculators are becoming increasingly object-oriented. Therefore, it is entirely possible that we may end of having the terminal smarter than the user. I have always thought we were better off having dumb terminals and smart users in computing – without extreme care we will soon be facing the reverse.

Examining the Tools to Think With

The creation of new objects of thought or tools to think with can become very powerful pedagogical tools assuming we understand the concepts underlying them. The hidden danger surfaces when we cannot understand the underlying mathematical concepts upon which the active objects are operating on and we simply take them for granted, follow their recommendations blindly, and accept their results at face value.

This would be analogous to letting your writing be totally edited by wizards in your word processor. The following poem, which has enjoyed wide popularity among information technology faculty through the years, will serve to illustrate the dangers of such an approach.

SPELL BOUND

I have a spelling checker,
It came with my PC.
It plainly marks four my revue
Mistakes I cannot sea.
I've run this poem threw it
I'm sure your pleased too no,
Its letter perfect in it's weigh,
My checker tolled me sew.

Because of our in-depth knowledge of words and word usage it is easy to see the humor in this piece of writing. The errors are obvious and mostly harmless. If, however, we are looking at a

computational object which was created with a flaw in the underlying logic the errors are not nearly so obvious, harmless, or humorous.

Consider the following:

Depth	The Total Relation	Diff. From 1	Radical Portion	Diff. From .5
1	2.00000000000	-1.00000000000	1.00000000000	-0.50000000000
2	0.00000000000	1.00000000000	0.00000000000	0.50000000000
3	1.08239220029	-0.08239220029	0.54119610015	-0.04119610015
4	0.99401088611	0.00598911389	0.49700544305	0.00299455695
5	1.00019859327	-0.00019859327	0.50009929664	-0.00009929664
6	0.99999679901	0.00000320099	0.49999839950	0.00000160050
7	1.00000002540	-0.00000002540	0.50000001270	-0.00000001270
8	0.99999999990	0.00000000010	0.49999999995	0.00000000005

In this example it may not even be possible to identify the purpose for which the "object" was created, the assumptions that underlay it's creation, or the use to which it's results might be applied. The calculations are done correctly, of that we have no doubt, but to what use are they to be put? I am reminded of Douglas Adams Science Fiction classic "Life, the Universe, and Everything". In this classic text we learn that the answer to all of the truly deep problems of philosophy, metaphysics, etc., is actually 42. The difficulty is we do not know precisely what these questions are and in what form this answer fits.

Conclusion

In conclusion, the mathematics classroom of today is a far cry from that of 15 years ago. The technological objects upon which we act now routinely have intelligence built into them. If you made an error in using a slide rule, as was quite common when I was in school, all that would happen is that your result would be inaccurate. Today's intelligent objects have the potential notifying you of the error, suggest new options for you consider, and quite possibly lead you astray through giving information at a level which does not match with your understanding.

Ironically, the importance for understanding the underlying mathematical concepts in this scenario is significantly stronger than during the previous introduction of technology – the calculator. The calculator, despite the vast hue and cry of the time, proved to be a relatively benign intervention. Helping, as it were, with the numeric processing of skills and procedures that the child would have to construct, apply, and evaluate. The computer with its increasingly powerful objects of thought is a much more insidious problem.

On one hand it allows us to leverage our thinking tremendously forward through interaction with tools which themselves have rudimentary problem solving abilities. Furthermore, the natures of the data organization made possible through using technology lend themselves to types of approaches with known mathematical pay-off. On the other hand, however, we are in a very real danger of having our tools become more intelligent than the people using them. It is the responsibility of mathematics educators everywhere to ensure that our teacher candidates, teachers, and students are able to use the tools and not be used by them.

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Faculty/Student Collaboration in Education and Math—Using the Web to Improve Student Learning and Teaching

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Abstract: In this paper we describe a model for interdisciplinary collaboration between students interested in teaching and faculty teaching courses in the students' area of study—math and education. This collaboration involves the education students in the development of Web materials, video recording of classroom activities, and development of rubric for pedagogy effectiveness. It has as its objectives: the enhancement of the education students understanding and development of effective teaching strategies, including knowledge and application of instructional technology skills; the improvement of student learning in an existing course being taught by one of the collaborating faculty; and the enhancement of the teaching expertise for the faculty member teaching the course. These goals are accomplished through the use of the Web to provide immediate feedback to students in the class on topics that they find difficult, and through the faculty and education students' reflection on classroom dynamics through the use of digital video.

Introduction

The World Wide Web (or, more simply, Web) is rapidly becoming a ubiquitous feature of all aspects of society, including higher education. However, in the collegiate setting it is all-too-frequently used only to reproduce information that is available in other formats or media. Thus while it provides a new and effective vehicle for the dissemination of course information, it is difficult to determine whether its use is improving student learning. This is of increasing concern given the continual expansion of responsibilities felt by many university faculty, for whom adding Web page development to their repertoire may be part of a zero-sum game the loser in which is sleep. We are interested in the synergy afforded by the collaboration of faculty and students, especially those students interested in education, and the manners in which this cooperation may be used to enhance teaching and learning at the interrelated levels of the faculty member's course, the students learning in the course, and the education students' development as effective teachers. The involvement of the education students allows the distribution of the workload associated with the use of the Web and results in the students applying instructional technology skills acquired from a required education course, "Instructional Technology," which introduces them to a variety of educational software applications.

The use of the Web in this model has two interrelated parts, which are carried out with differing frequencies throughout the semester. First, it is used by the faculty member(s) teaching the course as a vehicle to respond to student confusion as expressed in specific classes through the use of a classroom assessment technique similar to the "Minute Paper" and "Muddiest Point" methods of Angelo & Cross (Angelo & Cross 1993). Second, it is used in conjunction with videotaped classroom sessions, taped by the education students, to similarly address students' misperceptions and confusion. The videotaped sessions are discussed by the faculty and education students using a rubric on pedagogy (developed by both the math education students and both faculty members) to isolate areas of confusion, and the education students then develop Web materials to address these. In either part, the Web provides a unique and valuable vehicle for the dissemination of the information to be conveyed: it allows for a dynamic information base that may change on a more-or-less daily basis, and provides a universally

accessible resource for the information. Its use in this manner also allows these confusions to be addressed simultaneously with the usual progression of the course, thus avoiding the loss of the time in the classroom which is so often already in short supply. Finally, there are multiple levels of learning occurring as a result of the second component, as the students in the class are learning through the Web materials being developed and the education students are also learning through the discussions of pedagogy and development of these materials.

In the remainder of this paper we explain how we implemented this model, describe in greater detail the different components indicated above, describe the manners in which we assessed the success of the model, and draw conclusions as based on the results of the assessment in the Fall Semester.

Implementation

All of the activities described in this paper were implemented in the environment of a small (about 1500 full-time students), somewhat selective, liberal arts based university. Upper-level courses in both mathematics and education, the two subjects studied, are small (10-15 students large), as are even lower-level courses offered out-of-sequence. This has clear advantages in teaching, as well as disadvantages when it comes to assessing the impact that the methods we discuss here actually have.

We are implementing these uses of the Web in the Fall semester 1999 in a second semester calculus course in the mathematics department. In the Spring semester 2000, we apply the same methods to the "Secondary Methods" education course.

Day-to-Day Web Use

The "day-to-day" use of the Web to respond to students' confusion regarding the material covered in class was accomplished through a classroom exercise resembling the "Minute Paper" or "Muddiest Point" techniques in "Classroom Assessment Techniques" (Angelo & Cross, 1993). At the end of each class period, approximately five minutes were reserved for student consideration of the material covered during the preceding hour. In this time, students answered the questions "what was the central theme of this course period?" and "what about this was least clear?" in a couple of sentences each. These were collected by the instructor, who then reviewed the comments and, if appropriate, articulated a response. Appropriateness in this case was defined by whether a significant number of the students in the class expressed confusion on the same topic or posed questions that were of sufficiently general application as to merit a response.

The response articulated was implemented as a Web page designed to elucidate the material and resolve questions and confusions. The materials developed were limited to a single Web page per day.

Videotaping and Web Materials

Three classroom sessions were selected in advance of the commencement of the semester as being on topics that would prove especially difficult for the students taking the course. These class periods were videotaped by the education students involved in the project using a digital video camera. The faculty and education students then watched the video later in the day and assessed the effectiveness of the class presentation, degree to which the instructor accurately adjusted to the classroom dynamics, and areas that were particularly confusing to the students in the class. As a vehicle for this assessment, a rubric was cooperatively developed by the students and faculty to evaluate the instructor's teaching method, effectiveness of questioning, assessment of students' understanding, and class organization. This rubric appears in an appendix.

Following this discussion and assessment, the faculty and education students determined what type of Web-based materials would be appropriate to resolve those issues left 'hanging' by the classroom presentation. These include demonstrations, excerpted sections of the videotape with further explanation and references, text and graphical instructional pages, and links to other on-line resources providing background information for the topic being covered. The outline of the mathematics and substance for the materials was determined in advance by the faculty and education students, collaboratively, and the actual pages were then developed independently by the

education students. Excerpts from the video were obtained through video editing Final Cut, MotoDV and included in the resulting Web pages, and the resulting materials reviewed and posted by the faculty member on a class website.

The technology skills of math education students were gained in Education 187 "Instructional Technology" and the development of this project allowed these students to apply these skills. In addition, these students were able to analyze the role and impact of interactive video and website development. This approach supports the Davis' (1999) principles for technology in teacher education including "...students should experience innovative technology-supported learning environments in their teacher education programmes" (p. 9).

Assessment

This project has three primary goals, namely, 1. the promotion of the education students' awareness of effective teaching strategies and the use of reflection and assessment in the development of the same, 2. the improvement of student learning in the courses involved with the project as a result of the use of the Web to provide "immediate" feedback on difficulties encountered with specific course topics, and 3. the enhancement of faculty teaching expertise. In order to determine the degree to which these were accomplished in the course of our work, several assessment instruments were employed. However, the assessment of any of these objectives is constrained by their inherently qualitative nature and by the small size of the classes and small numbers of education students involved, and we are therefore constrained to use generally indirect measures to determine our success in accomplishing them.

To assess the first objective, the education students each developed in the course of the semester a portfolio describing their thought processes at the beginning and end of the program, as well as their reflections on the nature and success of each of the videotaping sessions. They were provided with a number of prompts to which to respond, as described in the appendix. Samples of the students' entries are also included in the appendix. The reflections in these by the students and the assessment of the cooperating faculty members of the students' portfolios and their overall development were used to obtain a picture of the effectiveness of the project in accomplishing this goal.

The second objective is assessed through three different measures. First, we surveyed the students in the course at the beginning, middle, and end of the semester to determine their perception of the effectiveness of the course and usefulness of the Web materials produced. Second, the quality and relevance of the materials were evaluated by the faculty in the program at the end of the semester, taking advantage of knowledge of the difficulties students experienced on homework and exams. And third, we monitored the number of "hits" on the course Web throughout the semester, assuming that a continued or increased number of hits as the semester wears on is indicative of perceived value by the students. It is worth observing that while we would prefer to have more direct measures of the success of this objective it is difficult to obtain them in the face of the size and number of courses taught at a small university. We have therefore instead used these measures of effectiveness of the materials rather than try to directly assess the improvement of student learning.

The third objective suffers from the same difficulty in assessment as the second, for the "faculty teaching expertise" that we seek to enhance should be measured in improved student learning. As noted above, this is notoriously difficult to determine, and we therefore used subjective assessment measures to determine its success, having the education students and faculty member who was not teaching the course evaluate the instructor's effectiveness using the rubric developed for the examination of the videotapes and through general reflection

While it is not within the scope of this paper, the most significant assessment of the impact the program had on the education students involved in it would be an examination of those students' teaching (ideally, as compared with the teaching of students who did not participate in the project). This is again complicated by the small numbers of students in the program, but we look forward to being able to evaluate this as the education students do begin their student teaching, at the end of their university experience.

Results

Because we are still in the process of the first semester in which this program has been implemented, final results of the assessment program described above are not available here and will be presented in the conference presentation. In particular, the portfolios and faculty teaching assessments require the comparison of results from

the beginning and end of the semester, the latter of which are not available at this time. Similarly, complete results from the surveys of the students in the class are unavailable. We are, however, able to provide the preliminary results from the midterm surveys, which are positive.

In the midterm survey given in the Fall, students in the calculus class indicated that they were using the Web materials (with a majority indicating periodic or regular use, and 100% using it when an assignment referring to the materials was given). When asked to rate the usefulness of the materials on a four point scale (0=not useful, 4=immensely useful), they gave an average score of 3.13 (with some students simply responding "yes," it was useful; no students gave the materials less than a 2 in their rating). In addition, the number of hits on the Web pages did increase in successive months of the semester, from an approximate rate of 3 hits per student in the class in the first two months to approximately twice that in the last two. This provides some material evidence that the Web pages were perceived as useful by the students in the class. Further results will be presented at the SITE Conference on 1999 Fall Semester work as well as initial research in 2000 Spring Semester.

Conclusions

We have discussed an innovative, collaborative method of using the Web to respond directly to students' misperceptions and confusions as they take a class. The course primarily discussed here was second-semester calculus, but the method is applicable to courses in any area, and will be implemented for a course in secondary education methods in the Spring semester. In this method, we have involved faculty from our education and mathematics departments, as well as students who are studying mathematics education, to promote interedisicplinary learning at multiple levels—in the classroom, by the education students involved in the program, and by the faculty teaching and observing the class. Results from assessment of the method provide evidence that these goals are accomplished. The use of the Web is in integral to the project, as it provides a universally accessible medium that admits frequent addition of material on a regular basis and is an instructional technology to which the education students will both have access and be expected to use as they begin their careers.

Appendix

Assessment rubrics and materials are included in this appendix. The assessment rubric used to evaluate the videotaped class sessions is shown in figure 1, below. Note that the columns 3-5 headed in the second row should follow to the right of the first row in the table.

	1	2
Teaching Method Appropriate to Material	No method, or no formal connection between teaching material being covered	One evident tie of teaching method with content
Demonstrated Effective Use of Basic Questioning	No questions asked of students	Few questions asked of 25% of students or topics
Effective Assessment of Students' Understanding of Class Material	No method of assessment	Limited assessment of limited number of students
Effective Class Organization (Intro/Overview, Sequence of Instruction, Closure)	No effective organization	A minority of the lesson structure is present: one element present and good, or more present but all abysmal
3	**4**	**5**
Two evident ties of teaching method with content	Three evident ties of teaching method with content	Several (four) evident ties of teaching method with content
Some questions asked of	Similar, 75%	Questions asked of all

50% of students or topics		students and topics
Some assessment of a select few students	Many assessments of a majority of students	Many assessments of all students
Mixed or muddled lesson organization: all three elements present but ineffective	Majority of lesson structure is present and effective: at least two elements present and good, or three present but not fully effective	Effective organization including clear intro/overview, good sequence of instruction and effective closure.

Figure 1: Class assessment rubric.

The prompts given to the education students at the beginning and end of the semester, and following each of the videotape discussion sessions, are shown in figure 2.

At the beginning and end of the semester:

1. Outline a classroom lesson on a topic that you would expect to teach following your graduation or when you student teach.
2. Comment on the terms "assessment" and "feedback." In particular, what do you think about when you hear them? And how do you think they are related to teaching and the classroom.

After each videotape session:

3. Comment on what happened in the classroom and in the development of the supporting materials.
4. What key ideas or issues relating to teaching did you encounter in the course of working on this part of the project?

Figure 2: Portfolio prompt questions.

Samples of student responses to these prompts (prompt #2) are shown in figure 3.

Student response one--"When somebody uses the terms assessment and feedback, the first thing that comes to mind is tests! However, there are many other things that are involved with assessment and feedback besides just testing. First of all, assessment is...".

Student response two—"Feedback: The information students give to their teachers that convey confusion, also not always verbal. Things as simple as seating arrangements or eye contact can be considered a type of feedback for a teacher...Assessment and feedback work together in a well-organized classroom".

Everyone was really well engaged in the discussion and development of the rubric. It looked like everyone had fun with it, too".

Figure 3: Sample portfolio responses.

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Examining the Feasibility of Using Computer Supported Collaborative Work-Space in Pre-Service Mathematics Methods: A Vygotskian Perspective

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Abstract. Many elementary teachers lack the conceptual knowledge needed to teach even basic mathematics and thus create a weak link in the chain of mathematical learning for students. The socio-cultural theory of L. S. Vygotsky may offer direction for the design of a concept-building mathematics experience for elementary education majors. Computer supported collaborative workspaces have the potential to support and enhance a Vygotskian approach to mathematics learning for the preservice teacher.

Introduction

According to Rech, Hartzell and Stephens (1993), the quality of teaching at the elementary level is a critical factor in the future mathematical success of the student. High quality teaching is heavily dependent upon the teacher's conceptual knowledge of the subject matter. Yet, when questioned, many elementary teachers communicated a sense of personal inadequacy in mathematics and a lack of confidence in teaching mathematics (National Science Board, 1998; Stepans et al., 1986). Simon (1993) demonstrated that teachers who do not possess solid understanding of mathematics principles are unable to teach mathematics in a conceptual manner. Simply stated, teachers cannot teach what they do not know.

The competency of those who are teaching elementary level mathematics has long been questioned (e.g., Ball, 1990; Glennon, 1949; Zaslavsky & Peled 1996). Research conducted by Zazkis and Campbell (1994) supported the general claim that elementary teachers often possess weak content knowledge and insufficient conceptual understanding to teach mathematics. Rech, et al. (1993) found that "...the elementary education majors possessed deficits in almost all knowledge and content areas in mathematics when compared with the established norms of a general college population" (p.144)

Assuring that prospective teachers possess adequate mathematical content knowledge should be a primary concern in the preparation of elementary teachers; however, it is an area that continues to be neglected. Monroe (1984) stated that the mathematics education of elementary level teachers was less than adequate "by whatever standards are used" (p.23). Leitzel (1991) contended that the weakest link in the nation's system of mathematical education is the mathematical preparation of elementary teachers. According to Hungerford (1994) colleges and universities have done little to remedy the weak backgrounds of pre-service elementary teachers; "...the lack of attention being paid to mathematics courses for prospective elementary teachers is astounding" (p.16).

Teachers' mathematics backgrounds are particularly relevant in light of the research that suggests that a teacher's academic background (i.e., both level of courses and grades earned) may be related to student outcomes (Chaney, 1994). In 1985 Galambos et al. documented a pattern that reflected the absence of college-level mathematics requirements in teacher education. There is no indication that this pattern has changed.

Courses in pedagogy influence how preservice teachers think about teaching and learning mathematics. Yet, merely training teachers in mathematics pedagogy appears to be insufficient. Chaney (1994) demonstrated that mathematics pedagogy provided added benefit for teachers only if they possessed adequate mathematical concepts. Attending to mathematics teachers' beliefs about teaching and learning is unproductive when content knowledge is absent (Brown, Cooney, & Jones, 1990).

Advocacy for a combined content-methods mathematics course in teacher education is not new (Berg et al., 1993; Glennon, 1949; Heddens & Speer, 1997; Reisman, 1981). The combined content-methods approach recognizes that pre-service teachers may not possess the content knowledge and understanding needed to competently teach elementary mathematics. This curriculum emphasizes: (a) building a strong background understanding of mathematics concepts that are taught in elementary programs; (b) addressing and replacing misconceptions with conceptually sound knowledge; (c) reducing teacher anxiety and increasing teachers' self efficacy relative to doing mathematics; (d) demonstrating appropriate mathematics strategies and methodologies.

Conceptual learning differs from the rote memorization of facts and procedures (Bruner, 1963, 1971; Piaget, 1971; Vygotsky, 1986, 1997) that have historically characterized most mathematics classrooms (Cuban, 1984). Assuring conceptual knowledge of mathematics in preservice teachers will require change in both the learning environment and the emphasis of instruction. The socio-cultural-historical theory of learning proposed by Vygotsky (1986) may offer guidance in creating such an environment.

Vygtosky's Theory of Socio-Cultural Learning

Vygotsky's sociocultural theory of mind serves as a middle ground between formalism and constructivism (Kozulin, 1990; Minick, 1987; Moll, 1990; Vygotsky, 1986; Wertsch, 1985). According to his theory, concept formation is a dynamic interaction between the concrete and the abstract; neither requiring the learner to reinvent information, nor expecting the learner to conceptualize abstractions without first engaging in concrete activities that support the formation of mental models. Vygotsky proposed several key ideas relative to the levels and types of concept formation, the role of language and collaborative interchange in concept development, and the characteristics of an instructional environment that guide and promote mature concept development. Vygotsky viewed the ultimate goal of the learning process as the development of mature concepts which are characterized by the learner's ability to: (a) synthesize abstracted traits; (b) use the resulting abstract synthesis as his or her main instrument of thought without any reference to the related concrete situation or impression; and (c) use the concept in the formation of judgments and new concepts.

Language.

Language, and its relationship to thinking, is at the foundation of Vygotsky's theory (Vygotsky, 1986). Vygotsky regarded language as an indispensable requisite for all intellectual growth. He asserted that the merging of practical intelligence with a system of symbolic representation (i.e., speech) is the essence of complex behavior (Vygotsky,1978). According to Vygotsky (1978), speech has a particular organizing function that when combined with tool use produces fundamentally new forms of behavior. "...the most significant moment in the course of intellectual development... occurs when speech and practical activity, two previously completely independent lines of development, converge" (p. 24).

Two critical observations Vygotsky (1986) made were that: (1) the role of speech is equally as important as the role of action in attaining a solution to a problem; and (2) as situations demand more complex and indirect actions in finding a solution to a problem, speech plays a more important role in the solution process as a whole. Speech acts to organize, unify, and integrate the many aspects of the learner's behavior including perception, memory, and problem solving (Vygotsky, 1978).

According to Vygotsky (1986), individuals negotiate meaning and form concepts through verbal interactions with more knowledgeable others and by sensory interaction with their culture. Vygotsky noted that the mere association of words with objects does not imply concept formation and suggested that concept formation begins with a problem that cannot be solved other than through the formation of new concepts. The attainment of a true concept results in a qualitatively new type of thinking, therefore, merely quantitatively increasing associations of words with physical objects would never culminate in the higher intellectual activity that is characteristic of mature concepts (Markova, 1979; Moll, 1990; Ratner, 1991, 1997; Vygotsky, 1986; Wersch, 1985). Vygotsky considered the defining moment in concept formation to be the point at which the learner is able to use words as functional tools to facilitate communication, understanding, and problem-solving.

Spontaneous and Scientific Concepts

According to Vygotsky (1978, 1986), conceptual development does not occur in a vacuum, nor does it develop in a one dimensional, linear fashion. Vygotsky viewed concept formation as a multidimensional interaction of the child's social, historical, and cultural development. This view of concept development

considers the concept itself as being qualitatively more than the sum of its individual parts (Davydov, 1990; Forman, Minick, & Stone, 1993; Ratner, 1991; Vygotsky, 1986; Wersch, 1985).

Vygotsky identified two different types of concepts; *spontaneous concepts and scientific concepts*. Spontaneous concepts are those concepts that result from an individual's everyday exposure to his or her social and cultural environment. Typically, spontaneous concepts are unsystematic and highly contextualized. Scientific concepts are grounded in mediated instruction and are characterized by hierarchical, logical organization. Vygotsky (1986) proposed that spontaneous and scientific concepts differ in their development as well as their functioning, yet these two variants of the concept formation process influence each other's evolution.

Zone of Proximal Development

Vygotsky (1978) identified a construct that he called the Zone of Proximal Development (ZPD) which he defined as: "...the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p.86). An individual's movement through his or her ZPD requires a mediated environment that is rich in verbal communication and collaborative exchange (Forman, Minick, & Stone, 1993; Vygotsky, 1997; Wersch, 1985). Vygotsky (1986) stated that an individual's progression through his or her ZPD involves intelligent, conscious imitation, which requires an understanding of the field structure and the relationship between objects. Vygotsky and Luria (1993) cautioned that imitative behavior that is characteristic of movement through the ZPD should not be confused with automatic imitative behavior that shows no signs of conscious understanding.

Implications for Instruction

Vygotsky's theory clearly supports a mediated, collaborative classroom environment. He asserted that every function in cultural development appears twice "...first on a social, and later on the psychological level; first between people as a interpsychological category, and then inside [the learner] as an intrapsychological category" (Vygotsky, 1978, p. 128). According to John-Steiner and Soubermàn (afterward in Vygotsky, 1978) teaching represents "...the socially elaborated contents of human knowledge and the cognitive strategies necessary for their internalization" (p. 131). In the socio-cultural context, instruction should be configured not so "...that the student is educated, but that the student educates himself" (Vygotsky, 1997, p. 48) through the social negotiation of meaning.

Socio-cultural learning environments stand in contrast to traditional classrooms that historically have made little use of socially shared tasks (e.g., Cuban, 1984; Ferraro, Rogers, & Geisler, 1995; Wilson, Teslow, & Taylor, 1993). Learning environments consonant with Vygotsky's theories facilitate collaborative student engagement in: (a) the active process of sense-making through meaning negotiation; (b) the use of shared signs (i.e., speech) and symbols (i.e., objects of meaning representation) as cognitive tools for concept development; and (c) multidisciplinary approaches to learning that reflect the learners' social, cultural, and historical context.

As an instructional tool, computer-mediated-communications (CMC) have the potential to support the learning outcomes, orientation of instruction, and underlying pedagogical beliefs espoused by Vygotsky. Jonassen (1996) classified CMC as a knowledge representation tool that may engage learners in critical thinking activities. He contended that CMC has the potential to involve students in active learning that is built on cumulative (i.e., prior) knowledge, and supports integrative, reflective, goal-directed and intentional learning. Current technologies, particularly functions of computer networking, provide a mechanism for developing collaborative environments that transcend the constraints of time and place, thus increasing students' opportunity for socially supported engagement (Laffey, Tupper, Musser, & Wedman, 1998; Reeves & Reeves, 1997; Riel, 1996; Romiszowski, 1997).

Computer Supported Collaborative Learning Space Environments

Computer -mediated communications (CMC) is a general term used to define any form of organized interaction between individuals or groups of individuals that facilitates and/or mediates communication utilizing computers or computer networks as the medium of communication (Hawisher, 1995; Kahn, 1997; Jonassen, 1996). CMC includes both *synchronous* and *asynchronous* communications. Synchronous communications are those that take place when two or more individuals communicate simultaneously over a network (real time), while asynchronous communications are those that do not require concurrent communication (delayed).

CMC is a medium that can be used to more closely link collaborative classroom experiences with formal instruction to create a highly student-centered learning environment (Jonassen ,1997; Riel 1996). Results from studies suggest that teachers in a traditional classroom contribute up to 80% of the total in-class verbal interaction, whereas the total verbal contribution of teachers using CMC conferencing techniques is between 10-15% (Reil & Harisim, 1994). Curtis and Reynolds (1997) found that CMC-based interchanges resulted in more frequent exchanges between students and Scott (1993) demonstrated that students working within groups via CMC participated more evenly, and accomplished more task objectives than students not using CMC. CMC mediated environments often decrease the students' inhibitions to participate, while increasing student opportunity for reflection and knowledge accommodation (Romiszowski, 1997). This medium also offers a high degree of learner control, a wide range of environmental flexibility, and global connective capablities (Kahn , 1997; Relan, & Gillani, 1997) that support both formal and informal learning environments at various interactivity levels (Hiltz, 1994; McLellan, 1997).

Groupware

Groupware is any type of software designed for group work or group communication. Organizational and educational trends toward increased teamwork along with the availability of networked computing has stimulated the development of computer supported collaborative workspaces (CSCW) as a means of supporting tasks carried out by participants who are physically or temporally removed from one another (Brinck, 1998; ter Hofte, 1998). Ter Hofte (1998) used the term "working apart together" to describe the essential nature and function of groupware systems. The types of groupware that may prove beneficial to preservice mathematics learning include: (a) computer conferencing systems; (b) chat systems; (c) workflow management systems; (d) shared whiteboards; and (e) coauthoring systems.

Computer conferencing systems (also known as bulletin boards) can be regarded as a variation of electronic mail (e-mail) systems. E-mail systems support interpersonal communication by sending computer mediated messages to one or more persons, while computer conferencing systems facilitate the transference of messages to a uniquely identified address or location on the Internet (URL) that is devoted to discussion about a particular topic. Conference areas allow individuals to post and to retrieve information just like they might do on a physical bulletin board. Early conferencing systems supported only textual messages, but more current systems support the posting of other types of documents, such as word processor documents, spreadsheets, graphics, etc.

Chat systems provide synchronous text-based computer-mediated discussions between and among users. Discussions take place through rapid turn-taking entries by the participants. These systems provide "live" interpersonal communication for an arbitrary number of users who are connected via personal computers.

Workflow management systems have embedded workflow cooperative tasks models that coordinate actions by users by prompting the appropriate contributions at the right time by the right users. These systems can also track the progress of the workflow, provide relevant information required for particular actions, and block information entries that contradict the model.

Shared whiteboard systems are designed to support text, drawings, and sketches that are often shared at formal and informal meetings to point out particular items, clarify relations, or illustrate complex materials. Objects drawn in the shared workspace are immediately visible for all other users. These systems allow all participants to simultaneously refer to such illustrations, propose modifications by altering the drawing, or add textual comments. Entries can be saved and distributed.

Co-authoring systems are designed to support multiple users in creating a collaborative document. Classes of co-authoring systems support diverse phases of the writing process such as brainstorming, researching, planning, writing, reviewing, editing, and revising. These systems facilitate communication between authors and assist the coordination of the authoring process.

Conclusions

There is a documented need for mathematics reform in preservice teacher education. A long history of research suggests that preservice mathematics methods courses must play a dual role of delivering content in the form of reeducating students in basic mathematical concepts, and instructing students in pedagogy that supports concept development. Vygotsky's theory appears to offer guidance for structuring a learning environment that facilitates conceptual learning and promotes sound methodological strategies.

Among the roadblocks that may hinder change in preservice mathematics reform are internal institutional issues such as curriculum reform and time limitations imposed by course instructional hours, scheduling conflicts, required field work, and the length of school terms. Applying Vygotsky's theories to the application of computer-mediated collaborative workspace may help ameliorate problems associated with these issues. Computer supported collaborative work-spaces have the potential to add dimension to an existing course by extending facilitated collaboration beyond the limited classroom hours. The combination of synchronous and asynchronous communication options opens the possibility for student engagement in collaborative enterprises that otherwise may have been impossible because of distance and scheduling conflicts.

Networked technology and various categories of groupware systems offer a new spectrum of tools that, with proper implementation, may prove useful in preservice mathematics experiences. The inherent communicative nature of these tools is compatible with the underlying tenets of both Vygotsky's theories and the goals of the content/methods curriculum. As a tool, computer supported collaborative workspace has the potential to incorporate the extended boundaries of the student's social and educational milieu, thus providing an environment conducive to the application and generalization of knowledge.

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Implementing Technology in Secondary Science and Mathematics Classrooms: A Perspective on Change

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Abstract: The purpose of this paper is to examine and describe the change process as technology is implemented in secondary science and mathematics classrooms. This paper synthesizes the results from two studies, a qualitative study on implementation concerns of secondary science teachers resulting from the use telecommunications (Slough, 1998) and a quantitative study on technology implementation concerns of middle and secondary mathematics teachers and potential teachers of first-year algebra in North Carolina (Chamblee, 1996). The Concerns Based Adoption Model (CBAM) provided a theoretical framework for both studies.

This paper synthesizes the findings from two studies, a qualitative study on implementation concerns of secondary science teachers resulting from the use telecommunications (Slough, 1998) and a quantitative study on technology implementation concerns of middle and secondary mathematics teachers and potential teachers of first-year algebra in North Carolina (Chamblee, 1996). Both studies used a Concerns-Based Adoption Model approach to frame data collection and analysis. Commonalties and differences from separate content areas—math and science—and separate methodologies—qualitative and quantitative, were analyzed in an effort to triangulate data and findings. From this approach, commonalties that exist across content and methodologies are strengthened and differences that exist point to possible content specific idocentricities or need for additional corroboration. Thus, by comparing and contrasting the findings from the two studies, a more complete picture on implementation concerns for math and science teachers with respect to technology emerges, including a more holistic picture of the technology-based change process.

Theoretical Framework

The implementation of technology will require change in the classroom. One model that has been utilized to inform the decision-making process when innovations are introduced is the Concerns-Based Adoption Model (CBAM). CBAM states that successful implementation of an innovation is a process not an event (Hall & Hord, 1987; Fullan, 1991; Friel & Gann, 1993), developmental in nature (Hall & Hord, 1987), and a highly personal experience for each teacher (Hall & Hord, 1987). Thus, for any change to be successful the concerns of each individual teacher must be considered as important and their individual needs must be met.

Hall, George & Rutherford (1986) define concerns as the feelings, thoughts, and reactions that individuals have about an innovation or a new program that touches their lives. To measure these concerns, Hall, Wallace & Dossett (1973) developed the Stages of Concern Questionnaire (SoCQ). Initial research on the instrument construction verified the existence of seven stages in the concerns process: awareness, informational, personal, management, collaboration, and refocusing, with internal reliability for individual scales ranging from $r=0.64$ to $r=0.83$ (Hall, George & Rutherford, 1986).

Bailey and Palsha (1992) proposed a modification of the CBAM model to include only five stages: awareness, personal, management, impact, and collaboration. The awareness stage is characterized by teachers having little knowledge about the innovation but interested in learning more about it. The personal stage is characterized by teachers who are primarily concerned with how the innovation will affect them, with a specific focus on required changes in roles and tasks. The management stage is characterized by teachers who are primarily concerned with time management, organization, and prioritization of responsibilities. The impact stage is characterized by

teachers who focus on the effects of the innovation on learners and how this innovation can be used to change or improve learning. The collaboration stage is characterized by teachers who focus on working with others to implement the innovation as well as sharing information about the innovation with other teachers.

Data Sources

Data for the qualitative study (Slough, 1998) of secondary science teachers' concerns was collected through open-ended ethnographic interviews of twenty-four high school science teachers who had been in an emerging telecommunications-rich environment for at least two and one-half years as of the Fall Semester, 1997. The Bailey and Palsha (1992) five stage model was utilized to frame the analysis. The emerging telecommunications-rich environment was defined as including a district-wide infrastructure that had been in place for two and one-half years that included 24 network connections in each classroom, full Internet access from the network, four computers per classroom (teachers were required to attend training before receiving), and a variety of mandated and optional professional development opportunities within and outside the district. The teachers were from a single, large, suburban school district with five high schools. Teachers in the study were well distributed across each of the five high schools, across typical high school science courses, across all levels of educational attainment, and included fairly new to veteran teachers. Research questions focused on teacher and students' use of telecommunications, barriers and supporting conditions to telecommunications implementation, and the effect of telecommunications on the teaching and learning of science.

Data for the quantitative study (Chamblee, 1996) on first-year algebra teachers' concerns was collected using the Stages of Concern Questionnaire (SoCQ) by Hall, Wallace & Dossett (1973). A total of 132 middle and secondary mathematics faculties from 72 North Carolina school districts were mailed the Stages of Concern Questionnaire (SoCQ) and a teacher demographic data questionnaire during March, 1995. The SoCQ is a 35 item Likert-scale instrument that contains seven levels of responses. The teacher demographic data questionnaire consisted of 19 questions designed to obtain information in three areas: (1) standard demographic data such as age, gender, degree, years of experience, (2) teachers' school experiences such as current teaching load, and (3) teachers' technological experiences such as computer workshop experience, graphing calculator workshop experience, and in-class technology teaching experience. A total of six hundred and sixty surveys were mailed. Two hundred and sixty-six surveys were returned, with one hundred and fifty-one surveys from current teachers of first-year algebra.

Initially, SoCQ mean stage scores and total concerns score were calculated for each respective subgroup. To determine overall concerns, two analyses were performed. First, mean stage scores were converted to percentile ranks based on the norms presented by Hall, George & Rutherford (1986). Second, a peak stage score analysis was calculated. Peak stage scores are defined as the stage at which an individual has his or her highest percentile rank score on the seven concern stages (Hall, George & Rutherford, 1986). Analysis of variance (ANOVA) was utilized to determine differences for each mean stage score and overall total concern scores. Step-wise regression analysis was utilized to determine possible predictors for each of the seven stage scores and total concerns score.

Results

Results of the qualitative study (Slough, 1998) of secondary science teachers' concerns are summarized in Table 1. The data were analyzed vertically and horizontally; more succinctly, each interview was read in its entirety and then across each individual question. The data were grouped into CBAM stages by specifically looking for particularly enlightening themes, recurring ideas or language, and tacit descriptions of the social culture of the emerging telecommunications-rich high school science classroom. These themes evolved into the unique descriptors found in the summative descriptors.

Summative Five Stages of Concerns Descriptors	
Stage	**Descriptor**
Awareness (n=4)	Little knowledge of telecommunications beyond its existence Unaware of how to use telecommunications Unaware of barriers and supporting conditions for implementation Unaware of the potential for telecommunications to change science teaching and

	learning
Personal (n=6)	Some knowledge of telecommunications, mostly of others' use Some knowledge of the mechanics of telecommunications use Primary concerns dealt with how telecommunications would affect them--their time, their energy, their curriculum Vaguely aware that telecommunications could change science teaching and learning, just not sure of the mechanism
Management (n=6)	Some, if not frequent, personal use of telecommunications Little student use, often restricted Used designated local resources to learn telecommunications Concerns dealt with how telecommunications would affect their system of management over time, students, and curriculum Primary concerns dealt with students access to inappropriate material and support from administration Unaware of the potential of telecommunications to change science teaching and learning, sometimes in open opposition to it
Impact (n=4)	Frequent personal/professional use of telecommunications Required/allowed some student use in and out of class Primary telecommunications learning resource was local teachers and occasionally students Primary concerns involved how telecommunications would impact student learning Aware of potential for telecommunications to change science teaching and leaning and had openly embraced it
Collaboration (n=4)	True inventors with telecommunications Group use of telecommunications Required and independent student use of telecommunications Used students, local resources, and "off-site" professionals as resources Served as resource for local and "off-site" teachers Primary concerns were not with mechanics of telecommunications, but with how to sustain the momentum Aware of the potential of telecommunications to change science teaching and learning and spreading the message to all who will listen Enjoyed the challenge that change brings

Table 1: Summative Five Stages of Concerns Descriptors

Results of the quantitative study (Chamblee, 1996) of secondary mathematics teachers also generally supported the CBAM model. Teachers had their highest concerns at the lowest developmental levels (awareness and information) and their lowest concerns at the higher developmental levels (consequence and collaboration). Several reported teacher characteristics portrayed teachers of first-year algebra as very involved with integrating graphing calculator technology into first-year algebra. First, over 50% of the teachers rated themselves as better than novices at using the graphing calculator. Second, most teachers stated that they have been using graphing calculators in their classrooms for several years. Third, approximately 81% said that they had been exposed to some in-service training. But when teachers' SoCQ concerns profile was compared with the self-reported teacher characteristics, there was a contradiction between self-perceptions and actuality. Teachers considered themselves to be competent users of the graphing calculator. The overall concerns profile analysis generated a non-user profile. Only 52% had progressed beyond the awareness and information concerns stage (considered awareness stage in the Bailey and Palsha Model), which are the lowest developmental implementation stages.

ANOVA results demonstrated that female teachers of first-year algebra had lower overall concerns than male teachers of first-year algebra, which means female teachers were more likely to implement graphing calculators than male teachers. Personal concerns differed according to age. Specifically, teachers in their twenties and forties had lower concerns related to graphing calculator proficiency for the lowest stages. Gender, age, graphing calculator expertise rating and graphing calculator training had a significant relationship to teacher concerns. All significant relationships were at the lower stages, awareness, information, and personal (awareness and personal stages for the Bailey and Palsha Model). No significant characteristics for higher level concerns were found.

Stepwise multiple regression analysis found few predictions of the seven stage scores and total concerns score. At the awareness stage, graphing calculator training, graphing calculator expertise rating, gender and years of teaching experience were significant predictors. At the information stage, graphing calculator expertise rating, number of years using microcomputers in mathematics teaching and years of teaching experience, were significant predictors. For the personal stage, graphing calculator expertise rating was the only significant predictor. For the refocusing stage, graphing calculator access was the only significant predictor. Finally, for total concerns score, only graphing calculator expertise rating was a significant predictor.

Finally, the results of the study indicate that teachers of first-year algebra were beginning to focus more on the universal consequences of graphing calculators in the classroom. Many teachers reported that they are becoming proficient at using graphing calculators on their own and not through in-service. But, in actuality, all of the teachers in this study were still focused on the lowest levels of concern (awareness, information, and personal).

Conclusions

These studies show that: (a) math and science teachers can implement technology if they are given adequate resources, including copious access to the technology and a variety of formal and informal professional development; (b) even with access to the new technology and a variety of formal and informal professional development, most math and science teachers had not progressed to adoption; (c) the Concerns-Based Adoption Model (CBAM) addresses many of the perceived concerns of the teachers; (d) gender, age, and technology experience/expertise were not generally found to be adoption determinants; (e) the non-static nature of technology adds to teacher concerns; (f) teachers can and do decide *not* to implement technology in their classroom; and (g) a new change model that incorporates changing innovations and non-progress to adoption needs to be explored (Slough, 1999).

Science teachers were able to implement telecommunications at the two highest stages. They were able to accomplish this in a relatively short period of time when the combination of available technology, formal, and informal professional development were *all* in place. Of these three, the formal professional development was considered least important to teachers who had begun to successfully implement telecommunications. To a lesser degree, math teachers were able to implement graphing calculators at the highest levels (a smaller percentage of math teachers reached these stages). This is possibly due to the fact that less informal professional development opportunities were present. Regrettably, the majority of math and science teachers had not begun to implement technology after several years. According to the concerns-based approach, this is due to the fact that their individual concerns had not been met. But, both studies identified individuals who had made the decision *not* to adopt. This is significant because, CBAM does not factor in an individual's decision to not adopt.

Although age, gender, and technological proficiency were found to be statistically significant for mathematics teachers when using graphing calculators, the significance was only found at lower stages and were not found to be predictors at higher stages (Chamblee, 1996). In other words, males and females, young and old, and novice and expert alike were able to implement technology in both studies. In fact, Slough (1998) reported that female teachers comprised half of the teachers at the highest stages of adoption and that all of the teachers at the highest stages had taught at least six years. Technological proficiency was over reported by mathematics teachers based upon the CBAM model (Chamblee, 1996) and at least two of the four science teachers at the impact stage were relative newcomers to technology who had found telecommunications to be worth the effort to learn.

In general, the basic assumptions of CBAM were supported by both studies (Chamblee, 1996; Slough, 1998). Teachers at different stages of the implementation of technology did have different concerns; and further, teachers at similar stages of implementations did have similar concerns. Two observed shortcoming of CBAM as a theoretical framework for each study were CBAM assumes a static innovation and all individuals progress to adoption. Technology is not a static innovation. Teachers at all levels reported that one of the difficulties with implementing technology was that it was always changing, in effect constantly creating a new innovation. Also, CBAM assumes a general linear model where teachers go though each successive stage. There are no accommodations for individuals who reject an innovation. Both studies identified individuals who had, or appeared to have, rejected technology and were not progressing to adoption. The need for a change model that addresses the challenge of implementing changing innovations and non-progression to adoption must be explored.

Significant findings found in the study of science teachers (Slough, 1998) not found in the study of math teachers include: (a) administrative support, particularly from the building principal, is perceived by teachers to be a critical factor; (b) safety concerns, particularly related to wires and cables in and around sinks in science labs presents an additional safety concern in science classrooms that may not be present in other classrooms; and (c) loss of precious laboratory space, particularly related to loss of bench top space presents an additional concern in science classrooms that may not be present in other classrooms. Teachers perceived the support by the principal to be a primary concern. Where teachers perceived the principal to be supportive of telecommunications, teachers were more likely to adopt. Where perceived support was lacking, teachers were less likely to adopt. Lack of corroboration in the math teachers and graphing calculators (Chamblee, 1996) is primarily an artifact of methodology. The interview protocol (Slough, 1998) allowed teachers to express concerns about the principal that were not available on the quantitative SoCQ Instrument. But, when fourth and fifth grade mathematics teachers were interviewed about technology implementation concerns using a interview protocol modified from Slough (1998), they did perceive the principal as the primary change agent (Slough & Chamblee, in press)

Bringing telecommunications into the science classroom creates special problems dealing with loss of laboratory space and safety concerns. The science classrooms in this study, and in many other schools, typically had a lecture area and a lab area. Computers were typically placed in the laboratory area. Teachers in this study who were implementing telecommunications had done so at the expense of laboratory space and/or laboratory efficiency. Computers were either taking up permanent bench space or, where computer carts were used, they were constantly being moved for labs to occur. Neither situation is satisfactory in the long-term. Also related are the safety concerns associated with running electric wires in and around sinks and gas jets. If telecommunications are to become integral parts of the science classroom, long-term planning needs to address the potential need for lecture space, laboratory space, and computer space in a safe environment.

Significant findings found in the study of math teachers (Chamblee, 1996) not found in the study of science teachers include: (a) technology training needs to be matched to immediate teacher concerns; (b) some teacher characteristics were effective predictors of teacher concerns level, but only at the lowest stages; and (c) teachers self-rated themselves higher than the SoCQ rated them for graphing calculator expertise. While concerns models differ in the number and description of individual stages, researchers (Hall & Hord, 1987; Bailey & Palsha, 1992; Chamblee, 1996) conclude that technology training needs to be matched to the needs and concerns of individual teachers at appropriate times. Currently, many staff development models lack this feature. Integration of this feature will require more time pre-assessing teacher needs and personalizing instruction. It will also require having more content specific technology experts available in the schools and creating more specialized staff development opportunities with follow-ups throughout the year.

At the present time, much in-service is based on introducing teachers to new classroom innovations only at the awareness level. If studies continue to support the predictive validity of these teacher characteristics and more characteristics can be found that predict awareness concerns then selective screening can be used to place teachers with higher developmental level concerns (consequence and collaboration) in more appropriate in-service programs. For example, teachers who rated their expertise as intermediate vs. those who rated themselves novices differed on three concern stages: awareness, information and personal and overall concerns intensity. This implies that teachers who rated their expertise as intermediate have already began the process of gathering, synthesizing and personalizing the uses of graphing calculators in their everyday classroom instruction. Yet, the finding that these two groups of teachers did not differ at the other levels of concerns needs to be further explored. According to the model, to reach higher developmental levels of concern these teachers should begin to go through a refocusing phase in the near future. These data do not support this premise for these teachers. However, since neither non-users nor expert teachers were included in this analysis, further conclusions regarding any substantial differences in the groups is not possible at this time. The inability of teacher characteristics to predict higher developmental levels of concern (consequence and collaboration) was both discouraging and intriguing. One explanation of this lack of prediction is that as a teacher moves from a non-user (high awareness and information concerns) to an experienced user (high collaboration and consequence concerns) the more internal the innovational adaptation process becomes. Awareness and information about an innovation are externally controlled.

Overall, these studies demonstrate that commonalties and differences do exist between mathematics and science teachers going through the process of adopting technological change in their classrooms. These commonalties

provide opportunities for non-content specific professional development. Differences provide opportunities for content specific professional development. To become an experienced user of an innovation means a teacher has made a conscious and subconscious effort to focus on integrating the innovation into their everyday classroom activities and feels very comfortable with using the innovation as a tool for learning. If this is true then more emphasis has to be placed on being able to define the process teachers go through as they progress along the developmental continuum. Until we are able to do this, professional development opportunities which attempt to focus only on helping teachers meet low level concerns (awareness, personal, and management) are less likely to be successful.

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Tools for the 21st Century Classroom: How Digital Video and the Internet can Engage Learners in Math and Science

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Abstract: In a recent report commissioned by the Milken Exchange through Education Week, Zehr (1999) suggests that although schools have invested billions of dollars on computer hardware, the challenge now facing educators is in selecting appropriate software for use in their curriculum. The concern is that despite an emphasis on technology integration in the classroom, the use of computers fail to promote creativity, problem-solving and life-long learning unless the applications encourage these skills. The purpose of this paper is twofold: 1) to introduce educators to the Motion Media Grapher (MMG), a Web-based software utility designed by the authors of this paper in response to this growing need for effective classroom applications; and, 2) to share with educators the lessons learned when 9-12th grade mathematics students interacted with this utility.

Introduction

In a recent report commissioned by the Milken Exchange through Education Week, Zehr (1999) suggests that although schools have invested billions of dollars on computer hardware, the challenge now facing educators is in selecting appropriate software for use in their curriculum. The concern is that despite an emphasis on technology integration in the classroom, the use of computers fail to promote creativity, problem-solving and life-long learning unless the applications encourage these skills. The purpose of this paper is twofold: 1) to introduce educators to the Motion Media Grapher (MMG), a Web-based software utility designed by the authors of this paper in response to this growing need for effective classroom applications; and, 2) to share with educators the lessons learned when 9-12th grade mathematics students interacted with this utility. Additionally, this paper will show how the MMG can help teachers meet standards currently employed by the National Council for Teachers of Mathematics (NCTM, 1989) and the National Science Education Standards (NSES, 1996).

Based on a year-long research study (Pianfetti, 1998), this paper begins with a detailed description of the MMG and its convergence with mathematics and science standards. The next section presents a discussion of the research conducted on the efficacy of the MMG as a classroom resource. The last section examines three lessons learned emerging from the data. This paper concludes with insight from one mathematics teacher and her perspective on how this software utility could easily be adopted into her existing curriculum.

The Motion Media Grapher (MMG)

The impetus for developing the Motion Media Grapher was a result of observations made by one of the authors in a high school mathematics classroom of students using technology as an integral part of the curriculum. The students were effortlessly using such technologies as TI-82 graphing calculators to solve

algebraic expressions. In most instances, the technology was giving the students correct answers, but the students were failing to ascertain whether or not the answer was reasonable given the context of the problem they were trying to solve. The idea behind the MMG is that three networked-based interconnected components would give students multiple and situated representations of a single concept while they engage in authentic learning activities. Hence, the MMG would encourage the students to think critically about the answers that they were receiving because the answers would be presented to them through three different representations. These three interconnected components are a digital video component, a graph component and a table component. Students have the option of plotting points either by clicking on the graph or the digital video or setting points in the table. The other two perspectives are automatically updated to match the point initially plotted by the student. The digital video component allows the concept to be situated in an actual event and not just an abstract representation. Furthermore, this component contextualized the concept taught by the teacher. For example, in learning about nonlinear functions, such as acceleration, the digital video could be illustrating a car stopping and proceeding through a stop sign. The students could then plot a points directly on the video clip. This way, students see the concept in terms of real world events. The graph component permits the visual display of data and through its connection with the digital video component may help students better interpret what the points on the graph represent in more concrete terms. The numeric representation in the table component with its connection to the other two components may help the students understand what numbers mean and how they are portrayed in actual events. The MMG's emphasis on multiple perspectives reaches students with varying learning abilities and learning strengths while adhering to mathematics and science standards.

The NCTM Standards include among other things: 1) the use of problems representing applied settings to motivate and apply theory; 2) the use of computer utilities to develop conceptual understanding; and, 3) the use of computer-based methods for learning. Decreased attention will be given to word problems, simplification of radical expressions and pencil and paper graphing equations (NCTM, 1989, p. 125-9). Furthermore, the NSE Standards have stated that beyond basic skills and understanding, students in the middle schools should have heightened sense of inquiry that would help them understand the relationship between a concept and its explanation. By so doing, students become better problem solvers and are better able to communicate their reasoning. Students easily interact with the MMG. They may capture their own video, develop problem sets to accompany the video and by making two changes in the "html" source code of the MMG, they become creative and critical thinkers while engaged in authentic learning activities.

Moreover, there is growing concern that in introductory math and science classrooms, teachers have a tendency to oversimplify abstract and complex concepts (Kaput, 1994). This oversimplification may prevent mastery and create difficulty for the transfer of knowledge in advanced level courses (Feltovich, Spiro, & Coulson,1989; Chi, Glaser, & Farr (Eds.), 1988). The challenge becomes finding a way for students to learn knowledge flexibly so that they may situate it into a variety of unique contexts and not simply those in which they were learned (DeGroot, 1978; Lave,1988; Lave & Wenger, 1991). The MMG attempts to bridge all these issues by providing multiple and situated representations of an abstract concept and by permitting hands-on engagement with this network-based learning tool.

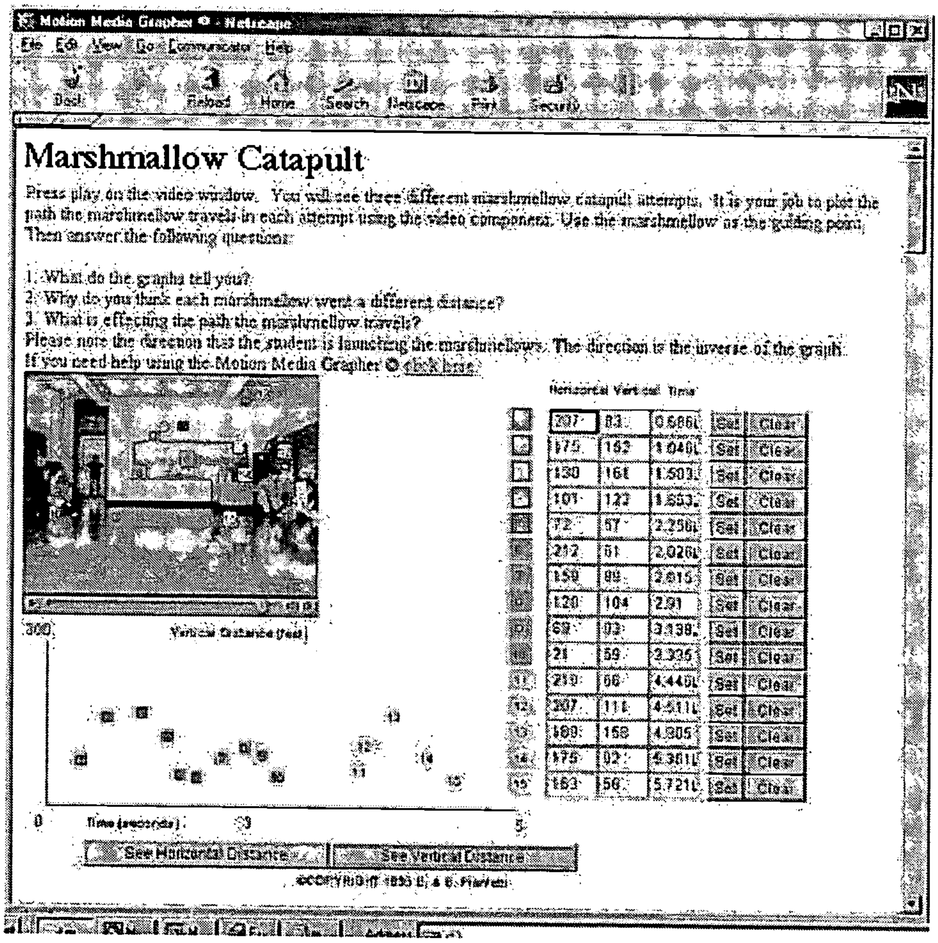

Figure 1: Screen capture of the Motion Media Grapher (MMG)[1]

The Study

This year-long study consisted of three phases. Phase 1: The Developers' Phase involved four high school upperclassmen who were primarily responsible for collecting and digitizing video, creating problem sets and building Web pages. These upperclassmen eventually developed the MathNet Web site that consists of several pages that incorporate the MMG and ask students to solve mathematical problem sets regarding linear and non-linear functions. Phase 2: The Evaluators' Phase involved four teams of high school sophomores who conducted a formative evaluation of the MathNet Web site three times throughout its development. The sophomores' evaluations were subsequently reported back to the upperclassmen and systematic changes were made to the MathNet Web site in response to the evaluators' comments. Phase 3: The End-users' phase involved twelve high school freshmen in an introductory-level algebra class. The freshmen used the MathNet Web site as part of their mathematics class while they were learning about functions. A situated evaluation was employed as the main methodology (Bruce & Rubin, 1994). Additional measures used in the data collection included: 1) audio and videotaped interviews, 2) field notes, 3) an analysis of artifacts such as the Web pages created by the students, 4) an analysis of the

[1] http://www.cyber-joe.com/education/Motion_Media_Grapher.html.

answers given by the freshmen to determine if they were using the multiple representations to answer the problem sets, and 5) pre and post surveys.

There were three core research issues that guided this research study. The questions addressed were built upon these core issues: 1) Technical: How can technology, specifically digital video and the Internet, be used to help students understand and interpret functions in applied settings?; 2) Cognitive: What impact does technology have on the way students learn to understand and to interpret functions in applied settings?; and, 3) Instructional: How can technology, specifically the MathNet Web site that incorporates the MMG, be integrated within a high school mathematics classroom?

Lesson learned from the data collected include: 1) The selection of visuals is important because misleading visuals may obscure the learning. The technology should not transcend the learning; 2) Collaboration is a key factor is the transfer of knowledge. Students can exchange their ideas and discuss concepts in terms that they know and they understand; 3) Digital video is a good tool that permits an abstract concept to appear more concrete in the learner's mind. The use of digital video because it can show a variety of contexts helps students better articulate their understanding. What was learned from this study will be briefly examined in the remainder of this paper[2].

Lessons Learned #1: Learning transcends the technology

The high school senior described in this mini-case study showed significant growth in her understanding of functions as well as in her understanding of how visuals can empower students by authenticating what they are learning. Conversely, she came to understand that the inappropriate selection of visuals could in fact misrepresent the content. She learned that technology should not transcend learning. In her own words,

> I think like we almost have to pump them up with math. You know take it a little away from the focus of 'wow, look at the graph, look at the movie' and say, 'okay so why does this work' ... we [shouldn't] take away from the purpose of the page - learning math.

Katina was working on a problem set that centered on the descent of a fire escape. She wanted the students to determine if the fire escape descended in a linear or non-linear path. In shooting the video, the upperclassmen were limited in where they could position the camera. Consequently, when the video was digitized, Katina realized that in considering the Cartesian plane, the fire escape moved solely within the second quadrant. Hence the corresponding plots on the graph would have negative numbers for the 'x' and the 'y' axes, but a positive slope. Katina believed that this perspective would confuse the freshmen who had only completed one semester of algebra; therefore, she attempted to horizontally flip the video.

> The freshmen students might think that the slope was negative because of the negative 'x' and 'y' values and because visually the students would see the fires escape moving downwards. [The freshmen] may associate the downward movement with negative numbers and forget that a negative divided by a negative number is positive. They might think it had a negative slope.

Katina was considering the larger impact the video might have on the students. Katina did not want to confound the understanding of math by misrepresenting the mathematical concept because of a limitation of the video. Katina knew that the video she collected was misleading. She did not want the visuals to "obscure the math" and subsequently obscure the learning.

Lesson Learned #2: Collaboration is key

[2] This paper is based three in-depth case studies. For more detail on these case studies, contact esecaras@uiuc.edu.

In reviewing the three evaluation phases and tracing the trends of comments that were made, it appears that there was significant growth made over the duration of the evaluation phase. For the first evaluation, these sophomores primarily submitted individual evaluation forms with aesthetic recommendations. By the second and third evaluations, however, the sophomores were more critical in their comments as they considered the overall operation of the Web site and worked together to give comprehensive feedback. As one evaluator stated:

> We were never asked to evaluate something before ... and now when we do [the upperclassmen] listen to us. It's a great feeling. It's forcing me to really think about the math and think about these pages. We're working more as a team because a lot of the uhm ideas we have we can talk about and see if we are on the right track. It's good to work with [our teammates] because I'm learning a lot from them about the math and about Web pages.

Comments such as the one above were echoed in many of the evaluators' comments. Other tangible evidence included the extensive recommendations that they made on their final evaluation forms. For example, one team of evaluators gave illustrated suggestions for how better to layout the three components so that the end users would be able to utilize more efficiently the multiple representations. They wanted the digital video clip to appear in the upper left-hand corner while the graph would cover a larger portion on the bottom of the screen. They included with this illustration a justification for why they wanted the layout changed.

> If you put the video at the top, then you can look at the video and work your way over to the table and the graph. The video is what draws your attention first, but the graph and the table are important, too. And for the graph you need more space to really spread out the [plots].

Lessons learned #3: Digital video as a situating medium

From the data collected, it was apparent that the freshmen end-users had a more concrete understanding of function. They were able to articulate their ideas about functions more directly than before their interaction with the MMG.

> A linear function is where you put something in and get the same thing out. Like when you talk on the phone and someone talks back. ... and like gas, the more miles you go, the more gas you need.

> Or like when you are reading and fall asleep. You're taking your time, then you slow down and then you fall asleep ..

> ... and the line on the graph continues going, but the number of pages your read stay the same.

Although the pre and post survey results indicated that the freshmen still had difficulty understanding functions, dialog exchanges such as the one above suggest that the students are able to transfer the knowledge to familiar events when they are asked to make the association.

Conclusion:

One of the major findings of this study suggests that proper integration of the MMG is instrumental for its functionality as an effective learning tool. Its placement in the curriculum should reflect what the teacher is currently teaching. The teacher in this study considered how it could be used within a mathematics class.

> Oh, now this is interesting. I could definitely see myself using this problem in my class. ... do you remember that worksheet I gave [the class] - the one the students had to draw graphs on different functions based on what they thought the graph would look like?

> Well, they had trouble drawing the graphs ... so now see here with this problem, I could have the students draw the graph and then have a student make a graph using the Web page. Yes, I think that the video would really add to the instruction ... you know, it might not even be a bad idea to have video that represents all the graphs [the students] are asked to draw.

In this teacher's opinion, the strength of the MMG was that the Internet could now be used for more than just browsing or research. Her students could be 'constructors of knowledge'. In terms of engaged learning, they were learning by doing. In addition, this software utility could, with minor adaptations, be used in a variety of classrooms and in a variety of disciplines, including science. Since conducting this research, the MMG has been modified for use in middle school science classrooms.

In essence, the MMG is geared towards the shifts in learning and instruction that are stated in the NCTM and NSE standards. The use of the Internet to support multiple media as a means to present interconnected multiple representations of a single concept is a key feature. The network-based interconnected components encourage the students to see how the different representations of a single event each reflect a perspective of the same underlying concept. Ideally, these different perspectives would foster problem solving and inquiry because the students would have to learn to negotiate the different representations and the meanings of the variables. Moreover, the digital video component offers a concrete representation of a natural event and as such can encourage the use of contextual problems to motivate and apply theory.

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Actions on Objects: A theoretical framework for mathematics education

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Abstract: When one thinks of reasoning, problem solving, communication and connecting related ideas the tool of choice in nearly every discipline is the microcomputer. Furthermore, unlike the traditional calculator, the modern classroom computer has an unparalleled ability to implement both graphical and procedural components of mathematics understanding in a single unified object.

Through creation and utilization of mathematically relevant computer-based objects this dual encapsulation enables the students a unique opportunity to see both the form of representation and their actions utilizing this representation simultaneously. For this reason alone it would be a natural tool for both classroom use and theoretical musings. This paper explores the potential for classroom uses that blend learning theory and practical realities of student actions. It addresses the extent to which the object orientation metaphor, found in the modern windowed operating systems and programs, transfers to the "tools to think with" notions of current action upon objects models of mathematics teaching and learning.

In particular, we will suggest that the object-oriented environments which modern technology has created are ideally suited to parallel and facilitate the ability of students to take a broader variety of action upon objects of a nature and kind hitherto unknown.

Technologically Enhanced Mathematics Learning.

Over the past ten years I have noticed that a major theme that has been emerging in my research and writings has been that of *action upon objects*. This has in turn lead to some foundational questions surrounding the nature of the objects and the types of actions that one might be expected to perform upon them. I have found this framework of actions upon objects to be very powerful in both the laboratory as well as in the predictive power they enable in the minds of the students. I feel that they also capture quite a bit of current interest in the field as evidenced by recent thinking on object reification (Sfard, 1994).

What I am trying to add to the mix is the notion of a firmly developed and articulated way of looking at what these objects might be and in particular how we might utilize them to develop mathematical thinking. In particular, I have developed an approach that results in students developing mathematical thinking regardless of the developmental level and nature of the object. When this method is followed we repeatedly observe markedly similar patterns of thought on the part of the students. This is all the more significant when we consider that this parallelism shows itself in the same type of thinking taking place at each developmental level.

I am taking this opportunity to share some of my notions concerning the action upon objects models I have been using in my university classes and in my own personal thinking. As we will see, my approach toward addressing these questions has been very heavily influenced by readings of and work with Mikhail Bounieav and Sergei Abramovich (Abramovich, 1998; Abramovich, 1995). Together with Mikhail Bounieav, we have been developing a way of thinking about step-by-step development of mental activities as enhanced by technology (Bounieav & Connell, 1999; Connell & Bounieav, 1997). With Sergei Abramovich we have been looking at the nature of the new tools to think with which technology provides (Connell & Abramovich, 1999). The development of this theme includes developing concepts through mental picturing, and the notions I've been developing over the last 20 years or so regarding actions upon objects of various types.

Background examples.

At the elementary level, the objects the children are capable of thinking with (or acting upon) is influenced by both their developmental level and their prior experience. In particular, we find that young children are not able to think with formalized abstracted mathematical objects. This should not be a major surprise, as it has been part of our understandings of human growth and development for some time. This limitation, however, at first glance would appear to limit the degree of mathematics which might be made.

As Whitehead (1978) correctly noted, it is only when one reaches the abstracted levels of mathematical formalism that we can really leverage forward our thinking. It is at that point that the tremendous growth in the intellectual potential of the individual might happen. This has led many to speculate and even to promote the notion that young child is incapable of rigorous mathematical thinking, and in fact that much of what we do that young childhood level is basically preparatory for the real mathematics which they'll be developing later.

Based upon my experiences in the classroom and my own theoretical musings I have taken a very contrary position to this. As I have stated in many different venues the young child is capable of very well developed mathematical thinking if the objects with which they think and questions upon which they think are of an appropriate level and type for their developmental abilities. I will be the first to acknowledge that this is a different type of mathematics content than we often see in more formal mathematics, but the thinking strategies is in direct parallel to that exhibited in the higher levels.

Let us work through a few examples to see how this might play out. For a preschooler working with pattern blocks we can ask questions concerning these blocks that require acting upon these blocks and the use of some quite elaborated thinking. This thinking is to a large degree rooted in the physical actions the child is taking upon the physical object presented to them for their use.

Suppose, for example, the child creates a base pattern composed of a square followed by a triangle and then a parallelogram.

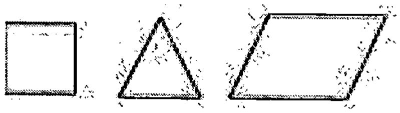

Figure 1: Pattern block base.

The child can easily and correctly predict what would come next from extensions to this pattern based upon this starting sequence as it is continued and repeated. Indeed, for any given starting sequence the children will quickly learn how to extend that pattern and to create their own patterns from bases of their ownchoice.

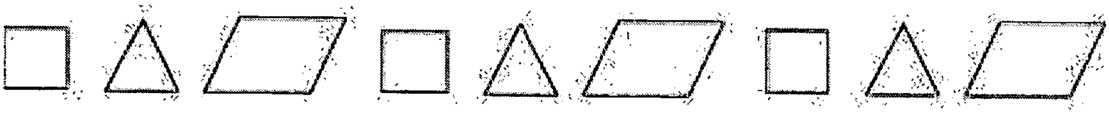

Figure 2: Extended pattern derived from the earlier base.

Now some might suggest that this type of thinking is more replication them prediction. However, we commonly see the same type of thinking occur when we observe algebra students using a guess and check strategy to fill in values in a function like the following:

x	F(x)
1	3
2	6
	9
4	
5	15
6	
7	21
8	
9	27
	30
11	33
⋮	⋮

Table 1: Function illustrating a guess and check solution strategy.

I really believe that we are not just laying a foundation for later mathematical thinking but that we are actually seeing mathematical thinking which is appropriate for the objects which the student is able to think with.

A model for use.

It is clear, however, that if this approach is to be effective that the objects to think with must be developmentally appropriate for the student. For the past 15 years I have been researching and writing about one such model which has proven to be very helpful in identifying the level of objects to think with and some of their properties (Connell, 1998; Connell & Ravlin, 1988; Connell, 1986). Figure 3 serves to illustrate these developmental levels.

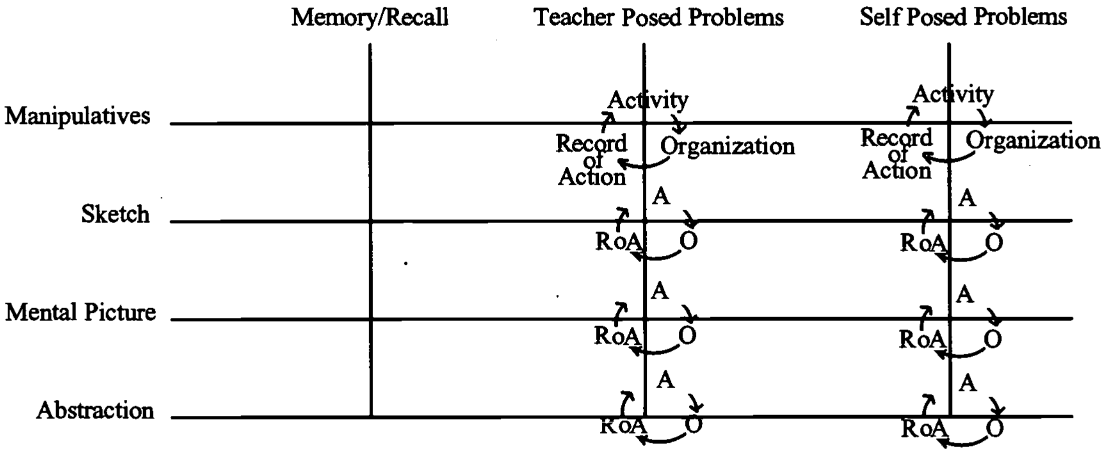

Figure3. Model illustrating the type of *actions* as performed upon the *objects of thought*.

Let me provide a quick general overview of this approach. The instructional goal is to enable gradual student construction of meaning through the use of manipulatives through abstraction via four transitional object types. Within each problem type three types of activities will typically be encountered by the student: 1) memory/recall - often of terminology; 2) teacher posed problems - related toward student

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construction of concepts; and 3) student posed problems - based upon developing understanding of the problem space presented and it's relations to other problem types. These activities will be experienced by the student in the form of related problems requiring the use of the developmentally appropriate object to think with: manipulatives, sketches, mental pictures, and abstractions.

Furthermore, at each location in the model where a student will encounter a problem – either teacher or self-posed – the student will solve this problem via activities which are then organized and recorded for later reference.

An extremely elementary example of this model showing actions upon all of the object types might include initial actions upon a manipulative - such as a pile of counters used to develop elementary addition. A sketch might then be drawn recording the actual counters, which in turn would serve as an object of thought for further construction of meaning. Mental pictures, in addition to serving as a further representation of the problem space, provide natural entry points for technology – which will be utilized in technology-aligned classrooms. Abstraction would occur when it is no longer necessary for the student to use countable counters but is capable of reflecting upon the constructed representations in the construction of new knowledge, a process that Piaget referred to as "reflective abstraction". As we thus expand our earlier notions of action upon object we can see that we are working with a carefully selected set of developmentally appropriate primitive objects[1] and experiences with these objects to build up a working vocabulary and subsequent conceptualization.

What should occur next, regardless of the students' developmental level, would be for a skilled teacher or instructor to pose follow-up problems or questions relating to the newly instantiated and defined object of thought. This would again hold true whether we're talking about a physical ***manipulative object***, a ***sketch object*** of predictive power such as an interactive fractions object, or a ***mental picture object*** such as a comparison of mass based upon remembrances of experience, or a formal and logically ***abstracted object*** such as function or some other mathematical construct. In each case we observe a skilled teacher using newly developed objects as a venue within which questions are to be asked and problem situations explored via student actions upon these very same objects of thought.

Good Thinking is Good Thinking, At Every Level at Which it Occurs

It should also be noted that the nature and form of the thinking and reasoning strategies runs parallel across each of these developmental levels. We can easily observe the young child reasoning with the manipulative objects, communicating their findings with others using the manipulative objects, connecting their most recent experiences with previous experiences with the manipulative objects and using these same manipulative objects in making quality judgments regarding their work. We can likewise easily observe the same strategies being used at each of the other developmental levels of objects within classrooms utilizing this approach.

If the question that has been posed relies upon action upon objects that the child is capable of manipulating and has developed personally meaningful understandings for, then the child is typically successful in their problem solving efforts. This holds true whether the form of the action upon the object is via a physical manipulation, a symbolic manipulation, or a more abstracted application of logical formalisms. It is important to note that I am not suggesting that we are necessarily observing extreme mathematical sophistication. However, what I am arguing for is that it is possible to observe a parallel form of mathematical thinking as students perform their respective actions upon their understood objects at each of these developmental levels. Thus I am quite comfortable making the claim that we can observe quality mathematical thinking at the preschool level as well as at the graduate level.

Furthermore, as we extend this model the children are given the opportunity to develop problems of their own based upon the objects that they recently defined, worked with, and developed problem solving skills and schemata for. This is an important part of the instructional strategy, for without this piece of the puzzle the children will always look to someone else to serve as the source of their problems and as final judge as the answers to the problems they face. This ability, to pose one's own problems and to

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[1] I am using the term *primitive* to refer to a foundational material from which later concepts will be built – not necessarily as referring to simple or unsophisticated. This is in keeping with the use of *primitive* in computer systems. Thus, Dienes $Base_{10}$ blocks might well be considered as an experiential primitive upon which later conceptualizations would be built.

then successfully solve these problems, provides further opportunity for growth in mathematical thinking and problem solving. In this, we also see once again the direct parallelism between each of these developmental stages.

Conclusion

Since their inception in 1989 the NCTM Standards for Curriculum and Evaluation have been changing the face of what constitutes mathematics and how we think about its teaching and learning. Consider the following: Mathematics is communication; Mathematics is reasoning; Mathematics is problem solving; and Mathematics is connections. These statements are drawn directly from the process strands of the 1989 standards document and constituted a major revision as to what counts in mathematical thinking.

These process strands have become the de facto class of acceptable actions that are to be performed in mathematics education. These actions are much different in both form and substance than earlier procedural and content driven actions of the past. And it is in this very difference that we see that it is possible to perform these actions - to reason, problem solve, connect, and communicate mathematically - at every developmental age provided that an appropriate object for this action to act upon is present.

With the addition of the technology enhanced object there is tremendous evening of the playing field in terms of what counts as mathematical thinking. With this addition we can observe that the both the thinking processes and sophistication as shown by students of various ages begins to parallel each other. The technology serves an important role in this process. In particular, the computer can serve as a tool to record the information that has been generated by the students' activities. It can then capture the essence of the activity by allowing the students to organize their work in powerful structures. For example, a table might be built using developed data in a row and column structure, or an organizing graphic might be constructed reflecting the series of activities the children have performed. The technology can then be used to create formal records of action that may be shared or used in later problem solving endeavors. These records of action can even be shared with others outside the immediate sociocultural milieu within which the student is working via the World Wide Web.

The computer, with its object oriented interfaces and tools geared specifically to enable the user to perform specific actions upon specific objects, lends itself perfectly to an action upon object model of learning and instruction. Some of these include Step-by-Step Development of Mental Activities (Galperin & Talizyna, 1979; Leontiev, 1972), Action Reification (Sfard, 1994), and Emergent Structural Theory (Connell, 1996) to name a few. This linkage between suggestions from learning theory and the object classes engendered by the technology is far too priceless to allow going to waste.

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Some Psychological Aspects of Using Information Technologies in Teaching Linear Algebra

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Abstract: Despite the indisputable advantages of using information technologies in teaching mathematics in general and linear algebra in particular certain problems related to technology-oriented education have become quite evident now. The presentation reviews and analyses efficiency and expediency of using information technologies at different stages of teaching linear algebra. Our research is based on the results of the experiment conducted during the last five years in teaching linear algebra with MATLAB and modern calculators. This paper is a follow up of an earlier article "Linear Algebra With MATLAB Package In Preservice Teacher Education" (Bouniaev, 1997).

Introduction. Basics of DMA Theory

Our analysis of using information technologies in teaching linear algebra is based on the theory of stage-by-stage development of mental actions (DMA theory) developed by the Russian school of psychology (Galperin 1960, Leontyev 1975, Talizina 1975) as applied by the author in teaching mathematics (Bouniaev 1991, Bouniaev 1996, Bouniaev &Connell 1996). Without going into a detailed description of this theory we will outline some of its basic concepts that are essential for this paper. We also assume that in a linear algebra course an instructor can use various technologies at different stages of instruction, such as modern calculators and software packages like MATLAB or Derive. So we are not going to specify what software or a calculator should be used in the course of instruction . In most cases this problem of choice may be solved by different means and depends on their availability. According to the DMA theory the major goal of instruction is developing mental actions with objects of the studied field. Finding a solution of a system of linear equations, proving that systems of vectors is linear independent (dependent), reducing matrices to the reduced row echelon form, finding eigenvalues or eigenvectors are examples of the actions to be developed in a college linear algebra course.

Instruction is viewed as organizing and controlling students' activities and hence organizing and controlling the process of development. Thus, instruction efficiency is determined to a great extent by a well developed system of control and management.

Analysis of component operations of any action shows that they perform different functions. A part of performing an action is taken up by some preliminary work, a preparation for an action in a certain sense. This preparatory part is called *orientation part of an action*. The performance itself is called *executive part* of an action. Analysis of an action and experiments carried out in this respect show that there also exists a *control part* which takes place after the executive part, when an individual compares the results achieved

in the executive part of an action with the goals of an action and the draft plan of the execution planned in the orientation part.

As a rule, the performed actions consist of other, more primitive actions and in their turn can be part of other actions. Actions that are part of a given whole, are called operations. That is, operations are also actions; hence the term emphasizes only a hierarchical subordination among actions. The DMA theory specifies four independent characteristics of any action used to determine the level of development of an action. The first characteristic is a *form of action*. An action can be in a materialized (material), speech or mental form. The materialized form of action is connected with manual activities (manipulation, hand-on activities, etc.); objects of action (or their models) are presented in a material form; results of action should be real transformations of these objects or of their models. For example, entering an equation into a graphic calculator could be considered as an action in materialized form.

There is no need to discuss the speech form of an action. It should be noted that according to the DMA, writing belongs to the same form, i.e. the speech form. If we consider an example of solving a system of linear equation then the speech form will mean *articulation* of the performed actions. There is no need for these objects to be present in the material form. For example, in the process of instruction a student may be asked to comment on all the operations of entering an equation into the calculator. The action can be an answer in the form of oral speech or a note in a workbook.

The mental form of action is the highest form of action development. An action in this form is imperceptible for one's associates and its results are recorded in an imperceptible for others form also. This form of action means that its objects are representations, notions and concepts. All operations are performed to oneself. The ability to perform a whole action in the mental form indicates that it has gone through all the stages of development and interiorization.

Structure of the actions to be developed in a linear algebra course

The primary goal of the first linear algebra course is introduction of basic concepts of the subject such as systems of linear equations and their solutions, the concept of a matrix, linear space and linear operator. Activities-oriented learning theories claim that development of concepts takes place through development of actions aimed at the objects that fall under these concepts as well as at the objects that fall under the concepts immediately connected with the developed one.

All actions can be referred to two categories: general logic actions and specific actions. The characteristic general logic action for a linear algebra course is that of recognition. For example recognize if a matrix in the reduced row echelon form is an augmented matrix of the inconsistent system of linear equations. Another example of a general logic action is an action of classification, for of matrices into subclasses of singular and nonsingular matrices. We will demonstrate that developing general actions is crucial in the course of linear algebra study.

Specific actions are basically inherent to a given subject field. For example, in linear algebra they are: reducing a matrix to the reduced row echelon form, matrix multiplication, finding determinant of a given matrix, etc. We will show that in developing basic concepts of linear algebra most specific actions can be performed with the help of technologies.

Let us consider the structural composition of some actions aimed at developing the basic concepts of a linear algebra course. Naturally, if we consider the development of the systems of linear equations concept, then the basic action to be developed is that of finding a solution of systems of linear equations. This action is not homogeneous, it consists of a sequence of certain operations.

Example1 Action of solving a system of linear equations.

- Operation 1. Recognizing the system as a linear system (general logic action).
- Operation 2. Recognizing variables, coefficients, constant terms (general logic action).
- Operation 3. Rewriting the system in the standard form (specific action).
- Operation 4. Finding a method of solution (general logic action).
- Operation 5. Creating a matrix **A** – augmented matrix of the system (specific action).
- Operation 6. Reducing matrix **A** to the reduced row echelon form (specific action).
- Operation 7. Making a conclusion based on the form of rref**A** (general logic action).
- Operation 8. Determining the method of solution that depends on the results of performing operation.
- Operation 9. Solving the system given in the reduced row echelon form.

In developing the concept of vector space an important role belongs to developing such actions as recognizing linear independent (dependent) system of vectors; determining whether this particular vector is a linear combination of vectors of the given system and recognizing the basis of a vector space. Let us consider the operational composition of these actions.

Example2 Action of recognition of linear independent (dependent) system of vectors.

Assume we have a system of vectors $\mathbf{a_1}=(a_{11}, \ldots, a_{1m}),\ldots, \mathbf{a_n}=(a_{n1}, \ldots, a_{nm})$ in m-dimensial eucledian vector space $\mathbf{R}^m$. The problem is to determine whether this system is linear independent or dependent.

- Operation 1. Designing a master plan for solution (general logic action).
- Operation 2. Creating the system of linear equations $x_1\mathbf{a_1}^T+\ldots+x_n\mathbf{a_n}^T = 0$ (specific action)
- Operation 3. Creating the matrix $\mathbf{A} = [\mathbf{a_1}^T \ldots \mathbf{a_n}^T\ \ \mathbf{0}]$ (specific action).
- Operation 4. Reducing the matrix **A** to the reduced row echelon form (specific action).
- Operation 5. Making a conclusion based on the form of rref**A** (general logic action).

Example3 Action of representing a vector as a linear combination of the system of vectors.

Assume we have a system of vectors $\mathbf{a_1}=(a_{11}, \ldots, a_{1m}),\ldots, \mathbf{a_n}=(a_{n1}, \ldots, a_{nm})$ and the vector $\mathbf{b}=(b_1, \ldots, b_m)$ in m-dimensial eucledian vector space $\mathbf{R}^m$. The problem is to determine whether the vector **b** is a linear combination of vectors $\mathbf{a_i}$, i=1…n.

- Operation 1. Designing a master plan for solution (general logic action).
- Operation 2. Creating the system of linear equations $x_1\mathbf{a_1}^T+\ldots+x_n\mathbf{a_n}^T = \mathbf{b}$ (specific action)
- Operation 3. Creating the matrix $\mathbf{A} = [\mathbf{a_1}^T \ldots \mathbf{a_n}^T\ \ \mathbf{b}^T]$ (specific action).
- Operation 4. Reducing the matrix **A** to the reduced row echelon form (specific action).
- Operation 5. Making a conclusion based on the form of rref**A** (general logic action).

Example 4 Action of basis recognition.

Assume we have a system of vectors $\mathbf{a}_1=(a_{11}, \ldots, a_{1m}),\ldots, \mathbf{a}_n=(a_{n1}, \ldots, a_{nm})$ in m-dimensional eucledian vector space $\mathbf{R}^m$. The problem is to determine whether this system is a basis for $\mathbf{R}^m$ or not.

- Operation 1. Designing a master plan for solution (general logic action).
- Operation 2-5 as in example 2.

Then we have to check whether any vector in $\mathbf{R}^m$ is a linear combination of vectors $\mathbf{a}_1,\ldots, \mathbf{a}_n$. It may be done in different ways. Usually we choose the method that assumes the use of technologies, but not symbolic computation systems. So the idea is to check whether the vectors of standard basis $\mathbf{e}_1,\ldots, \mathbf{e}_n$ are linear combinations of vectors $\mathbf{a}_1,\ldots, \mathbf{a}_n$. This problem can be substituted by the problem of determining whether n systems of linear equations are consistent or not. Fortunately all these systems have the same matrices of coefficients, so it makes sense to determine their consistency simultaneously.

- Operation 6. Creating the matrix $\mathbf{A} = [\mathbf{a}_1^T \ldots \mathbf{a}_n^T \mathbf{e}_1^T \ldots \mathbf{e}_n^T]$ (specific action).
- Operation 7. Reducing the matrix **A** to the reduced row echelon form (specific action).
- Operation 8. Making a conclusion based on the form of rref**A** (general logic action).

From the point of view of our analysis it is instructive to compare the operational composition of the action of the previous example with the action of finding a matrix that is inverse to the given one.

Example 5 Action of finding matrix inverse .

Assume we have matrix $\mathbf{A}== [\mathbf{a}_1^T \ldots \mathbf{a}_n^T]$. The problem is to find its inverse.

- Operation 1. Designing a master plan for solution (general logic action).
- Operation 2. Creating the matrix $\mathbf{A} = [\mathbf{a}_1^T \ldots \mathbf{a}_n^T \mathbf{e}_1^T \ldots \mathbf{e}_n^T]$ (specific action).
- Operation 3. Reducing the matrix **A** to the reduced row echelon form (specific action).
- Operation 8. Making a conclusion based on the form of rref**A** (general logic action).

Developing Actions In A Linear Algebra Course

Comparison of the operational composition of actions of the above examples shows that actually the only "transformational" operation in all of these actions is that of reduction of the matrix to the reduced row echelon form. Analyzing the actions to be developed in a linear algebra course one may come to the conclusion that the majority of actions to be mastered by students in this course can be presented as a sequence of three absolutely identical operations. The first operation is construction of a certain matrix, second – reducing this matrix to the reduced row echelon form, the third is interpretation of results, i.e. comparison of the original matrix with the one in the reduced row echelon form.

It is easy to see that the above problems require practically identical treatment not due to the limited number of concepts we operate with in linear algebra but because these operations form only the executive part of action. The executive part of action in many linear algebra problems comes down to construction of a matrix and its reduction to the reduced row echelon form.

In real life situation (not in class) that require performing any of the above described actions it would be natural to perform explicitly only the executive part of the action. An engineer or a mathematician would enter the matrix into the computer or the calculator and then push the button controlling "rref" command irrespective of the fact whether one is looking for the solution of the system of linear equations or proving that system of vectors is linearly independent. The situation is completely different in class since all students actions are not aimed necessarily at getting the right answer for the given problem but more at acquiring skills to solve problems of this category.

In the course of the experiment while studying the linear independence and the concept of basis in the experimental group we allowed the students to start the solution of problems right from the executive part of the action. Thus, for example, in developing the action of recognizing the linear independent system (example2) students were not required to start with the system of linear equations but with operations 2 –3 (entering the matrix in a computer or a calculator and finding its reduced row echelon form). In the control group the students were required to start with the system of linear equations and write down an explanation how this system is related to the problem in question. Thus the experimental group in the course of study was able to solve almost twice as many problems as the control group but 60% of the students experienced considerable difficulities substantiating their actions, and they also provided substantiation that could be related to a different class of problems. They could not extend the same idea to a similar class of problems.

While determining the fact that given vectors generate the entire space (example 4) the students of the experimental group were allowed to perform all operations (except 6 and 7) mentally. The students in the control group were required to write down all operations with detailed substitution. The day before we discussed these topics we found an excuse to remind the students how to find an inverse matrix, i.e. actually reviewed the operational composition of the action of example 5.

Proceeding from the assumption that the executive operations of example 4 (operations 6 and 7) and example 5 (operations 2 and 3) are absolutely identical the students from the experimental group came to the independent conclusion that actions of examples 4 and 5 are based on the same idea (which is a misconception). All the attempts to provoke students in the control group to come to the same conclusion failed. The control group students were fully aware of the fact that despite the superficial similarity of the execution parts of these actions their orientation parts are absolutely different and thus these actions cannot be similar.

According to the DMA theory, besides the form any action has another three independent characteristics:

- *degree of generalization;*
- *degree of completeness;*
- *degree of assimilation.*

Generalization of an action means the ability to determine and discriminate essential for performing an action properties as well as the ability to apply them to objects of different nature . For example, if the action of solving systems of equations is developed at a high enough level of generalization the student does not find it difficult to progress from solving the system of three equations with three unknowns to solving any system. It also does not matter how the unknowns are designated. The degree of completeness indicates whether all the operations that were to be performed in the process of performing an action have been actually completed. If the action is already developed, then the subject of the action (the student who performs it) practically does not discriminate operations from each other, i.e.

the action takes place in the compressed form. If we assume that the previous learning was successful, then failure to perform an action (without any time limits) often indicates that a student can not present the action in operation-by-operation form when all the operations are present and are clearly identifiable. This indicates that performance of the action is not completed. The ability of the student to perform an action in the operation-by-operation mode giving justification for their performance shows that the action was developed at the sufficient degree of completeness.

Going back to discussing different approaches to organizing the learning process in the experimental and control groups we can come to the conclusion that in the experimental group the development of actions did not reach the required level of completeness which in its turn affected negatively the degree of generalization of the developed action. On the other hand, the degree of assimilation was higher in the experimental group.

In the experimental group we had to spend additional time to develop the actions at the required level of generalization. For this purpose we created a class of exercises that we called inverse problems. The students were given only the executive part of the action of the problem to be solved. The task was to restore the full operational composition of the action.

This experiment as well as other experiments conducted in the course of teaching linear algebra with information technologies demonstrated that each part of the action should be singled out and developed separately. In the process of instruction the executive part of an action should be performed by a computer or a calculator.

The executive part usually is a specific action for the subject. The orientation part as a rule is a general logic action aimed at the objects of the studied field. The orientation part of an action includes intermediate goals, reducing a problem to the already familiar ones, selection of definitions and theorems related to the performed actions.Thus in the above examples the problem is reduced to determining the consistency of the sysem of linear equations. The expediency of this problem substitution is determined by the corresponding definitions and theorems.

In developing any new action in the course of linear algebra its orientation part should go through all the forms of development starting at least with written speech. For the above discussed examples 2-4 it means that at the initial stage of development a plan of action should be written down as well as all necessary theorems and definitions on which this plan is based. The system of linear equations should be presented in a written form. Only after completing all these actions a student can use a computer or a calculator to perform the corresponding operations. Thus major problems in teaching linear algebra arise not in developing specific actions of the course but in developing general logic actions aimed at the objects of the studied field.

The DMA theory presupposes *five stages in organization of instruction*. At the first stage the instructor presents new material. Taking into account a relatively abstract nature of the linear algebra course it is expedient in presenting a new material to illustrate it with practical problems and to create computer models of these problems. Thus in teaching the theme Least Squares Solutions it is worth starting with the discussion of linear regression and demonstration of vivid programs modeling linear regression. In teaching the projections it is hard to overestimate the value of visually enhanced programs illustrating the geometry of the performed actions. At the second stage the actions are developed in the materialized form. At this stage of instruction it is expedient to organize the work with blocks of texts and illustrations and move these blocks to different parts of the screen.

The third stage is development of actions in the external speech form. At this stage it is important for students to articulate their thoughts out loud and write down necessary comments. As experience showed at this stage traditional pencil and paper are hard to substitute. Group work is also very useful. Computers can be used for conducting different

experiments requiring discussions with other students. And only the fourth and the fifth stages are developing actions in the form of internal speech and mental form.

In developing every new action the executive part can be delegated to a computer. Thus for example in developing an action of reducing matrix to the reduced row echelon form it is expedient to use programs like MATLAB m-file "RREF", providing executions of elementary row operations at students instructions. At further stages of instruction it is expedient to delegate this action fully to a computer or calculator. In finding eigenvectors and eigenvalues computers can solve the systems of linear equations and characteristic equations. At the same time development of the orientation part of this action should go through all the stages and forms.

Conclusion

In the course of study of linear algebra it is expedient to carry out the structural analysis of every new action to be developed. It is preferable to present the orientation part with all the necessary operations to be performed and to develop it going through all the stages starting with the material form of an action. The executive part of an operation can be given over to computers or calculators. At further stages the orientation part can become an operation of the executive part of an action and be performed by a computer. It is worth pointing out that in developing the orientation part of an action the use of computers can be highly efficient in creating visual models and a bank of basic concepts, definitions and theorems.

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Factors Related to Teacher Use of Technology in Secondary Geometry Instruction

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Abstract: This survey sought to identify variables related to teacher use of technology in secondary level geometry classrooms in southeastern Idaho. The primary variables examined in the study were teacher technology awareness, teacher attitude toward technology, teacher technology training, and teacher computer use for instruction. This study also tested for associations between these primary variables and principal attitude toward technology and a selected group of demographic variables: geometry teaching experience, number of sections of geometry taught, college mathematics major, and computer lab access. Four significant relationships were found. An inverse relationship was found between teacher computer use and the number of geometry sections taught. Direct relationships were found between teacher attitude and both teacher technology awareness and principal attitude. Finally, a direct relationship between type of teacher training and teacher instructional computer use was reported.

Introduction

The use of technology in education, especially mathematics instruction, has been recommended on multiple occasions by the National Council of Teachers of Mathematics (NCTM, 1996, 1998). In the state of Idaho, technology use has even been mandated (Watson, 1996). At the secondary level, many articles have recommended the use of computer technologies in geometry classes; however, few studies have been published on the factors which relate to teacher use of technology within geometry classrooms.

The purpose of this study was to discover relationships of teacher technology awareness, teacher technology training, teacher and principal attitude toward technology, and teacher computer use among secondary, geometry teachers in the southeastern region of the state of Idaho. This study was broken into three groups of research questions. The first set of research questions sought to discover associations between selected demographics variables (experience, number of sections taught, mathematics major, and hardware availability) and the primary variables of teacher technology awareness, teacher technology training, teacher attitude toward technology, and teacher technology use. The second research question examined relationships between the primary variables and principal attitude toward technology use in geometry. Finally, the last three research questions sought to determine associations between the four primary variables of the study.

Methods

Description of the Population

Idaho teachers and principals were considered in this study for several reasons. Since 1994, Idaho has invested heavily in technology for schools (Idaho Council on Technology in Learning, 1998). The State of Idaho has provided, and is still providing, monies earmarked for technology directly to school districts, requiring a plan for integrating technology into instruction from school districts as a condition of receiving that money. In addition, a private foundation has provided large dollar amounts for Idaho schools which incorporate technology into instruction. Finally, the state of Idaho has mandated the appropriate use of technology in instructional settings (Watson, 1996). Therefore, Idaho teachers were considered because Idaho schools have had both the money and the incentive to incorporate technology into the classroom for the last five years. Geometry teachers were examined in this study because dynamic geometry environment software offers

opportunities for students to interact with the constructs of a field which has been described as a hurdle for high school mathematics students (National Research Council, 1989).

Data Collection Techniques

The data were collected via a mail survey instrument. The surveys consisted of both closed and open response items. The surveys were sent in packets to high schools and junior highs in southeast Idaho school districts during the latter part of the school year. Each packet contained a principal survey and teacher surveys for each geometry teacher in the school building.

After allowing several weeks for the return of the instruments, it was noted that some districts had not returned the superintendent permission form for using their districts data as required by the Human Subjects Committee. The superintendents of these districts were contacted again and asked to return a faxed copy of the permission form. The data from those districts were then added to the total data list.

Participants

The study participants were restricted to secondary school geometry teachers and their principals in southeastern Idaho. All junior and senior high schools which offered at least one section of geometry were invited to participate in the study. The principals of each of the selected schools made up the principal section of the sample. If more than one teacher from a given school was in charge of at least one geometry class, then all such teachers from that school were asked to participate in the study.

There were 75 secondary schools from 52 school districts in the three southeastern Idaho regions which fit the criteria for this study. The number of geometry teachers in each school was determined by calling all secondary schools in southeastern Idaho. A representative of each school was asked if geometry was taught in the building and, if so, how many teachers were assigned at least one section. From this initial phone survey, it was found that 75 secondary schools in 52 school districts located in southeastern Idaho offered at least one section of geometry. Each of the school districts was asked to participate in the study. One district refused to participate and two districts closed prior to being contacted. This meant that the potential sample consisted of 136 teachers in 72 schools from 49 districts across southeastern Idaho.

Completed surveys were received from 52 teachers and 33 principals from 26 school districts. This resulted in a return rate of 38% for teachers and 46% for principals. The demographic data obtained from the teachers and the principals are reported in the tables below.

Table 1: Teacher Demographic Data

Description	Responding Teachers	%
Gender		
Male	34	65
Female	18	35
Geometry Teaching Experience		
1 to 5 years	17	33
6 to 15 years	19	37
16 or more years	16	31
Number of Geometry Sections Taught		
1	22	42
2 to 3	26	50
4 or more	3	6
Mathematics Major		
Yes	33	63
No	19	37

Table 2: Principal Demographic Data

Description	Number of Principals	%
Gender		
Male	29	88
Female	4	12

Experience as a Principal		
1 to 5 years	14	42
6 to 15 years	12	36
16 or more years	7	21
Mathematics Teacher Background		
Yes	1	3
No	32	97

Summary of Findings

The research questions for this study were divided into three sections. The first section, of four research questions, examined the relationships between the primary variables listed above and the selected demographic variables. The next research question sought associations between the primary variables and principal attitude toward technology. The final section, comprised of the last three research questions, tested for relationships between each of the different pairs of primary variables. For each of the research questions, the critical alpha value was set equal to .05.

Relationships Between the Primary Variables and Demographic Variables

The first set of research questions sought to discover associations between selected demographic variables (geometry teaching experience, number of geometry sections taught, mathematics major, and hardware availability as measured by computer lab access) and the primary variables of teacher technology awareness, teacher technology training, teacher attitude toward technology, and teacher technology use. Chi-square procedures were used to test for associations. The findings for each of the first four research questions are summarized below.

The first research question examined relationships between teacher technology awareness and the selected demographics variables. For each of the demographic variables, no significant relationship was found.

Research question two tested for relationships between teacher technology training and the selected demographic variables. Once again, no significant relationships were found for the demographic variables.

The third research question looked for associations between teacher attitude toward technology and the selected demographics variables. The results indicated that no significant relationships were found in these tests.

Research question four sought to discover associations between teacher computer use and the selected demographic variables. No relationships were found between computer use and geometry teaching experience, mathematics major, and computer lab access. However, teacher computer use was found to be significantly related to the number of geometry sections taught. The chi-square value for the comparison between number of geometry sections taught and teacher technology use was χ^2=9.776, df=4, p=.044. The strength of the association, as measure by Cramer's V, was V=.31. Examination of the data revealed that the more sections of geometry which a teacher was assigned, the less likely that teacher was to make use of technology in teaching geometry.

Relationships Between the Primary Variables and Principal Attitude

The fifth research question examined relationships between the primary variables and principal attitude toward technology use in geometry. In three cases: teacher technology awareness, teacher technology training, and teacher computer use, no significant associations were found. However, principal attitude toward technology was found to be significantly related to teacher attitude toward technology. The chi-square test for the comparison between principal attitude towards technology use and teacher attitude towards technology use was statistically significant, χ^2=6.297, df=1, p=.012. The strength of the association was measured using Cramer's Φ as Φ=.351. It was found that those teachers with high attitudes toward technology use tended to work for principals with high attitudes toward technology use.

Relationships Among the Primary Variables

The last three research questions sought associations among the four primary variables of the study: teacher technology awareness, teacher technology attitude, teacher technology training, and teacher computer use. For these comparisons, correlation statistics were used.

The sixth research question tested for relationships between teacher attitude toward technology and the other three primary variables. No significant relationships were found between teacher attitude and teacher technology training or teacher computer use. However, a significant association was found between teacher attitude and teacher technology awareness. The Pearson product-moment correlation value was $r=.30$. Those teachers with higher awareness of the capabilities of computers tended to have higher attitudes toward technology.

The seventh research question examined relationships between teacher technology awareness and teacher technology training or teacher computer use. The results of this study indicated that teacher technology awareness is significantly associated with neither teacher technology training nor teacher computer use.

The eighth and final research question looked for a relationship between teacher technology training and teacher computer use. The results of this study indicated that there was a significant relationship between these two variables. The Kendall tau value was $\tau=.34$. Those teachers who were trained in the integration of subject specific software into their geometry classes were more likely to make use of technology when teaching geometry.

Conclusions

Relationships Between the Primary Variables and Demographic Variables

Three of the four demographic variables tested in this study showed no significant relationship to the primary variables. From these findings, it may be concluded that years of geometry teaching experience, college mathematics major, and access to a computer lab were not related to teacher technology awareness, technology attitude, technology training, or teacher computer use. This is in keeping with Dupagne & Krendel's (1992) finding that attitude towards computers was independent of personal characteristics.

The fourth demographic variable, number of sections of geometry, was not significantly related to technology awareness, attitude, or training. Therefore, the results of this study lend evidence to the conclusion that no such relationships exist in the general population of secondary geometry teachers.

The only significant finding involving a demographic variable developed in this study was the relationship between the number of sections of geometry which a teacher was assigned and the use of computer technology in the classroom. It is interesting to note, however, that none of the high users taught more than three sections of geometry per day. Further, the majority of those teachers in the medium use group only teach one section of geometry. This may be a result of the large number of small schools in the sample which can only offer one geometry section per year. However, if these results are indicative of a more general population, it may represent a trend of those teachers which have a larger number of geometry classes proving to be less willing to experiment on a new teaching technique. Additionally, it may be that unequal access to computer technology may lead teachers to adopt a least common denominator strategy: if it isn't available for all students, it won't be used by any students. Several teachers specifically mentioned the lack of time as a factor in their decision not to use technology. As one teacher put it, "We don't have time to teach the current curriculum; much less add time with technology." Many of the respondents stated that technology required more time to learn and implement than they had available or were willing to give. This is in agreement with findings from previous studies on both principals (MacNeil & Delafield, 1998) and teachers (Cooper, 1998).

Relationships Between the Primary Variables and Principal Attitude

This study found no significant relationships between principal attitude toward technology and the variables of teacher technology awareness, technology training, and teacher computer use. The lack of a significant relationship between principal attitude and teacher computer use is in contrast to Stegall's (1998) finding that enthusiastic principal leadership was related to high technology use. This discrepancy may be explained by Stegall's definition of enthusiastic leadership. That term encompassed actions as well as attitudes. This study examined only the principals' attitude. In order to effect classroom practice, it may be necessary for the principals to act upon their beliefs about the usefulness of technology. In other words,

principal attitude may be a necessary but not sufficient condition for changing teachers' technology practices.

The interpretation of the significant relationship between teacher and principal attitudes towards the use of technology is straightforward. As the principals' attitudes goes up, so do the teachers' attitudes. These findings are consistent with Drake & Roe's (1994) assertion that the principal should be able to foster change in teacher attitudes. It should be noted, however, the results of this study could also be explained as teachers effecting a change on their principals' attitudes.

An examination of the open response items indicated a potential problem. In both the teacher and the principal samples, approximately one third of the respondents indicated that the amount of use was their primary gauge of appropriate technology use in the classroom. Since Roberts & Stephens (1999) found that merely increasing the amount of time students spend at the computer does not increase achievement in geometry, those who advocate simply more technology access or higher usage levels in secondary geometry classrooms have no current research to support their position.

Relationships Among the Primary Variables

This study found that teacher attitude was not significantly related to technology training or teacher computer use. These findings are in contrast to Okinaka's (1992) results. One possible reason for the difference is that Okinaka surveyed pre-service teachers' interest in taking more computer courses and their intent to use computers after being hired. It may be that inservice teachers have enough demands on their time that their attitude toward technology does not always lead to training on technology and use of technology in the classroom.

The variable of teacher technology awareness was not significantly related to teacher technology training or teacher computer use. This is somewhat in opposition to the conclusions of Okinaka (1992) and Sheingold & Hadley (1990), that awareness is necessary for technology implementation. It may be that mere awareness of the capabilities of technology is insufficient to guarantee technology training or use.

In spite of their non-significant associations with technology training and teacher computer use, teacher attitude toward technology and teacher technology awareness were significantly related to each other. This finding does not contradict Okinaka's (1992) conclusion that teacher attitude toward technology can be positively affected by making teachers aware of the capabilities of technology.

Several papers have recommended additional training for teachers in order to increase their level of technology use (Cooper, 1998; NCTM, 1998; Mathews et al., 1996). Yet none of these studies have shown that technology training and teacher computer use are related. Therefore, the significant association between teacher technology training and classroom technology use found in this study is a step toward justifying the recommendations for teacher technology training.

Recommendations

Recommendations for Future Research

This study found a relationship between teacher and principal attitudes. A portion of the relationship was based on the attitude that appropriate computer use could be described as an amount of time or level of access. Since merely increasing the amount of time spent in geometry class on a computer has been shown to be unrelated to achievement (Roberts & Stephens, 1999), the shared attitude has no supporting evidence. Therefore, it is recommended that one topic for future research should be an investigation of how teacher and principal attitudes towards the use of technology can be changed.

The relationship between type of technology training and teacher computer use also has more room for exploration. This study did not determine any causal relationship between these two variables. If a specific type of training is found to cause a higher level of computer use, that type of training should become standard. Therefore, it is recommended that the relationship between type of technology training and teacher computer use be a topic of future study.

Since the use of technology is both recommended (NCTM, 1998) and mandated (Watson, 1996), the inverse relationship between computer use and the number of sections of geometry taught becomes important. If it is a goal to use technology, the teachers who teach the most students should be using technology. Discovering the reasons behind this lack of technology use by these teachers should also be a topic for future research.

Recommendations for Practice

The results of this study can provide school districts with several recommendations for practice. The inverse relationship between technology use and the number of sections of geometry taught provides one such recommendation. School administrators need to be aware of this relationship and take steps to discover if it holds true in their district. If those administrators should find the inverse relationship among the geometry teachers in their district, an attempt should be made to determine the reasons behind the lack of technology use. At that point, the administration could seek to alter the factors which lead to low technology use among teachers with the most sections of geometry.

The teachers in this study were asked to report on the type of training they have received in the use of geometry specific software. Of the 52 teachers who responded, 25 (48%) indicated that they have received no training in the use of geometry specific software. Another 9 (17%) reported that they had undergone training only in how to use geometry software. Since the use of technology has been both recommended and mandated, another recommendation for school districts is to even out the levels of training received by providing integration training to all geometry teachers.

The results of this study indicate that 26 of 51 (51%) of the respondents indicated that they had low or medium levels of awareness of the capabilities of technology in geometry classrooms. It is recommended that school districts make an effort to assure that their teachers are kept up to date with the latest products available in their field. Since it is not possible to use technology that the teacher is unaware of, this will remove a potential impediment to technology use.

Finally, this study offers recommendations for current practice in teacher education. Schools of education should provide opportunities for pre-service teachers to become aware of the capabilities of technology in the teaching of geometry. Pre-service teachers should also be trained in the integration of technology into their specific subject areas. In this way, colleges of education will assist school districts in accomplishing the previous two recommendations.

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Using WebCT to Deliver a Finite Mathematics Course to Preservice Teachers.

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Abstract: In the spring of 1998 five faculty members at the University of Regina in Saskatchewan, Canada received funding to implement an online version of an introductory mathematics course. This course, Math 101, was designed to meet the needs of students in the elementary education program in the Faculty of Education and to satisfy the "critical thinking" requirement in the Faculty of Arts. This paper chronicles the development of Math 101 Online from the initial conception through the first full offering of the course in the Fall of 1999. It includes an overview of the tools that are available in WebCT. Strengths and weaknesses of WebCT are addressed from the course developer, instructor and student points of view. The paper also addresses the difficulties in online communication with students when such communication involves diagrams and mathematical notation.

Introduction

Math 101 is an introduction to finite mathematics which is delivered through a standard lecture format to 500-600 students per year on campus, and through regional and community colleges at various locations in Saskatchewan. The content contains arithmetic and numeration systems; problem solving; number theory; rationals, irrationals, ratios and percent; sets; and logic. In the spring of 1998 funding to implement an online version of Math 101 became available from the provincial government which has a desire to expand the number of university level courses that are accessible to learners in remote communities. Our motivation was to use this opportunity to tailor the course more closely to the needs of Saskatchewan learners and to improve accessibility for students who, for whatever reason, find it difficult to attend lectures. The proposal was made by five faculty members, four in the Department of Mathematics and Statistics and one from Mathematics Education.

Once the approval for funding was received a variety of possible software platforms were considered and a decision was made to use WebCT, a collection of course tools created by academics at the University of British Columbia. A number of factors influenced this decision. Software features that were required for delivery of the course were used to narrow the range of possible platforms and then versatility of the tools available and cost were the final determining factors. An added bonus was that WebCT was being used at the University of Regina to deliver a non-credit course in genealogy and thus there were people on campus with experience using the software. In the intervening eighteen months WebCT has been used to deliver and supplement other courses at the University of Regina (Maeers, SITE 2000).

Content Creation and Organization

Two undergraduate students were hired in the spring of 1998 to begin collecting, organizing and inputting the content. Both students were familiar with the content of the course and one of them, a geography major,

had experience the previous summer creating web pages. The second student, an elementary education major, had only minimal experience with HTML.

During the summer of 1998 the students took course notes and problem sets from three of the faculty members involved and began to design the course around this material. Each of the six units in the course was assigned to a faculty member who wrote the first draft which was then formatted for web delivery by the students and uploaded to the WebCT server. Each unit went through several iterations as all the participants read, edited and reread the material.

The content was prepared for WebCT delivery using a text editor and most of the HTML coded from scratch. Adobe Photoshop was used to draw the diagrams and MathType for construction of the mathematical symbols. Creating the HTML from scratch is certainly not necessary as any page creation software that produces HTML could be used. The File Manager in WebCT was used to easily move the content pages from the local computer to the server. Collections of files were zipped together, moved to the server as one file and then unzipped. The course material was organized on the server into units and sections using the Path Editor and problem sets were collected into the quiz database.

Pilot, Revisions and Delivery

In the fall of 1998 a pilot section of Math 101 Online was offered to five volunteer students. These students met with the instructor in a laboratory setting, three hours per week for the semester and worked online. The students, for the most part, communicated with the instructor through the Bulletin Board and the Private Mail Tools in WebCT. The scheduling of the class at a particular time and place was to observe the students and identify any problems they might have with the technology as well as allow for the class to be continued in a lecture format should some major problem develop. The class was completed without incident and the students performed well on the common final examination. The students had some constructive criticisms of the course layout and the number of worked examples but there were no serious criticisms of the technology or format of the class.

In the summer of 1999 revisions were made to the course material based on the comments from the students in the pilot section. The page layout was changed to improve the readability. The material was expanded in areas where the students found to be thin, more worked examples and practice questions were added and the quiz database was expanded. Work also began on translation the course into French.

Math 101 was scheduled in an online format for the first time in the fall of 1999. Twelve student registered and subsequently three dropped. Of the nine remaining students four live in Regina where the university is located, four live in other locations in Saskatchewan and one lives out of the province. At the time of writing this paper the students are completing the sixth quiz in the course and the final examination is scheduled in three weeks. The quizzes are written online but the final examination, which is common for all students in all sections, will be written with pen and paper.

WebCT Tools

The tools in WebCT can be roughly categorized into four sets, communication tools, study tools, evaluation tools and management tools. The specific tools used in Math 101 Online are outlined below.

Communication Tools

Bulletin Board
This is the main tool for communication among the students and the instructor. Messages posted to the Bulletin Board are viewable by everyone in the class. Messages are threaded and can be organized into fora by the instructor. The Bulletin Board is hypertext based which allows graphics, mathematical symbols and hypertext links to be included in posted messages.

Private Mail
The Private Mail Tool is used by the students and the instructor for private communications. Private mail between students or between students and the instructor is visible only to the individuals involved. In many instances students asked the instructor questions about the course material using Private Mail Tool. In these situations response were posted to the Bulletin Board without identifying the student. This helped to open up the discussion and show individual students that they are not alone with their difficulties.

Calendar
Important dates were posted on the Calendar, dates of quizzes, the final exam and university holidays when it might take the instructor longer to respond to questions. The instructor can post to the Calendar for everyone to see and the students can post notes to the Calendar which they alone can see.

Chat Room
The Chat Room was made available to the students in the course although the instructor had no plans to use it.

Study Tools

Compile notes for printing
Using this tool a student can collect pages into one file for printing. Since the course is organized into units and sections, with each section being an individual file, this tool make it very convenient for students to print individual sections, collections of sections or whole chapters.

Resume Reading Notes Where You Left Off
This tool, which uses the WebCT Path facility, allows students when they log on to return to the last page they were previously reading.

Glossary
A glossary of important terms used in the course.

Search Content
Students can search the course material for a particular word or phrase.

Evaluation tool

Quiz tool
Quiz problems and solutions are organized in a database. The questions can be multiple choice, matching, short answer, paragraph answer or calculated answer. All except paragraph answer can be graded automatically. In Math 101 the Quiz Tool was used for six quizzes given throughout the semester, one at the end of each unit. Students had a forty-eight hour window in which to write each quiz, but once a student began a quiz there were sixty minutes to complete it. One additional practice quiz was given in the first week to allow students to become familiar with the Quiz Tool. All questions were graded by the instructor. After each quiz was graded the student was able to see the questions, their responses, the correct solutions from the quiz database, their grade and any comments from the instructor.

Student management

The instructor is able to create and delete student accounts and manage the student password file. Students are able to change their own passwords. Grades on quizzes are automatically stored in a spreadsheet-like format which can be used to manipulate grades and compute averages. The instructor is able to view tracking information on each student which shows the distribution of hits on each page and tool in the course. The only time this facility was used in Math 101 was to ensure, in the first few days of the class, that each student was able to successfully log on.

WebCT: Strengths and Weaknesses

WebCT has strengths and weaknesses that need to be considered by anyone considering it as a delivery platform. From the designer's perspective it has a rich array of tools which can be used in a variety of ways to present course material. The course material is created using standard HTML with no special of custom code creation software required. The ability to structure the material using Path Editor was extremely valuable in making Math 101 function as desired. This reliance on standard HTML does however have its drawbacks. A designer can use a WYSIWYG editor to produce the HTML code but in the author's experience there are times when the HTML code has to be edited directly to get the page to perform exactly as desired. Also the fact that the WebCT File Manager is used over the web to manipulate the files means that it is slower than if you could manipulate the files on your own computer. The main means of support for a designer is the WebCT mailing lists, and this support is excellent. Replies to questions posted to the mailing list is very quick and helpful, both from the employees of WebCT and other subscribers to the list.

As the instructor in Math 101 one of the most useful features was the Bulletin Board. Since the Bulletin Board is a hypertext environment it allows the instructor to respond to students' questions using diagrams and mathematical notation when required. This however requires that the instructor have a knowledge of HTML or create the reply using a WYSIWYG editor and upload it to the server. The Private Mail Tool has also proved to be valuable. The instructor found it very helpful that the private correspondence with students in the class stays within the WebCT environment. The course record facility which keeps the grades on quizzes in a spreadsheet-like format was found to be limited and slow since it has to be accessed over the web. It is, however, easy to download the grades from this facility to a spreadsheet on the instructor's local computer.

Each student in the class is being asked to complete a course evaluation form but at the time this paper is being written these forms are unavailable. The students have used the Bulletin Board, the Private Mail Tool, the Quiz Tool and the ability to compile and print the notes but their reaction to these and other tools, and to the course in general is not available at this time.

Concluding Remarks

There are no easy solutions to many of the problems that arise in designing, implementing and teaching an online class. One of the first problems to face is the choice of software. The author has been satisfied with the selection of WebCT despite the weaknesses mentioned. No other course delivery software has been found which contains its versatility and array of tools. The requirement of mathematical notation and diagrams adds an additional level of complexity to a mathematics course. For Math 101 the requirements of mathematical notation are minimal and the use of MathType by the designers and instructor met these requirements. The students however have difficulty with mathematical notation when posting to the Bulletin Board or answering quiz questions. There are also times when a student asks a question that would be easier to articulate if a diagram were possible. The White Board, which is available in WebCT and in other web delivery software, may help to fill this need but its synchronous nature made it unsuitable for Math 101.

On reflection the author has misgivings about the choice of Math 101 as a first attempt in creating an online course. Many of the students who register in Math 101 have a fear of mathematics and would not be expected to enroll in a web based class. The participants, however, have learned from this experience and have produced a version of this existing course that complements the lecture format and expands the options for students wishing to enroll in Math 101.

A version of Math 101 can be seen at http://online.math.uregina.ca/public/math101sampler/. This sampler version of the course contains all the structure of Math 101 and a sample quiz but most of the content has been removed.

Online Conversion of a Technology Based "College Algebra" Course

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Abstract: The aim of this paper is to report on the authors' experience in designing and implementing an online version of a technology (graphing calculator) based "college algebra" course. College algebra is one of several courses mandated by the State of Louisiana as a component of the core curriculum requirements for undergraduate students. This is a course, which many K-12 educators will go on to teach in their classrooms. We identify some of the problems we encountered and the solutions we employed in order to resolve them. In particular, we discuss the unique challenges we faced in communicating mathematics online and utilizing the graphing calculator technology. Finally, we examine the compatibility of the standards advocated by the National Council for Teachers of Mathematics (NCTM) with the online paradigm, and we describe what we believe to be strengths and weaknesses of online learning models for college algebra.

Introduction

"College Algebra", a course offered by every university in the State of Louisiana and by many universities around the country, contains material which should have been covered in the K-12 curriculum completed by many of our incoming students. Nonetheless, few Louisiana students (less than 2%) place out of this course. Thus, it appears that many students are not learning this material before entering college. Eight years ago, the Department of Mathematics at NSU was motivated to "reform" the course. A major component of our reform effort involved making the course technology-based. Namely, graphing calculator technology was heavily integrated into the course.

Several considerations led to the development of an online version of the course. NSU has a large proportion of nontraditional students (i.e. students who work full time and/or commute). For many of these students, the online alternative is not only more convenient, but may also be the only alternative. A second reason is the university's current mission of making it possible for a student to complete an associate degree program completely online by the year 2005; it will be necessary to have this course in place if the university is to achieve its mission. A third consideration for the authors was the compatibility of the course goals and objectives of our reform based college algebra course with the online paradigm. At first, we were cautiously optimistic that we would be able to provide a "reasonable" alternative to the traditional on-ground class for nontraditional students who were sufficiently motivated. As the development of the course progressed, we knew that we could do much better than simply provide a "reasonable" alternative. After only a minimal amount of training, it seemed apparent to us that the principles which guide current reform efforts in undergraduate mathematics education went hand and hand with those which tend to guide the design of online learning models. We began to think that perhaps the online learning environment was more conducive to achieving some of these "reform" goals than the "on-ground" one was.

Section 1: Challenges/Problems Encountered – Some Resolutions and Advice.

In this section we discuss some of the challenges we faced and some methods we used to resolve (or at least attempt to resolve) the problems we encountered. Some informal advice and recommendations are offered.

Training & Non-technical Support

We knew that the project could not even get off the ground without certain preliminary resources, as well as general support from our institution – both departmental and administrative. We needed time to develop the course, new personal computers, and professional training. We obtained these through a grant from our state Board of Regents (with matching support from the university). The grant provided us with course release time, money to take training courses in the design and delivery of online courses from the UCLA Online Extension Program, and new computers. We strongly encourage anyone developing an online course or program to get some training. Only a very short time into our own training process, we were amazed at our initial naiveté and at some of the misconceptions we had held. The online experience is inherently different than the on-ground one, especially when the online mode is asynchronous. Bedore (1997) maintains that online experience and training, as well as content expertise, are necessary prerequisites to a successful online curriculum conversion. This is particularly important for those who are facilitating more interactive learning models. Bedore also recommends having a "champion" in your corner, someone dedicated to the success of your project who will do what it takes to keep development and support for the project on track. In our case, we had this from the dean of our college and our departmental coordinator. Finally, for the purposes of doing justice to your course and preserving your sanity, we recommend against developing an online course for the first time without release time and/or help from a graduate assistant (both would be preferable).

Technical Support.

As concerns technical support, we did run into some problems. Use of the course management system TopClass was mandated by the university; a lack of training in its use, and a lack of support when things went wrong were major stumbling blocks. We strongly recommend that, before jumping in, you find out about the existing technological infrastructure at your institution and the level of technical support you can expect it to deliver. Unreliable or difficult to use technology and poor support services could doom a program to failure and put a permanent dent in your market. Fortunately, NSU has been a Louisiana leader in distance learning. There were many people around for us to talk to during the process of developing our course. We strongly recommend actively seeking the advice and expertise of people who have experience with whatever technology you are using.

Course Management Systems

We found Top Class, the course management software, to be somewhat inflexible (especially in terms of our need for graphical representations). As it turns out, that problem may be resolved as the university is switching to a system called Blackboard (which appears to be more user friendly). For anyone in the position of being able to choose a course management system, we would recommend giving this careful consideration. Learn something about the different alternatives and make an informed choice rather than just choosing one randomly. They really do differ, and it doesn't seem to be the case that the more expensive options are necessarily the better ones.

Accomplishing Learning Objectives & Choosing Technologies

We wanted to accommodate different learning styles, yet at the same time keep it simple. We did not want to burden students with complicated technological demands or overwhelm them with distracting state-of-the-art "bells and whistles." We were especially concerned about the availability and quality of technical support services. We felt there was no reason to use a given technology unless it would clearly support/enhance the learning objectives for the course. We did know that something beyond plain text and "lecture" was needed to convey problem solving techniques and develop problem solving skills. One develops problem solving skills by solving lots of problems. Some mechanism needed to be in place to provide students with an opportunity to attempt problems and get immediate feedback. While we would be available to answer students' questions via email, we did not feel this would be sufficient to provide

students with an appropriate level of guidance and feedback. Initially, we considered requiring students to purchase an interactive CD ROM device (such as Math Systems' *Mathpert Assistant*, Quant Systems' *Adventures in Algebra*, or Academic Systems' *Mediated Learning* software). But we decided against this for two reasons. We wanted to keep student costs at a reasonable level and we discovered that there were already wonderful free resources available on the Internet. In addition to the text and TI-83 graphing calculator which we also require for our on-ground class, we required students to purchase one additional piece of software called Graph Link that allows communication between calculator and computer.

The course was structured as follows: students received weekly assignments that included readings from the text, problems to solve, and discussion question(s) requiring responses in our class "discussion" area. Each assignment was accompanied by a "lesson enhancement." The lesson enhancements were Web pages (written by us) containing summaries of key concepts, examples, suggested interactive activities, and links to interactive tutorials and self-quizzes. Many of the tutorials offered multi-layered dynamic presentations of concepts with visual/graphic explanations, opportunity for experimentation, and self-quizzes with instant grading and feedback. Weekly quizzes were given for credit. (We provided solutions to assigned problems before posting quizzes-for-credit.) Another integral component of the course was the use of both group and individual projects. These provided students with an opportunity to apply the concepts learned in the assignment to "real world" situations (i.e., choosing the best cell phone plan from options offered or predicting market value of property for a given geographic location). Finally, we gave midterm and final examinations (administered online via the TopClass testing feature).

Graphing Calculator Technology

Research has suggested that use of graphing calculators enhances students conceptual understanding of mathematics and tends to foster a more positive attitude toward mathematics in general among both students and faculty (Hubbard, 1998). One of the major issues involves the need to effectively use the graphing calculator within the academic setting and its incorporation in the solution of real-world problems (Testone, 1998). Based upon our own experiences and that of others (Hollar, 1999), students using graphing calculators tend to have a better understanding of functions than those who do not use this technology and, therefore, have a better grasp of the implications in problem solving. The calculator allows students to easily view problems and principles from multiple perspectives, including visual or graphic, numerical, and symbolic, and it allows them to see the relationships between them. It also makes it feasible for students to attack "real world" problems without losing the forest for the trees.

As we mentioned, the graphing calculator is an essential component of our current on-ground course; also our text is intended to be used in conjunction with the graphing calculator. Knowledge of the graphing calculator is assumed in all courses for which "college algebra" is a prerequisite; it was essential that we find a way to incorporate this technology into our online course. That is where the Graph Link software came into play; this software allows the user to send images generated by the calculator to the computer for inclusion in documents. We used this technology to send graphical representations, tables, instructions, etc. to our students and the students were able to send graphs to us. The biggest problem was the way that must be done; check your course management software. Graph Link saves images as .tif files but the software would only accept .gif files; the conversion was time-consuming but not impossible (you need good technical support here to find out exactly what is required). In addition, we created a "Calculator Corner" where students could go for help in using both the Graph Link and their calculator. In some cases they were referred to various sites for assistance; in others, we wrote simple instructions and provided images from the graphing calculator using Graph Link. Other than that, the students used an ordinary keyboard for most of their work, using the same symbol conventions as they do with the graphing calculator. There are nice websites out there that explain "how to type mathematics" on an ordinary keyboard.

Students' Computer Literacy

We did encounter some problems with computer literacy on the part of students. The university does not officially require a computer literacy prerequisite. We strongly encouraged literacy in a course

"disclaimer;" nonetheless, we did end up with some students who had very little or no computer experience. In the future, we would like to see a computer literacy requirement for incoming freshmen.

Other Considerations

We had high hopes about the discussion component of our course. Based on our experience with online learning, we imagined an active and stimulating "virtual classroom" where we as facilitators would ask leading questions, steer the conversation in the appropriate direction and bring about understanding of the key concepts. We have since reconsidered our assessment of the potential value of the class discussion. Many of the learning objectives for our algebra course involve specific "skills" which must be mastered. These are probably best demonstrated through an interactive component that can provide meaningful feedback. We still have hopes that discussion of the class projects can be fruitful. We intend to make the projects our main vehicle for assessing the achievement of learning objectives centering upon "real world" application of mathematical knowledge, critical thinking and communication skills, and building cross-disciplinary knowledge.

Section 2: Compatibility of Online Paradigm with NCTM Standards.

In 1989, the National Council of Teachers of Mathematics (NCTM) published standards for mathematics education. The document provides general guiding principles for mathematics instructional programs and specific standards about mathematical content and processes students should know and use as they progress through school. The chief premise is that the underpinnings of everyday life are increasingly mathematical and technological; students will live in a world where intelligent decisions often require quantitative understandings. Just as the level of mathematics needed for intelligent citizenship has increased dramatically, so too has the level of mathematical thinking and problem solving needed in the workplace. The guiding principles for instructional programs include promotion of the learning of mathematics by *all* students and the use of technology to help students understand mathematics and to prepare them to use mathematics in an increasingly technological world. We believe that the online paradigm is particularly compatible with these basic principles. The abundance of Internet resources and emergence of new technologies are creating opportunities to accommodate a wider variety of learning styles. Concepts can easily be presented from many points of view. Mathematical software, computer algebra systems such as MAPLE, and graphing technology are being integrated ever more seamlessly online.

The Standards are divided into two categories – those which focus on content and those which focus on process. Embedded in the standards we found many of the learning objectives for our college algebra course, as well as other lower level math courses offered here at NSU. One of the content standards includes a recommendation that attention be given to patterns and models so that students acquire the ability to "use mathematical models and analyze change in both real and abstract contexts." Another is that attention be given to data analysis and statistics so that students learn to "pose questions and collect, organize, and represent data to answer those questions," "interpret data using methods of exploratory data analysis," and "develop and evaluate inferences, predictions, and arguments that are based on data." We believe that the combination of graphing calculator technology with Internet resources offers outstanding potential in these content areas. Numerous Internet resources are available for data gathering and experimentation with patterns and models. The TI-83 graphing calculator is particularly well suited for statistics and data analysis. Students can readily test predictions of models by collecting information from the Internet or by running simulations on their calculator.

The process-oriented standards focus on problem solving capabilities, reasoning abilities, communication skills, making connections, and mathematical representation. It is not only recommended that students learn to express mathematical ideas coherently and clearly to others, but also that they extend their mathematical knowledge by considering the thinking and strategies of others. It is also recommended that students develop a repertoire of mathematical representations and learn how to use them to "model and interpret physical, social, and mathematical phenomena." We believe that the process-oriented standards can be met most effectively through interactive discovery-oriented learning models in which the student is

expected to actively assume responsibility for his/her learning process. The capability of the online learning model to accommodate asynchronous interactions allows much greater opportunity for students to learn by drawing on their own experiences and the experiences of others to apply knowledge in a real world context, and to make connections between math and other disciplines. It is worth noting that asynchrony, as well as being a convenience is what makes the high level of interaction possible. Internet resources further facilitate the goal of having students draw on a number of resources to answer questions and solve problems. Internet resources also facilitate multiple representations of phenomenon and the illustration of ideas from different points of view (e.g. graphic, numerical, and symbolic).

It struck us from the beginning that the guiding principles advocated by proponents of online learning models tend to be similar, if not identical, to those which continually pop up in the undergraduate mathematics reform literature. For example, Berge (1996) recommends avoiding lecturing, encouraging group interaction , and intentionally giving students little direction. De-emphasis on lectures, cooperative learning, and student-centered learning are all cornerstones of the current reform efforts and appear to have positive effects on student learning (Reynolds, 1995, Rogers, 1988). Other "reform" goals include emphasis on concepts and the "big picture and de-emphasis of rote memorization (particularly of isolated facts and techniques for which no context is provided.). Research supports the contention that students learning objectives are better achieved when "teachers regularly utilize the computational, graphic, or symbolic capabilities of technological tools to develop mathematical ideas. (Carpenter 1998, Heid 1988, Hiebert & Wearne 1996).

Section 3: Strengths and Weaknesses.

Strengths of an Online Program

Offering college algebra online accommodates both "distance-free" and "time-free learning." The asynchronous element of the program opens educational opportunities for students with varying backgrounds and experiences. Each brings a unique mathematical perspective to the "class" which promotes interest and may provide each with a better understanding of why mathematics is so important. Furthermore, the online environment is especially suited for fostering the development of critical thinking skills as a vehicle for students to apply course content in a "real world" context. Not only does the online discussion encourage students to draw upon their own experiences to tie theory to practice, it also provides an environment conducive to cooperative learning activities. In addition, the lack of time constraints gave students an opportunity to digest the material and relate it to their own experiences.

Conversion of traditional algebra courses to online courses will vary but utilizing grant resources, as we did, can provide some budgetary relief. Naturally, as faculty experience grows and technology changes, these costs can be expected to decline. According to Bedore (1997), curriculum conversion costs should be about $500 per course with setup and technology costs ranging from $0 to $1,000. Complete course development costs would be substantially more (about $2,000).

Weaknesses of an online program

With the need for major modifications to the existing infrastructure, the cost of implementing an online program could be prohibitive. Without the kind of support we had for this project in terms of equipment, release time, and faculty education, this project would have been doomed from the start. In addition, poor promotion of the course could lead to frustration on the part of both faculty and students. We had problems with students who were registered for the course but really had no desire to participate in an online course (their advisors put them in the section because it was the only one open at the time).

Research suggests that the dropout rate for online courses may be higher than that of traditional courses (Sherry, 1996; Starr, 1995). Students taking a college algebra course online (or any other online course) must be sufficiently motivated, self-directed and dedicated to the task. They must understand that they share a somewhat greater responsibility for their learning than might be expected in a traditional class. One

of our main concerns was student interaction; the students were reluctant to "discuss" mathematical concepts with each other for a variety of reasons. The lack of face-to-face contact was a real problem for some; this may have been due, in part, to the novelty of the situation since these students had limited online experiences.

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Issues in developing an on-line mathematics learning series for middle school teachers

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Abstract: Online learning could be an important resource in meeting the need for helping teachers learn more mathematics, which is critical to the success of long-term change in mathematics instruction. We report on a pilot of an online learning series for middle-school mathematics teachers. An existing Web-based professional development center was utilized together with specially designed interactive web pages to structure and support six weekly synchronous meetings. The mathematical content of the series was proportions. The pilot yielded initial success in fostering mathematical discourse among participants and raised issues, technological and other, for the future.

As a decade of reform work in mathematics education—based on the National Council of Teachers of Mathematics' Curriculum Standards (NCTM, 1989)—comes to a close, reformers are looking to technological solutions for the problem of delivering high-quality professional development to teachers nationwide. Subject-matter expertise is of particular importance as recent research (Ball, 1989; Schifter, 1997; Darling-Hammond, 1998; Ma, 1999; Sowder et al, 1996) highlights the mismatch between teachers' knowledge of mathematics and what and how they are expected to teach. Neither simply exploring student activities nor taking traditional college-level mathematics courses will help teachers develop the mathematical practices they need. Reformers are designing new programs focusing on developing content knowledge in support of change. Online learning communities hold promise for providing professional development that is convenient to schedule; can be offered to urban, suburban and rural teachers; can fit in with ongoing reform programs rather than be simply "another inservice." The question of how well subject matter learning can be supported online is an open one.

This fall, we at IRL developed and offered a pilot version of an online seminar for teachers, designed to contribute to this reform work. The pilot, *Brush up on Proportions*, is part of our WebMath online math learning community for middle school teachers, which will expand into a larger program next year. The intended audience includes teachers who are already engaged in implementing a Standards-based math program or are at least using some materials or processes recommended by the Standards. The seminar consisted of six hour-long sessions, offered as a series. Each session was devoted to exploring and deepening teachers' proportional reasoning—a central topic in Standards-based middle school programs—through activities and discussion. Conceptual and procedural knowledge were both emphasized, as well as the relations between them. We also aimed to establish norms of discourse that will encourage teachers to develop mathematical practices such as making conjectures and constructing mathematical explanations.

This paper describes features of our online seminar environment and issues that arose during the pilot.

Features

<u>A suite in TAPPED IN.</u> Rather than build and support our own interactive web infrastructure, we contracted with TAPPED IN to house the virtual classroom in which *Brush up on Proportions* took place. TAPPED IN is a virtual professional development center designed to house activities for teachers throughout their career. The classroom is part of a suite where various middle-school math-related events sponsored by IRL take place. Organized as a campus, with building, suites and offices occupied by tenants who provide professional development services for teachers, TAPPED IN provides an infrastructure with a graphical interface in addition to a text window through which participants can communicate with each other and use objects in the environment. Participants' main venue for participation in class is a text window in which their comments, "emotings" and interactions with objects are seen by others, and they can see what others say and do. Objects and occupants of the classroom appear in a graphics window too. The graphics window gives participants a sense of location through maps, floor plans, and sometimes, a 3/4

view into a room. One room in our suite is portrayed visually as a corner of a classroom with objects on the walls, through which teachers can view the course syllabus, get more information about IRL and access the web pages that form the text for our seminar.

Web pages and other tools. One of our initial questions was how to build a discussion of mathematics in the relatively thin online medium of text exchange. Current math teaching and professional mathematicians' practices include the use of many different materials and representations. In teaching, handouts, texts, manipulatives or other curriculum materials are resources for mathematical thinking and discourse. Also, there is some medium for whole class display of ideas: a white board or overhead projector. The overhead can display pre-made representations or spontaneous ones. The practices of working mathematicians often include discussion centered around a just-in-time scribbled diagram, sketch or equation.

The current TAPPED IN tools that provide similar capabilities are text-only whiteboards, which we determined to be of limited use in displaying mathematical ideas. The whiteboard did begin to serve an agenda structuring purpose, though. In future iterations, we plan to design, with TAPPED IN staff, and use a graphics-capable whiteboard and a special mathematics notation tool. In addition we are looking at inexpensive commercial devices for bringing scribbles to the digital environment. In this first pilot, however, we worked with software and capabilities we had already to create web pages.

We created interactive web pages that play the roles of both manipulatives and textbook in our virtual classroom. These pages are textbook-like in that they structure the course content; they serve as manipulatives in that their interactivity allows users to have experiences on which to base mathematical conjectures. The facilitator, or anyone in the room, may project the pages for all to see and work with. Four of these web pages were used in *Brush up on Proportions*:

- Page one shows the iconic proportional man by Leonardo DaVinci, where a circle is inscribed around his armspan and height and a square is constructed around him in another way. There is no interactivity to this page. Text asks users to consider what is commonly meant by the term "in proportion", using the picture as a springboard for discussion.
- Page two shows a floorplan of a room with some furniture in it. When users type in a scale for the room, the resulting width and length of a rectangular table appear. Text asks users to set the scale so that the floorplan rectangle represents a table that is 130 cm wide.
- Page three presents a more complicated floorplan problem: selecting a table from one scaled diagram to insert in a floorplan with another scale. The ratio between the sides of the table is the first determiner of which table is a good choice.
- Page four shows a proportion form, $\frac{a}{b}=\frac{c}{d}$. In a set of challenges, numbers replace a, b, c and d to make a false proportion and users must change one number to make a true proportion. The proportion form is tied to a picture of two rectangles—a by b and c by d—superimposed on a grid, so users can note how the rectangles compare visually when the proportions are true or not. They are asked to use this experience to help them think about why the cross-multiplication algorithm works. They are encouraged to use other representations or arguments based on arithmetic, too. In other words, they are to explain why if a/b=c/d, then ad=bc, without resorting to algebra.

These experiences are designed to help teachers develop their proportional reasoning and connect it to formal representations. The problems on pages two and three are not difficult for many mathematics teachers to solve; however, we have found that their connection to proportion and the relationship among all the multiplicative relationships in the pictures are not always explicit. For example, one participant said, "we don't need proportions" to solve the problem on page two, indicating that dividing 130 by the width of the rectangle in floorplan units would suffice. This is certainly a correct procedure for solving the problem, based on an intuitive understanding of its underlying multiplicative structure. However, this solution to the problem does not help teachers help students develop their own multiplicative sense. In discussion of the problem together in seminar, we asked ourselves to justify each stage of the answer and to connect the work to the proportion a:b=c:d.

The web pages worked well as a resource for mathematical discussion. Participants actively engaged in trying out solutions in the interactive structure. The discussion was anchored in the particulars of the representation but also led to more general mathematical insights. We will improve the representations based on insights we gained through using them. For example, setting the scale may not be the most helpful interaction to offer in solving the problem presented on page three. We will also build new sequences of web pages that follow other learning trajectories through proportional reasoning: for example, supporting the connection between the proportion form and linear variation.

Objects. The TAPPED IN environment, in true "moo" fashion, includes a number of objects with which users can interact. A few of these have been used as instructional devices. As a simple example of proportionality, we created a virtual pet, Shrinky, who responds to the text command, "shirnk by 50%" by shrinking from 100 to 50 centimeters. This prompted others to display two cows, drawn in the text window in ASCII symbols. The cows then became the topic of discussion: what percent of the first's length was the second? Conjectures were made and the facilitator was able to model mathematical questioning and justifying in a non-threatening way around objects that were displayed with humor.

In the future, we hope to have objects that can accept more flexible commands than "upon text x, print text y." For example, Shrinky Jr. might be able to know her current length and calculate her new length based on the percent she was commanded to shrink. Participants could try to get Shrinky to shirnk from 160 to 25 feet in exactly three shrinks and learn about the concatenation of percents, part of multiplicative and proportional reasoning.

Using research findings. We are building on existing insights into cultivating and growing Web-based communities (Reingold, 1993; Rochelle and Pea, 1999). From this research and reflection, we know, for one thing, that attention must be paid to norm setting. Our facilitators set the tone of discussion in the community and establish mathematical norms. Essential to this tone setting are both providing and requesting mathematical explanations. We have also encouraged a sense of play with the TAPPED IN objects and with light banter in between and throughout the mathematical insights.

The literature also informed us that personalities can be an important factor, and that social events and personal talk help bind people together to do the more content oriented work. In the future, we plan to focus on these aspects of community building: We will encourage participants to create profiles and use pictorial "avatars" when they are online. We will host online social events and encourage "idle chatter" as a way of establishing commonalties. We will utilize TAPPED IN's resources and existing culture to help "enculturate" course participants.

Issues

Mathematical discourse. We aim to help teachers connect their mathematical intuitions with standard forms through discourse. This is a two-way street: teachers can use standard forms such as proportions to construct mathematical explanations of numerical insights they have; they can also use the situation presented in the interactive web pages to help support explanations of their use of the standard forms. In *Brush up*, this meant that we helped teachers connect the proportion form, a:b=c:d, to their own multiplicative reasoning. Figure one shows one of the interactive web pages that sets up a simple scale problem: to set the scale of the floorplan so that the rectangle represents a 130 cm long table. For adults fluent in intuitive proportional reasoning, it is not too difficult to divide the 130 cm by 5 squares of the rectangle's length to get 26 as number to put into the scale. But our participants did not immediately construct explanations for why division was the operation to use and why those two numbers were involved. Through discussion together, we came up with two explanations: that the 130 cm of the real-world length needed to be distributed across the 5 units of length of the rectangle, and that this distribution called for division. We also saw that we could set up the proportion 1 unit:? cm = 5 units:130 cm. The proportion related the scale to the paper and real tables. Building these kinds of multiplicative connections is facilitated by use of the proportion form, a:b=c:d. The result of all this should be more conceptual resources for teachers to draw on as they help students reason about and solve similar problems.

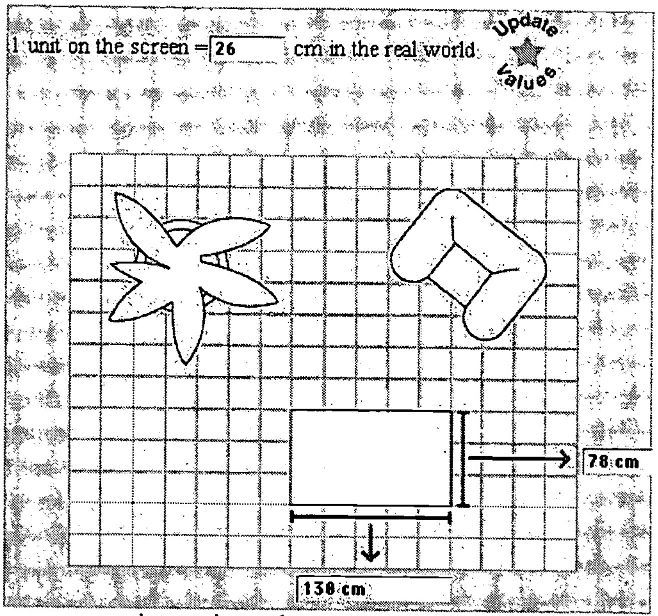

Figure one: an interactive web page to support mathematics learning

Pace of interaction. As compared with a face-to-face discussion in a classroom, the pace of conversation is slow in our online course. One hour was not sufficient time to do an activity, discuss it, and summarize the important mathematics in the activity and discussion. The initial course outline covered the material in three weeks; our just-prior-to launch outline was stretched to six sessions, and we ended up covering about two thirds of the outlined material. This phenomenon is, of course, not restricted to syllabi of online courses, but it is our sense that the problem was exacerbated by the slow rate of conversation online. The next seminar will have ninety-minute sessions. We will also institute two leaders: a facilitator, keeping the discussion flowing and helping everyone participate, and a recorder, keeping track of insights on the white board.

There are some benefits to the slowed pace of idea exchange in the online classroom, however. The pace of the overall discussion leaves room for side conversations to emerge. And obviously, these are not disruptive the way two people whispering to each other in class can be. Two staff members participated in *Brush Up* from computers that were housed side by side. They were able to carry on a face-to-face exchange about a mathematical topic related to that week's seminar: they were trying to informally prove or disprove that "three points determines a circle." Scratch paper and white boards were involved. They made a fair amount of progress while still participating seamlessly in the discussion of Leonardo DaVinci's iconic proportional man.

This interaction and, additionally, phone calls to solve technical problems during the class, has led to the plan to encourage participants to pair off into "buddies", between whom some kind of communication outside but during the seminar is encouraged. Online, phone and face-to face communications are three means for this. The online environment allows participants to whisper to each other: in other words, to type comments that only the two in the exchange can see on their screens. Phone conversations are possible if long-distance phone bills are not a problem and if the Internet connection does not take up the phone line. Alternatively, participants from the same school could participate together from their school's computer lab.

Abandoning linearity. Giving up conventions of linearity that apply to oral conversation seems to be key to becoming adept at online, text-based discussion. In oral conversation, we allow parenthetic remarks, but they have some labeling, and they are limited in scope and frequency (depending on the speakers, of course). Online, two or more conversational topics can become quite interleaved. Online participants develop conventions for marking this, too, if the comments in the same conversation become widely spaced

in the text. For example, a participant might preface her comment with "re table size" if table size had been the topic several lines earlier.

Our preliminary experiences suggest that the non-linearity of online, text-based conversation can allow for greater access to participation. Though new users sometimes say that the moment for their comment was lost so they kept quiet, in fact, they probably could insert their comment way down the line, with a marker, and make a meaningful contribution to the conversation. We will track data on this hypothesis in the next pilot, and we will seed, by example, appropriate markers.

Attracting participants and supporting change. We had no idea how many participants to expect at our first series. We announced the series on our Middle-school Math through Applications Web site and related Web sites visited by teachers and curriculum decision makers. We sent email to teachers with whom we had worked in the past and also announced the series on TAPPED IN's calendar and newsletter. Seven was our highest attendance. Additionally, no one teacher attended all six sessions. These numbers were adequate for our pilot purposes. We didn't want to have a crowd in our initial pilot, where our intention was to try out the new environment and course materials.

Our initial pilot confirmed one of our starting premises: that this online subject-matter learning series needs to be linked to ongoing professional development programs for teachers. We believe that this is important not only for attracting participants, but also for making the experience effective in supporting long-term change. We already have in place connections for the future. Connections can be made through curriculum adoption or through state and district programs. For example, our next seminar series will be offered to 20 teachers who are piloting a unit from a new Standards-based comprehensive math curriculum. They will be teaching a unit focused on scale factors and proportions, and the *Brush up* seminar will directly support their teaching. We have developed interactive web pages that present problems similar to those found in current Standards-based texts. We have also connected with state and district leaders to see how *Brush up* can be of service to their programs.

Divergence vs. convergence. We experienced the tension true of all problem-centered, conceptual-understanding-oriented teaching: constraining the conversation to keep the participants' discussion and insights in the range of the mathematics topics defined in the lesson plan, as opposed to encouraging divergence to capture the range of mathematical insights possible based on a given situation.

For example, one week, the entire session's discussion focused on page one of the "web text", displaying a man with arms stretched and figures circumscribed about it. The depth and breadth of the conversation around this image surpassed our initial planning expectations. The page was designed simply to ground proportion in a familiar image, helping us tease out the meaning in everyday usage. But the discussion went beyond that: Questions were asked and conjectures made about the relationship between the circle and the square. The connection to ratio and proportion was made. Someone raised the question, "What was he trying to tell us with this image?" We agreed upon a relation among the geometric figures and the body parts in the image and, finally, shared insights about the meaning of "proportional" in common usage.

As we plan for balancing convergence and divergence in the next iteration, we are structuring the session so that time is left at the end for the facilitator, and others, to mount a virtual soapbox in order to summarize the mathematical territory covered and make connections that might have otherwise remained implicit.

Technological capacity. We did not want to limit teachers' access to the series with high-tech demands. Yet we wanted to provide a rich online learning experience. This led to tensions. Web pages with text and graphics, like the DaVinci activity, work for any teacher with an Internet connection and a browser. The TAPPED IN environment offered both Java-based and Web-based versions of the classroom. In order to create a more interactive experience, we decided to use JavaScript. JavaScript does not take significantly longer to download than a traditional web page, but requires a Java-enabled browser. This did not seem too limiting since Java-enabled browsers are quite common. In order to support the majority of these browsers, we limited ourselves to JavaScript 1.0, the earliest incarnation of the scripting language.

In this pilot we also required participants to get the Shockwave plug-in and provided a link to acquire it. Java applets will run without a plug-in, but would take longer to download and were more difficult for us to develop. When we combined these different technologies (particularly the Java TAPPED IN window and the Shockwave activities), we found that the browser could run into memory problems. The teachers needed to be able to allocate more memory to their browser if they had enough RAM to do so. This was too difficult for some participants to do while maintaining their role in the discussion.

Conclusion

Online learning environments hold promise for providing professional development opportunities for teachers. Our initial pilot showed that a focus on subject matter, as called for in recent research on teaching, can be accomplished through discourse centered on interactive web displays. Issues of problem-centered instruction are mirrored on line and new issues arise due to text-based pacing. Additionally, online learning programs can be "just another workshop" unless integrated into ongoing professional development programs. Balancing the need for rich representational tools for math learning with low-tech user limitations is a constant challenge.

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Symbolic Computers and Mathematical Objects

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Abstract: Technology is best utilized as a tool for exploring the foundational objects and exploring and varying the underlying nature of the object upon which the abstracted mathematical symbol is constructed. When this is done appropriately it can serve to elicit the formation of selected concepts. This paper will serve to illustrate how the symbolic computer can serve to create psychologically foundational mathematical objects of thought for the learning.

Introduction

The potential inherent in the modern microcomputer to serve as a bridge between and among instructional theories has not been lost upon many researchers in mathematics education and curriculum theory (Brownell & Brownell, 1998; Garofalo, Shockey & Drier, 1998). The computer easily enables a dynamic and active learning environment within which each of the process strands of the National Council of Teachers of Mathematics (NCTM) standards might find a home (NCTM, 1989). After all, when one thinks of reasoning, problem solving, communication and connecting related ideas the tool of choice in nearly every discipline is the microcomputer.

Furthermore, unlike the traditional calculator, the modern classroom computer has an unparalleled ability to implement both graphical and procedural components of mathematics understanding in a single unified object. By their creation and utilization of mathematically relevant computer-based objects this dual encapsulation enables the students a unique opportunity to see both the form of representation and their actions utilizing this representation simultaneously. For this reason alone it would be a natural tool for both classroom use and theoretical musings[1].

This has not been lost upon teachers and despite those who would use the computer solely for the presentation of pre-packaged instructional units, there is a growing consensus that the computer can be an ideal tool for knowledge construction at an individual or group level (Harvey & Charnitski, 1998). As we explore the potential for classroom uses of computer technologies we have a once-in-a-lifetime opportunity to blend the best of learning theory and the practical realities of student actions.

Creating a New Class of Mathematical Object

Let me address for a moment the extent to which the object orientation metaphor, found in the modern windowed operating systems and programs, transfers to the "tools to think with" notions of current action upon objects models of mathematics teaching and learning. In particular, the object-oriented environments which modern technology has created are ideally suited to parallel and facilitate the ability of students to take a broader variety of action upon objects of a nature and kind hitherto unknown. These student controlled actions upon these mathematically powerful and computer enabled objects have the potential for creating classroom environments which both surpass the pale hopes of the integrated learning system and would surprise those wedded to a conservative view of Piagetian developmental levels.

Given the long history of cognitive science of borrowing the most current metaphors from computer science it should come as small surprise to see the applicability of many of the object oriented programming strategies to reflect aspects of human cognition (DuPlessis, 1995). And, indeed this new metaphor plays out very well for the case of mathematics education. The tools supported by the modern computer enable a new class of objects with which to think.

[1] For further background on the importance of what I am calling dual encapsulation Sfard offers a highly informative account of the intertwined roles of process and objects in mathematics (Sfard, 1991).

In order for this to happen, however, we must attempt to leave behind any preconceived notions about the role of the technology as being most useful for information presentation and delivery. A much healthier perspective, at least in terms of understanding this new approach, would be to envision the technology as being used to providing a milieu within which knowledge construction can occur (Connell & Abramovich, 1999). To see what this might entail, let me begin by telling a brief story from a very early research study using the Windows based authoring program ToolBook.

I had created a ToolBook program that I called a "Cognitive Playspace" for children to explore various foundational notions of mathematics. My goal at the time was to examine the extent to which traditional physical manipulatives might be augmented by technology. One activity, in particular, involved the use of various geometric shapes. I had intended these to be analogous to the traditional pattern blocks with which the children were already familiar, but to not be identical to them. In this activity, the children were presented with a variety of the puzzles to solve.

In the puzzle set for this particular day one of the tasks was for the child to reconstruct a pattern made using the provided shapes through manipulation of the geometric forms on the computer's screen. I had developed some fairly simple tools that would enable the geometric shapes to be rotated, translated, and generally moved about the screen.

Of particular interest for the notion of object creation is an event took place when I brought a group of Kindergarten and First-grade students to the University to work with this exploration package. By this time they had had other experiences in both using ToolBook and the relatively primitive Windows machines. By the time of this incident the children typically had very little difficulty relating to the computer itself. In looking into their level of expertise I would say there were easily the equal of a computer savvy kindergarten student of today. If this is somewhat surprising given the fairly primitive state of technology at the time I should mention that these were 386 and 486 computers running Windows for workgroups. At the time of this study they represented an extremely high end product. Furthermore, for the type of software that we were running, these were more than adequate to give reasonable performances even by today's standards.

As an aside, the notion of using the most powerful technology and authoring system then available to work with kindergarten students struck many as being amazing. I made the point then, which I still believe, that in order for the computer (of that day) to be meaningful it required the highest end product. One of the major pleasant surprises of the last nine years is how well these earlier findings hold up. Indeed, the off-the-shelf machines of today are quite comparable (in terms of the visualization and manipulability of objects they engender) with these early efforts. Not only was this work ahead of the curve, it was outside the box totally.

But what I remember most, relative to the notion of object reification, came from the experiences of one young man who in his manipulation of the graphic objects managed to drag all of them off of the computer screen. This was a bit more of a problematic than it might at first appear for in the nature of "it's not a bug it's a feature" I had not created a simple button to return objects to the screen once they had been dragged off the working area.

I must confess that this was a complete oversight on my part. The program was under development and I had not yet thought as to what would happen if objects were to be dragged off the screen. In the course of developing the activities I had always just clicked to the next screen and then back to reset the screen – this had become so much a habit that I had taken it for granted at the time work with the children began. Of course, this child was blissfully unaware of that strategy. When he dragged them off of the screen for all he knew they were gone forever.

I'll never forget his eyes looking up to me as they swelled with tears as he said, "Help me, Dr. Connell! I have lost all of my toys."

His painfully sincere statement serves as a powerful reminder that in the mind of this child these computer images represented real objects upon which he was carrying out real operations. Furthermore, these operations carried with them a heavy kinesthetic component that was totally unexpected at the time. Subsequent observations and interviews illustrated that the physical manipulation of his eyes and hands with the motions of the mouse as translated to the computers screen translated to his mind as a series of actual actions upon real objects.

To put it in more poignant terms, this was no virtual reality to this child. These were his real toys and they were really lost. I'll never forget his joy as I showed him how to get his toys back.

The experiences of this child that the technology had engendered were extremely powerful for him. Furthermore, they proved to be similar to the real world pattern blocks from which the geometric shapes had been designed. The combination of kinesthetic motion required manipulating the objects with the mouse and the geometric shapes on the computer screen appeared to provide a direct analog to the kinesthetic motion

required to move the pattern blocks on the desktop. To these children differences between moving the virtual object on the computer screen and moving the physical object of the pattern walks on the desktop were so small as to be indistinguishable.

For this child this represented a valid action upon a real object. To that mathematics does represent a series of action upon reified objects of growing complexity and abstraction, then this provides an excellent clue in terms of starting place for effective technology use.

Two Parallel Examples.

Let us see how this model plays out for the case of a young child who is just beginning the process of acquiring basic number concepts. The initial task for the young child is to perform sufficient actions upon a foundational set of manipulative objects to develop a working vocabulary for later use. This vocabulary must include the terminology used for the manipulative itself, relevant properties of the manipulative, and the canonic problems to which the manipulative is used to explore.

Consider the Dienes $Base_{10}$ blocks as an example. Typically a child begins by using the blocks to build with – just as with any other set of building blocks. Through carefully guided activities the young child will come to explore more of the mathematically relevant properties of the blocks and begin to assign the appropriate terminology to them.

Thus, the smallest block is soon recognized as a unit. Building from this basic foundation they learn that it is this unit that we count when using the $Base_{10}$ blocks. This is the set of primitive objects serving as the source for later representations within this system of modeling. From this beginning other vocabulary relating to the blocks is carefully developed, such as Hundreds Flat , Tens Rod , and Thousands Cube .

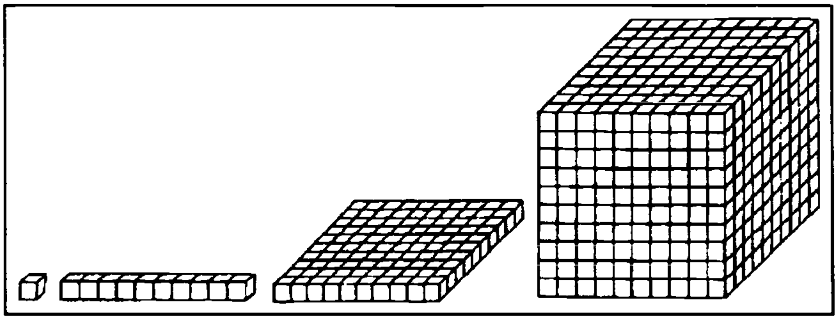

Figure 1: Traditional manipulative - Units, tens, hundreds and thousands Dienes $Base_{10}$ blocks.

With this vocabulary in place, experiences are designed to explore the relationships between the numbers represented in these objects to think with and problems are posed which require the child to consciously and strategically act upon these objects in order to solve. The child will then pose problems of their own, which will end up involving further actions that the child will perform upon the primitive objects that they have been working with.

To see the parallelism of approach this method incorporates, let us contrast this example from early elementary mathematics with one from introductory trigonometry[2]. First of all, the objects these students are thinking with are quite a bit more abstract. Let us look at a technology-enhanced Sketch object designed to allow exploration of the sine and cosine function via the unit circle. Just as was done with the young child we begin by developing a working vocabulary relevant to a developmentally appropriate object – in this case derived from examining selected points along a unit circle.

This Sketch object is indeed more sophisticated and is best thought of as a dynamic sketch, due to the changing nature of it's constituent parts. Despite this increased sophistication, however, we can observe the same pattern of thinking as the student uses it in exploration of their developing notions on trigonometric functions. The student must first acquire a working vocabulary regarding the object and some of its properties prior to any meaningful questioning or problem solving to take place. Careful examination of the unit circle

[2] Thanks to Mr. Robert Crotteau for permission to include these figures.

shows that there are two colored lines that are formed each time a ray crosses the unit circle at any particular angle, their lengths corresponding to the sine (shown in green) and cosine (shown in red) of the angle which is used. As the student explores various angle combinations the associated sine and cosine are displayed in both numeric and graphic form providing multiple representations for the same concept.

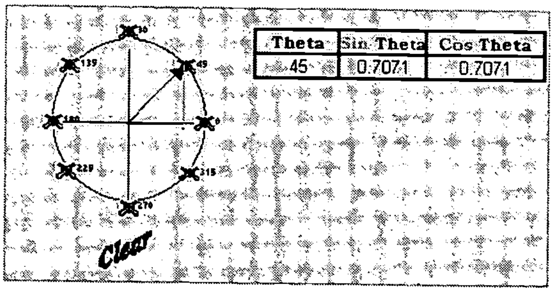

Figure 2: Technology Enhanced Sketch – An active unit circle object from trigonometry.

Just as was done with the Base10 blocks, once this vocabulary is in place experiences are designed to explore the relationships between the functions represented in this technology-enabled object to think with and problems are posed which require the student to consciously and strategically select actions using this object in order to solve. The child will then pose problems of their own, which will end up involving further actions that the child will perform upon the objects in order to solve. This same sequence may be likewise followed for the sketch and mental picture levels of the model.

What should occur next, regardless of the students' developmental level, would be for a skilled teacher or instructor to pose follow-up problems or questions relating to the newly instantiated and defined object of thought. This would again hold true whether we're talking about a physical manipulative object, a sketch object of predictive power such as an interactive fractions object, or a mental picture object such as a comparison of mass based upon remembrances of experience, or a formal and logically abstracted object such as function or some other mathematical construct. In each case we observe a skilled teacher using newly developed objects as a venue within which questions are to be asked and problem situations explored via student actions upon these very same objects of thought. As these examples serve to illustrate, these objects of thought become the basis upon which later mathematical thinking occurs.

Summary

The type of technology enhancement illustrated within this paper has the potential to significantly alter the nature of the mathematics classroom. This goes far beyond simple changes in content scope and sequence. The very nature of what counts as a mathematical thought must be examined when technologically enhanced active objects are a part of the learning environment. If we are to successfully prepare teachers to be comfortable within this new environment it strikes me as essential that we go beyond typical preparation programs, which for the most part use technology to present information. We must model the creation of active objects in our own methods classrooms if we expect to see them in those of our teacher candidates.

I have found that this is nowhere near the ordeal that many would suggest. What it requires, however, is a willingness to experiment with foundational representations to identify those which best benefit from technological enhancement. Although much more research needs to be done concerning such *objects of thought* might play it is increasingly clear that if we are to be successful in the mathematics reform effort they must find a home in our methods courses – and in the classrooms of our teacher candidates.

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Exploring Whole Number and Rational Number Division Within a Computer-generated Conceptual Domain

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Abstract: In this preliminary report of work in progress we discuss a prototype computer-generated conceptual domain designed to enable learners to explore various visual and symbolic representations of whole number, fractions, and decimals, and other fundamental differences pertaining to division with regard to whole number and rational number arithmetic. Feedback from prospective teachers were included as an integral part of the design process. Other instructional design considerations regarding developmental methods, platform limitations and constraints, and future directions for improvement are discussed.

Introduction

The difficulties learners have in understanding procedural and conceptual connections and differences between whole numbers, fractions, and rational numbers is well known (e.g., Mack, 1995; Markovits & Sowder, 1991; Resnick et al., 1989; Silver, 1988). Potential causes and solutions to these difficulties usually focus on the semantic or informal experiential, concrete, contexts in which arithmetical equations can be more meaningfully formulated as opposed to focusing on the purely formal conceptual relationships expressed in arithmetical equations with respect to the particular numerical domains involved. Previous work researching preservice teachers understanding of divisibility and multiplicative structure, however, found that many students do not have a meaningful conceptual grasp of the formal differences between either whole and rational numbers, or between whole and rational number arithmetic (Zazkis & Campbell, 1996). These difficulties where particularly evident with respect to understanding whole number division with remainder (Campbell, 1996).

In this paper, we draw on Greeno's notion of number sense as situated knowing in a conceptual domain (Greeno, 1991). The basic idea is to construct a spatially-oriented environment using computer graphics that presents the learner with a variety of inter-related visual and symbolic representations of whole numbers, fractions, and decimals, along with some interactive tools for working with those representations that collectively serve to accentuate connections and differences between them. The central thematic of the environment was to render visible the division algorithm -- a fundamental theorem of elementary number theory that provides the formal basis for whole number division (as most mathematics educators tend to think of the "division algorithm" as referring to an algorithm for long division, we will henceforth refer to this theorem as the "division theorem" in order to avoid any confusion). As will be illustrated below, the environment we are designing is intended to take advantage of the division theorem's potential for illustrating procedural and conceptual differences between whole number and rational number arithmetic (Campbell, 1997).

This is a work in progress. Here we offer a preliminary report on design criteria, with particular emphasis given to the guiding design thematic of a transition model between whole number and rational number arithmetic that is based on the division theorem defining whole number division. We will then briefly discuss constraining features of the development platform, some aspects of the development process and the role of learners in that process and some ideas on how that role can be optimized. We will conclude with a critical assessment of the prototype, and our ideas for future directions with this environment.

The prototype software, developed on a Macintosh platform using Real Basic, can be downloaded at:

http://www.gse.uci.edu/doehome/Deptinfo/Faculty/Campbell/divfact.html

Guiding Thematic: A "Transition" Model for Whole and Rational Number Arithmetic

It often comes as a surprise to learners and teachers alike to realize that whole number arithmetic is fundamentally different from rational number arithmetic. This is principally due to the fact that division is not closed over the whole numbers. That is to say, there are cases, such as $10 \div 3$, where there is no whole number solution. The surprising part is that this entails completely different definitions of division for whole number and rational number arithmetic. The part that is not so surprising is that if one is not clear about these differences, many problems relating to the conflation of whole and rational numbers, between whole number and rational number arithmetic can result (Campbell, 1996, July). This prototype has been developed to help learners explore, discover, and make procedural and conceptual connections regarding these fundamental differences. To avoid ambiguity in what follows, capital letters are used to designate whole, non-negative integer, number variables and small letters will be used to designate non-negative rational number variables

The formal basis for whole number division is a fundamental theorem of number theory is *the division theorem*. According to this theorem, for any whole numbers, A and (non-zero) D, referred to as the dividend and divisor respectively, there exists *unique* whole number quotient, Q, and remainder, R, where $0 \le R < D$, such that $A=QD+R$. Most learners are implicitly familiar with the division theorem, in so far as it is used iteratively in long division and as a means of "checking" the results thereof.

Rational number division, when thought of solely in fractional terms, may be more intuitive than whole number division, but conceptually it is much more involved. Formally, rational number division depends on the fact that for any (non-zero) rational number, d, there exists a unique multiplicative inverse, or reciprocal, d^{-1}. In dividing a dividend, a, by a divisor, d, the quotient, q, is defined as the product, ad^{-1}. The quotient can be expressed in a number of equivalent ways: $ad^{-1} = a/d = a \div d = q$; or implicitly, in an equation more closely related to the division theorem and divisibility, $a = qd$. *There is no such thing as a remainder in rational number division.* Instead, as is characteristic of rational numbers, the quotient has a decimal, or *fractional component* (possibly zero) in addition to a whole number, or *integral component*. The relationship between remainders and fractional components is not always evident to learners (Campbell, 1997).

The division theorem offers an effective starting point from which to illustrate the transition from whole numbers to fractions to decimals. Consider the following derivation:

A	$=$	$QD+R$	whole number division:	where $0 \le R<D$	(1)
	$=$	$QD+R(D/D)$		where $D/D = 1$	(2)
	$=$	$D(Q+R/D)$		distributivity	(3)
	$=$	Dq		where $Q+R/D = q$	(4)
$A(1/D)$	$=$	$Dq(1/D)$		where $X=Y \Leftrightarrow X(1/D) = Y(1/D)$	(5)
A/D	$=$	q	rational number division	where $D^{-1} = 1/D$	(6).

This derivation highlights the central role of arithmetic division in making some of the fundamental procedural and conceptual shifts involved in numerical transitions from whole numbers to fractions to rational numbers. More specifically, step (1) is essentially the division theorem defining whole number division. By definition it serves to exemplify the fact that whole number units cannot be divided. Step (2) remains implicit in the prototype as it currently stands, and yet it is both subtle and important to consider in understanding the transition from whole numbers to decimals. Here is an example of where learners' familiarity with whole numbers may be brought to bear on understanding fractions and rational numbers more generally. Conceptually, it seems to be much easier to go from whole numbers to fractions than it is to go from whole numbers to decimals. This is because the representational differences between the former are more intuitive than the representational differences between the latter. Consider, for instance, the difference between "1/8" and ".125". Moreover, the transition from fractions to decimals is much easier to make than it would be to jump straight from whole numbers to decimals. Consider, for instance, that ".125" is readily interpretable as "125/1000". Placing initial pedagogical emphasis on D/D, say in contrast so something like 1/D, helps to place emphasis on

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the division of a whole number unit, rather than on a previously divided part of that unit. That is to say, there is an important way in which D/D is both logically and intuitively prior to 1/D. Step (2) is also important in that it is a necessary precondition to the distributive step (3). It has been shown that distributivity can be problematic in a wide variety of ways for prospective teachers (Campbell & Zazkis, 1994, November). Nevertheless, the importance of this step in the transition model is crucial, in that it results in a form from which the integral and fractional components of the rational quotient of step (4) is readily identifiable. The transition from step (3) to step (4) marks a clear transition from the concept of fractions to rational numbers. Of course, one could resist, or postpone, this step and consider the rational quotient as the improper fraction (QD+R)/D. One way of so doing would be to apply steps (2) and (3) once again, only this time applying the identity (D/D) to the whole number quotient Q and then distribute out (1/D). Either way, the next step would be to isolate the rational quotient, and this would require multiplying both sides of the equation by the proper fraction, 1/D, in step (5). Finally, the crucial property of every whole number except zero having a multiplicative inverse in the domain of rational numbers, and the product of a whole number and its multiplicative inverse being unity, is exemplified in step (6). For the sake of expedience, other important relations such as commutativity and the more general concept of a multiplicative inverses of arbitrary non-zero rational numbers have either been left implicit in this analysis or simply fall outside the scope of the transition model. Also note that one can move logically either forwards from whole number division to rational number division or backwards from rational number division to whole number division. Pedagogically however, moving forwards through the transition model, as illustrated here, may be the preferable approach. Be this as it may, the transition model offers a rich venue for unpacking a wide variety of procedural and conceptual differences between whole numbers, fractions, decimals, and between whole number and rational number division. It is this characteristic that makes it such a rich thematic guide for designing a computer-generated conceptual domain for learners to explore.

Guiding Thematic: Visual and Symbolic Aspects and Related Factors

Using the transition model as a guiding thematic for the development of a computer-generated conceptual environment provided part of the original motivation of this project. Another guiding thematic of this project has been to provide an environment whereby learners are provided with a number of tools for exploring relations between the visual and symbolic representations. What exactly is involved in this and how to do it effectively is a deeply problematic. A number of factors pertaining to the relationship between visual and symbolic aspects of mathematics and mathematical cognition have been implicated from a wide variety of disciplines ranging from philosophy (e.g., particular and general), mathematics (e.g., geometry and. arithmetic), logic (e.g., sense and reference), computational theory (e.g., procedural and declarative), psychology (e.g., concrete and abstract), and linguistics (e.g., object and attribute) (Campbell, forthcoming). These factors pertain directly to the learners' understandings of the relations between visual and symbolic aspects of mathematics and mathematical cognition. There are, however, many other design factors involved regarding the environment in and of itself. Particularly regarding the very idea of a computer-generated conceptual environment. To what extent should one attempt to anticipate the kinds of things that learners might or might not do when they are actually engaged within such an environment? To what extent is it even possible? Such design issues are intimately bound up with assessment issues which will discuss in more detail below. We will now say a words regarding design with respect to the development platform and the developmental process.

Development and Delivery Platforms: Design Constraints

Instructional design is always going to be expedited or limited by what is possible with the hardware and software constituting the development and delivery platforms. Fortunately, as computer technology is rapidly evolving, these factors are placing fewer and fewer constraints on instructional design while opening up more and more possibilities. It is unlikely that one can ever be completely free of such constraints. We will discuss some factors that have limited our design. Predominantly due to the existing Apple cultural environment that we are in, the development and testing of the prototype software developed on and geared toward that delivery platform. Unfortunately, however, we have yet to find a robust programming language for Rapid Application Development (RAD) with the possibility to develop a Graphic User Interface (GUI) in the Macintosh environment. The only high level object-oriented programming language with the characteristics mentioned

above that we have found is Real Basic (RB). This is a relatively new implementation still in development with many similarities to Visual Basic from Microsoft in the Widows environment -- which constitutes [the latest] a more robust programming language. However, the alternative to use an object-oriented language was very attractive because we included in our design objectives the possibility to construct a virtual scenario in the computer where the students have an interactive and visual environment to represent whole numbers. Numbers can be manipulated using scroll bars and can be represented in spatio-geometric form as unitary squares (area) and as non-unitary rectangular products. Using the visual characteristics of the environment the learners can make changes in the dividend or the divisor and then see instantly their graphical representation (of these two values) and also the values of quotient and remainder not only as numerical representation but also graphically.

There are, however, ways in which RB is limited with respect to VB. These limitations are particularly evident with the inflexibility of RB in the handling of the screen. We will discuss one particularly bothersome example: refreshing of the screen after it has been hidden by other windows and in the handling of the z-order of graphics -- i.e., the order in which several graphics appear one on top of the other. In other words, if the screen is in the x-y plane, several graphics can be represented as occupying layers in the z-axis.

We developed a "trace" function that requires overlapping windows, so that the effect of different divisors with respect to a given dividend can be explored. The dividends and divisors are constrained, by design, as whole numbers, and the divisor is constrained to be less than or equal to the dividend. When a given divisor divides the dividend exactly we have used an areal graph -- one that displays the product of the divisor and the resulting (whole number) quotient -- that is colored blue. When the divisor does not divide the dividend exactly, then the areal graph that displays the product of the divisor and the resulting (rational number) quotient is colored red. When using the Trace function over several such configurations, the areal graphs, to some extent, overlap upon one another. We can easily trace either by increasing the value of the divisor or by decreasing it. The order (z-order) in which they appear, unfortunately in this particular case, affects the way the resulting information is displayed on the screen to the learner. For the case in point, if one uses the trace function when decreasing the divisors, then the overlapping areal graphs indicate which values of the divisors that divide evenly into the dividend very well. Unfortunately, they are not so clearly indicated when tracing proceeds using an increasing divisor. If we could manipulate this order (which in RB is not possible) we could provide much more consistent picture of the configurations, irrespective of the particular order in which they are explored by the learner.

Development Process: Learner Interaction, Assessment, and Feedback

All these design factors, whether they are originate in the minds of the designer, the learner, or the computer system, will always be, to one extent or another, bound up with what learners do within the environment. Prima facie, there are a number of different ways of assessing this. For instance, designers can rely on occasional verbal or written feedback from learners regarding their experiences or from teachers reporting on their observations regarding their students experiences. Other approaches involve various ways of having the computer keep track of how students use the environment, or to use audio-video equipment to record learners' interactions, possibly in tandem with various kinds of "talking aloud" protocols. We are currently developing more rigorous approaches along these lines (see Campbell, forthcoming). If all goes well, we will be able to report in more detail on our data and methods when we present this paper. Here, we will just say a few words about how we have developed the prototype as it currently stands.

The authors have brought complementary backgrounds, interests, and skills into this project which has proved beneficial to this collaborative effort. The first author conceptualized the guiding thematics of the transition model with an eye toward developing an environment suitable for both teaching and learning arithmetic and for further research into the relation between visual and symbolic aspects of mathematics and mathematical cognition. The second author has a strong background in educational software design and development. These complementary orientations regarding design and development gave rise to a important synergy that led to rapid implementation of an initial prototype suitable for classroom use.

This prototype was then introduced in undergraduate mathematics education course called "Thinking Mathematically: Learning and Teaching Mathematics" -- an undergraduate course designed by the first author for prospective teachers in mathematics. The guiding thematic of the course was essentially the same as for the

prototype: to explore ways of visualizing elementary arithmetic in ways that were conceptually meaningful. Around the middle of the quarter, the students worked with the software for about an hour and half, while remaining focused on how the environment was contributing to their conceptual understanding of whole number and rational number division. The students reported on their insights and difficulties in using the environment, and the software was adapted and refined wherever possible in accord with those reports for the next class. The students were then able to use the environment again and explore first-hand the impact of their feedback. In this way, they were able to contribute to the evaluation and design process. In what follows we will discuss a few of those contributions.

In the original prototype, there were two symbolic equation schemas that allowed for numerical instantiations immediately beneath them depending on the values selected for the dividend and the divisor:

$$A = Q * D + R$$

$$A/D = Q + R/D$$

Many students experienced significant difficulties in relating these values to the visual graphic representations. Particularly the one based on the product of the quotient and divisor. The revised prototype included the following equation schemas, again with numerical instantiations included immediately beneath each one:

$A = Q * D + R$ (with the explicitly noted constraint that: 0 R < D)

$$A = D(Q + R/D)$$

$$A/D = Q + R/D$$

With the revised prototype students were more successful in linking visual with symbolic representations. Other factors likely implicated with this success may have related to greater familiarity and overall involvement with the environment. In the upper right of the revised (and as of this writing, the current) prototype is a bar graph of each of the values of the division theorem from left to right. In the original prototype the bar graph was "top-down" in scale rather than the more usual "bottom-up" bar graph representation. Some students found the "top-down" graph distracting or disconcerting. They felt much more comfortable with the standard "bottom-up" representation.

In the original prototype, only changes in the divisor were possible for a given dividend. Some students felt unduly constrained by this, so the prototype was revised so that the dividend could be changed for a given fixed divisor, thus adding greater user-flexibility to the system.

In the revised version the remainder was also represented as small blue dots in the Quotient-Divisor graph. These dots provided a good focus task for the students. Many of them worked individually or in pairs, trying to see some connection. Gradually, the connections were made. Two students finally conceded that they could not figure it out and asked their neighbors. Once they were informed that they related to the remainders, they instantly made the connection. It seems that they had not expected yet another representation of that value, and thus were blocking themselves, a priori, from considering it as a possibility.

Overall, the students' first exposure to the original prototype allowed them to feel as though they were actively participating in beta-testing and de-bugging. Surprisingly, the students seemed to enjoy this role, rather than be dismayed by it, especially when they were able to see that many of the problems that they pointed out had been fixed in the revised version. Some of these bugs and suggestions for improvement included things like:

a) No windows refresh after hidden by another window.
b) No Restart function after closing the main window of the program
c) Suggestion to include up to 100 numbers in the dividend
d) Introduce cross hairs or some form of indicator as to the current operation in the graph

Critique and Future Directions

We think that the prototype it is still unclear the transition from whole numbers to real numbers (with decimals). There is much more that can be done to help bring out visual meanings that remain implicit within the symbolic representations, as evidenced by the analysis above. Perhaps a graphical representation of those decimals could be more appropriate adding a new window (floating) to illustrate that. In this window a magnified unitary square could be depicted to show fractions of it.

Other improvements can be made regarding more familiar representations of division with remainder. In particular, whole number division is often expressed as A÷D=QremR. Some caution must be exercised here. Note that this "equation" is imprecisely formulated and *does not* conform with standard arithmetic meaning and use. Some learners may be prone to operating on this common expression of whole number division as if it were a well formed arithmetic formula.

The software could be refined (despite current limitations of Real Basic) in the following ways:

a) Including the floating window mentioned above to enhance the "vision" of decimals
b) Shows in a notorious way the presence of prime numbers
c) Increase numbers up to 100
d) Redesign of the color bar graph for more meaningful information
e) Define three independent levels of difficulty for the division theorem: (1) including only whole numbers; (2) including real numbers; (3) including prime numbers.
f) Include a "help" service in the main menu for some directions
g) Include a "print" service for hard copies
h) Possibility to include a "freeze" function to insolate desired configurations
i) Work on the suggestions and difficulties (above) manifested by the students.

We will be running additional tests with the current prototype with preservice teachers and making further refinements prior to presenting this paper at the conference and hope to have a fuller report available then. One of the areas that we hope to gain much greater insight into between now and then is in how preservice teachers navigate their attention within the environment. Toward this end, we will be videotaping the screen during some of their sessions using talk-aloud and cursor-pointing protocols and analyzing the results using video-processing software. We will be presenting some of the preliminary results of these experiments at the meeting.

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Serendipity in Interactive Mathematics: Virtual (Electronic) Manipulatives for Learning Elementary Mathematics

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Abstract: The authors are co-principal investigators for a National Science Foundation project to create a web-based National Library of Virtual Manipulatives for learning mathematics in the elementary grades (K-8 emphasis). Many of our virtual manipulatives are based on physical manipulatives commonly in use in the schools (i.e. geoboards, tangrams, pattern blocks, fraction bars, etc.); others are concept manipulatives especially designed to teach or reinforce basic mathematical concepts. Our emphasis is on interactivity for the user, so the learner controls the variable aspects of the manipulative and is not only free, but encouraged, to explore and discover important mathematical principles and relationships. Teachers or parents can provide direction, but control of the activity remains with the user. This paper is preliminary and descriptive only, but it describes aspects of our experience in the design of manipulatives and some of the delightfully unexpected advantages of interactive technology for discovery learning.

Introduction and History

This paper must partake of some aspects of self-contradiction, intended as it is to describe in words some of the advantages of not using words. Our goal is to convey some of the unexpected, or at least unanticipated, consequences of interactive software in the educational experiences of both elementary school children and their teachers, both pre- and in-service. Since we have no choice but to rely on words in proceedings such as these, we will do what we can using verbal descriptions, supplemented by static figures. At the same time, however, we invite readers to visit our web site (www.matti.usu.edu), where it is our hope that they may experience for themselves some of the things we describe.

The authors of this paper have a history of working with interactive computer-aided mathematics instruction that predates their current National Science Foundation funded National Library project. The first two authors earlier received funding from the state of Utah to develop an interactive pre-calculus project for use in the state system. We learned early on, however, that despite rather extravagant claims to the contrary, there were no commercially available tools adequate to support the kind of interactive mathematical experience of the sort we envisioned. It was our extreme good fortune to add to our design team a colleague (Dr. Wellman, also in mathematics), whose interest in computer programming led him into the creation of a mathematics editor and related tools sufficient for our purposes.

With the completion of our pre-calculus project, we recognized the potential of our approach for both elementary students and for pre-service and in-service elementary teachers. That potential was magnified by the growing possibilities of a new programming language, Java. It was the Java language that has really made web-based instruction possible.

Java has many advantages over other object-oriented programming languages, especially C++. One of the most obvious—and critical—advantages is multi-platform and web accessibility. But while Java improves on a number of features of C++, it does not have the maturity of some of the older programming languages or the extensive libraries of built-in functions readily at hand. It has been necessary to build many of our own fundamental classes and our own mathematics editor to accomplish some of the things we considered essential to our long-term goals.

Our Utah State University team, in collaboration with a colleague from Fayetteville State University (North Carolina), proposed to the National Science Foundation that we build a National Library of Virtual Manipulatives, interactive applets for learning and reinforcing concepts in elementary mathematics. We intended our applets for the use of elementary (primarily K-8) students, but recognized that the same instructional tools could also serve to strengthen the mathematical preparation of pre-service and in-service teachers.

In the process of our negotiations with the National Science Foundation, it was suggested that we communicate with people working on the new Principles and Standards for School Mathematics ("Standards 2000") for the National Council of Teachers of Mathematics (NCTM). The NCTM had released their original Standards document in 1989 and recognized the need to update their national guidelines for the teaching of K-12 mathematics. As part of the planned publication of the new standards (which also address changes in technology) an Electronic Format Group was established to create a web-version of Standards 2000, including a new approach, "E-examples," to suggest and illustrate ways to incorporate technological resources into the mathematics classroom.

At the 1998 International Conference on Technology in Collegiate Mathematics, we demonstrated to some members of the NCTM Electronic Format Group some prototypes of the kind of virtual manipulatives we had developed for our proposal to the National Science Foundation. The upshot of that meeting has been a very productive collaboration. We are now working very closely with the Electronic Format Group and the writers of the new Principles and Standards to provide appropriate E-examples for all four grade bands. The majority of E-examples that will appear with the web version of the Standards, to be released at the annual national meeting of NCTM in April of 2000, will be our interactive applets.

In addition to productive exchanges with writers and teachers associated with NCTM, we have had the opportunity to work with several groups of in-service elementary teachers. In both web-based distance instruction (in Utah and in North Carolina) and in on-site classes (in North Carolina and Ohio), we have used our virtual manipulatives as part of our technology-supported mathematics courses. Participating elementary teachers in our current North Carolina project are designing ways to incorporate our materials into their curriculum and will conduct in-service efforts in their home school districts to make these resources available to elementary students throughout their districts.

Design Philosophy

Initially, as we contemplated constructing electronic manipulatives that could be used by children, we were guided by existing physical manipulatives. We were confident that we could make electronic versions that, because of their residence on the Internet, could be made available to students, teachers, and parents, at any time and in any location having a web-connection.

One of our first creations was a virtual geoboard, mimicking the common "nails in a board" version using rubber bands. As we shared an early version with teachers and asked for suggestions, several teachers said how nice it would be to be able to color the regions inside the rubber bands. So we did it. Later reviewers wondered if it would be possible to translate an elaborate construction around the board without having to shift the band from every vertex. We are now working on incorporating both translations and rotations, illustrating the mathematical concepts of "slides" and "turns."

Building such features into a virtual manipulative allows users to do things that aren't conveniently possible with corresponding physical manipulatives. We constructed a circular geoboard and another one using "nails" spaced to form an equilateral triangular grid instead of squares. The circular board has immediate applications as diverse as creating pie-chart fractions and illustrating trigonometric functions. But in the design of all of our virtual manipulatives, we try strenuously to avoid doing too much. We would rather have five manipulatives, each doing a well-defined task, than a single applet that requires more complicated operations to accomplish the same five tasks. Each applet has a tightly designed focus and the simplest interface we can create. The mathematics underlying the functionality is often very sophisticated; what the user sees and does is very simple.

Another principle that guides all of our design is that the student must interact with the applet to accomplish something. There is never simply a "watch this clever animation" or "see what happens when we do this" attitude. Mathematics, perhaps more than any other discipline, cannot be learned by watching someone else do it, no matter how elegantly. Any student, to be successful, must be involved, engaged in

the activity. And thoughtful engagement requires participation. Interactivity is thus essential to the design of every one of our applets, the one feature that we absolutely require.

The kind of interactivity we have in mind requires the user to think about a specific task, to formulate strategy to achieve a specific goal (almost always informally, and seldom articulated), to engage in some physical action (clicking to select something, dragging an object, or moving a slider), and to observe (and perhaps, describe) consequences of the action. The goal is to allow students to control events and to discover relationships. Differences between coincidence and causal relationships become clearer when we allow the user to repeat an activity as many times as desired. We can ask questions to direct explorations and, we hope, guide meaningful discovery, but control remains in the hands of the user. Nothing happens until the user takes action, and an activity can be repeated until there is satisfaction; the computer never tires of repetition.

Unexpected Consequences

With NSF support for our three-year project to build a National Library of Virtual Manipulatives, we could begin to focus our effort to accomplish some of our objectives. But even with early prototypical examples, before we had any formal structure to our project, we were learning something of both the limitations and advantages of working in an electronic environment and more specifically within the virtual machine of Java programming.

It is impossible to convey in words an accurate picture of what can be done on-screen with our interactive applets, so we compromise by giving a few pictures of some of our applets, simple snapshots of the kinds of screens produced by students actually working with these manipulatives. We will accompany each figure by a description of some of the functionality of the applet and some of the dynamic features available to the user. We hope thereby to communicate at least a little of what we have discovered in both the design and implementation of some of the virtual manipulatives.

Again, we invite interested readers to visit our web site (www.matti.usu.edu) and to explore freely. Everything is, of course, in a state of continual flux as we get feedback and suggestions from teachers, students, and evaluators. Applets already on the site are also changed as we build tools to support one particular concept applet and learn that such a tool would add value to another.

The serendipity to which we refer in the title of this paper is of two varieties. One is unexpected responses or capabilities that an electronic manipulative possesses in contrast to the physical model that inspired the computer implementation; the second occurs when we are led to unanticipated design changes that enhance the educational value of a virtual manipulative. We will try to illustrate both.

Figures 1 and 2 show two screen shots of a virtual manipulative on the Platonic solids. To help develop spatial visualization, we wanted students to be able to see all sides of a solid object. What neither figure can show is that by moving the mouse the student can rotate the given object freely in space. In future variations of this applet, we will paste different images onto the sides of a cube and ask questions about, say opposite faces. But as we worked with this applet, we realized that there was an opportunity to let students discover Euler's relationship among vertices, faces, edges ($V - F + E = 2$). As the user rotates the solid in space, a Shift-Click changes the color of a face, an edge, or a vertex. In Figure 1, we have changed the color of five faces with their surrounding edges and corners. The color changes make it easy to determine when you have counted everything. In the implementation shown, there is a running tally of the numbers, which the teacher can either choose to show or not.

One of our most exciting experiences with this applet took place during a visit to several inner-city schools in Cleveland. The settings and circumstances were less than ideal, but we took CDs containing some of our materials to leave with the teachers, some of whom we had worked with in an earlier NASA project. We took a projector and a lap top computer into the classroom and let the children (first, second, fourth and fifth graders) take turns with the mouse, rotating objects, selecting and changing colors while the entire class kept a (collective verbal) running count. The sense of ownership—and excitement—felt by the children as they controlled the magic of rotating the image and changing colors was palpable.

Figure 2 illustrates both kinds of serendipity we mention above. In the original discussions we had not thought of illustrating the idea of a dual of a solid (taking as vertices the mid-points of each face), but after seeing the solids in space, we serendipitously realized that we had another teaching opportunity. And, as may be seen from Figure 2, the electronic setting (using some fairly sophisticated mathematics) allowed us to show something that would probably never be constructed physically.

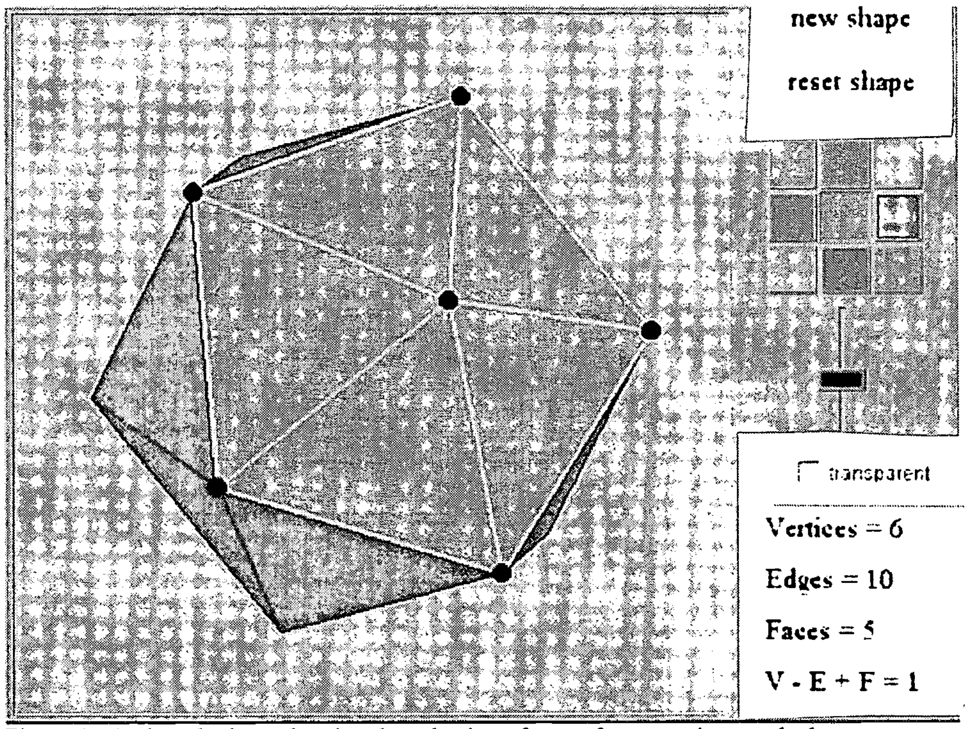

Figure 1. An icosahedron, showing the selection of some faces, vertices, and edges.

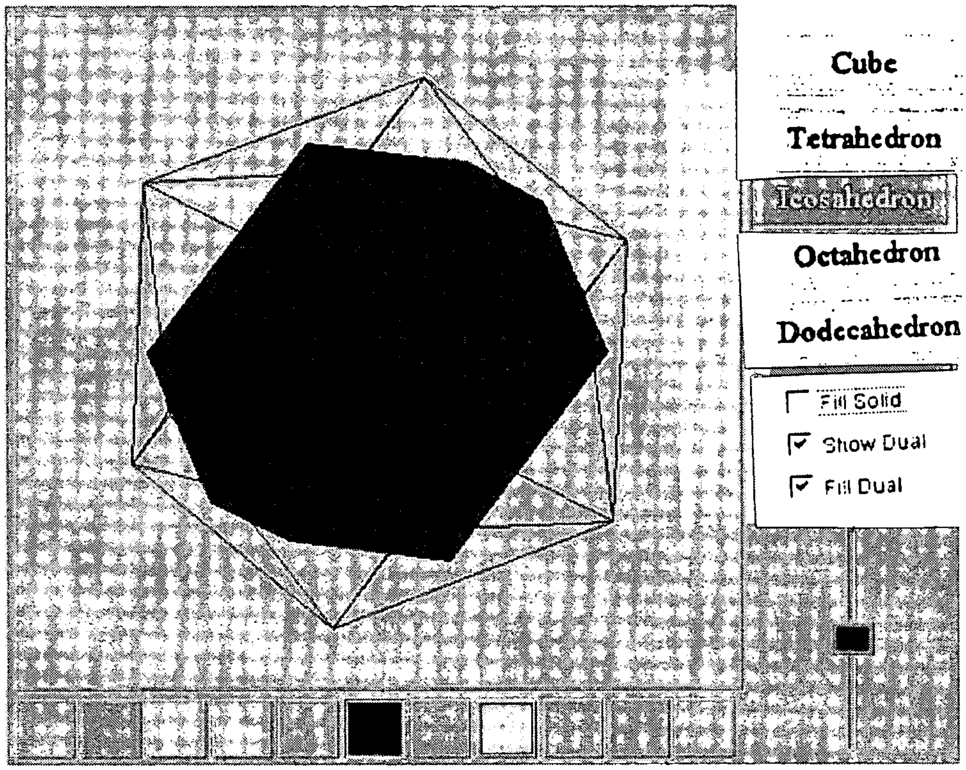

Figure 2. A transparent (wire-frame) icosahedron with its dual, a dodecahedron.

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Figures 3 and 4 together also demonstrate both kinds of serendipity. The virtual geoboard in Figure 3 is "standard" in the sense that the nails or pegs form a square grid, as do most physical geoboards, although few boards have as many nails as ours. With the added size, the electronic version makes it much easier to explore such concepts as similarity, transformations, or symmetry. The smaller physical geoboards have that built in limitation. As mentioned above, it was teachers with whom we were working who suggested the addition of color to geoboard regions. We thought it a nice idea, but we did not anticipate some of the advantages we have since observed. With color, the comparison of sizes of regions or geometric figures is much more natural. When we ask students to use their rubber bands to divide a square region into halves, challenging them to find ways that are different from the obvious one in the upper left of Figure 3, the color stimulates choices. In particular, it seems less likely that the solution in the lower right of Figure 3 would be as apparent without the use of color to put together the two outside bands to form a region matching the central band.

Having the standard spacing of nails with our first implementation of geoboard, we realized that a very minor change would allow us to keep all the functionality while illustrating a number of different mathematical concepts. Thus we constructed a geoboard with a triangular grid, leading to a natural tiling of the plane with equilateral triangles or regular hexagons, and we have two different geoboards making use of circular symmetry. Now, taken together, our set of geoboards permit a completely unanticipated flexibility and versatility. Figure 4 shows how one student constructed a pie chart to answer the question, "What is 1/3 of 1/4?" Again, the ability to add color greatly aids the visualization of the answer.

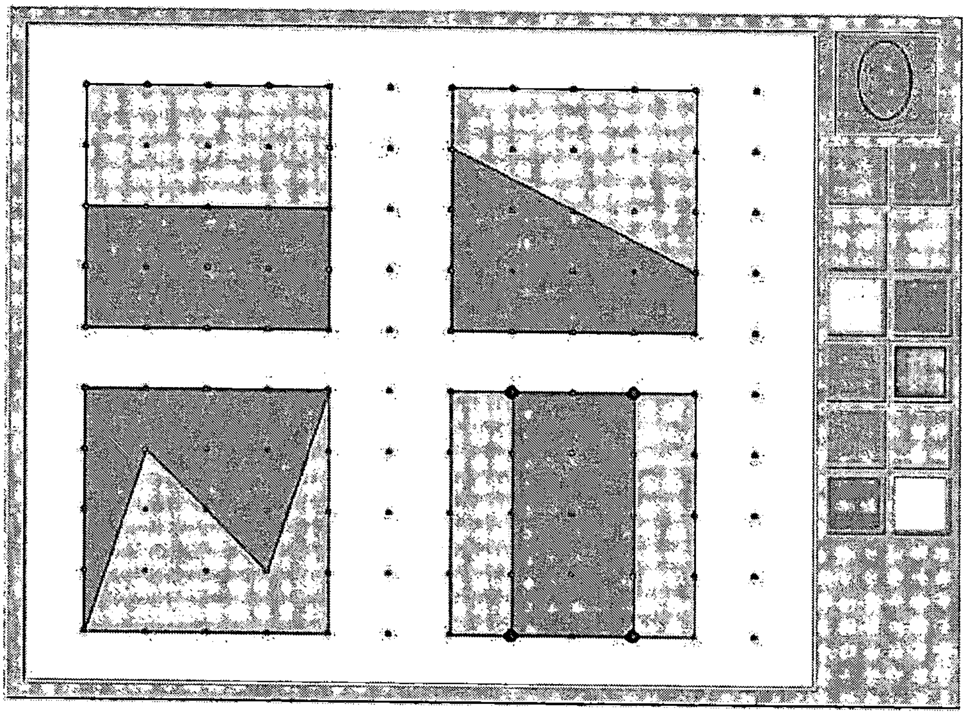

Figure 3. A "standard" geoboard illustrating different student pictures of "one-half."

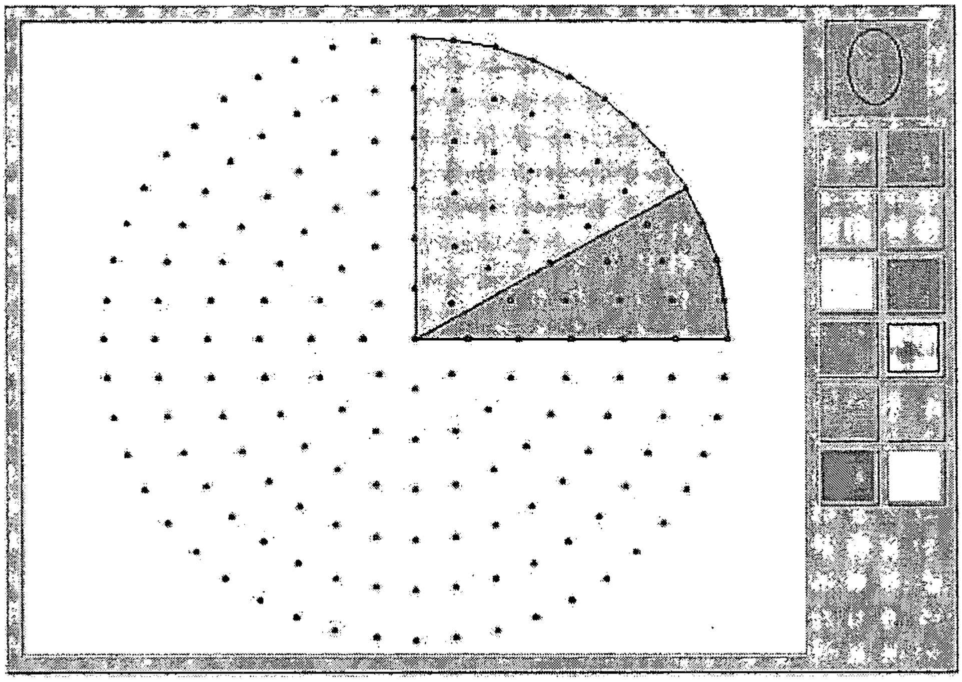

Figure 4. A circular geoboard, with a student's rendering of "1/3 of 1/4."

Conclusions

As is obvious at this point, we are submitting here only a preliminary report. This paper is intended to be neither technical nor definitive. In the future there will be a number of evaluation studies of the virtual manipulatives in our National Library. The summative evaluation for our project will be handled by Douglas Clements and Julie Sarama of the University of Buffalo. Given the direction of their previous educational research, Professors Clements and Sarama are uniquely qualified to assess the effectiveness of computer technology in early childhood education. Other teacher educators, including another of our co-principal investigators, James Dorward, will be examining the use of our materials in public school settings and plan comparative studies.

What we describe in this paper is purely descriptive, based on our own observations and information passed along to us from in-service teachers who are learning with and using our materials. However limited our observations, we have been delighted by the response of students actually using our manipulatives. The measurement of learning of specific mathematical content at different grade levels over an extended period of time is an important task that will extend into the future. But in our own development work, as we try to better understand, and address, the needs of various groups of students, the reactions have been wonderfully heartening. As typified by our visit to the Cleveland inner-city schools, the level of engagement, the enthusiasm, excitement, and participation of children will not soon be forgotten.

Using Web Pages to Teach Mathematical Modeling: Some Ideas and Suggestions

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Abstract: Mathematical modeling can perhaps be best defined as "the process of scientific inquiry" for mathematics. This is obviously a comfortable mode for teachers of science, but is rarely seen in the mathematics classrooms of today. This paper explores the possibilities of using interactive web pages to help facilitate an understanding of practical applications based mathematics. Because the scientific process is emphasized as the general operating framework, situations where students can hypothesize and experiment, and create data tables are most valuable. Special emphasis is placed on the fact that students and teachers both need to re-conceptualize effective mathematics instruction in order to really embrace a modeling approach.

Introduction

An important aspect of the continually changing reform movement in secondary level mathematics is that teachers are able to absorb and integrate what they have learned from both the classroom dynamics and from new research. It is perhaps most important that teachers of mathematics continue to grow with respect to the pedagogical techniques that have the greatest classroom potential. Although finding these techniques requires a great deal of effort, good teachers would certainly agree that the resources they bring to bear on behalf of their students set a foundation of success or failure for those students from both a competence standpoint and from a motivational standpoint as well.

The reform efforts of the past decade have resulted in a mass of professional documents, curriculum standards, and reports, all of which are intended to strengthen a teacher's profile of techniques. Yet with all of the various forms of assistance, the mathematics classrooms of the 21st century will probably look very similar to those that have been so common for the past 50 years. The fact that we know so much more now than we did 50 years ago, at least from a scientific standpoint, has appeared to have very little impact on what is taught or how things are taught in the secondary math classroom. Agreed, technology has brought flavor to the mathematics classroom, but the textbooks along with their very familiar format still seem to be the preferred method of instruction. Although there are instructional perks to this classroom format, the fact that students aren't internalizing the information would suggest that other formats merit exploration.

Instructional activities using a mathematical modeling approach have proven to be both effective and engaging for students. Additionally, some of the most valuable curriculum-application considerations in today's mathematics classrooms can be revisited in the context of an interactive web based format that preempts the "what do we need this for" question. The mathematical modeling approach to instruction is indeed a "front heavy" technique for teachers, but allows for the kind of valuable exploration in mathematics that has been absent to date.

Classroom Considerations for Mathematical Modeling

Mathematical modeling can perhaps be best defined as "the process of scientific inquiry" for mathematics. This is obviously a comfortable mode for teachers of science, but is rarely seen in mathematics classrooms. Students engaging in mathematical modeling activities would spend the majority of time experimenting in applied physical situations in an attempt to find patterns and consistencies in sets of data. Data sets could already exist in a number of different forms, or they could be collected as part of a classroom activity. Part of the impetus for mathematical modeling activities in the classroom is to help students understand that mathematics is not a discipline where complex solutions to problems are innately obvious or solvable in a matter of just a few minutes. In fact, any good mathematical modeling activity should be appropriately vague so that the students don't get the impression that the activity is just another textbook assignment. The teacher designing the activity has the difficult task of articulating the problem in such a way as to provide clarity without being too prescriptive. This is done to emphasize that mathematical modeling is a process of continual refinement and modification. In most cases, this process of refinement serves two distinct tasks. First, the refinements are intended to create a working model that is more efficient, faster, or more accurate in some way than any previous model. Secondly, refinement and modification are natural processes of building any axiomatic system of notation. Students in essence build their own mathematical system of notation and in turn, greater mathematical understanding. Some instructional considerations related to the use of mathematical modeling activities in the classroom are as follows:

1. Students have some control over how they approach a problem. This is not typically the case with most textbook problems.
2. Good modeling activities are adaptable to many different ability levels.
3. Good modeling activities are easily scalable to different grade levels.
4. Problem solving and mathematical modeling are different processes. Problem solving typically acts as a process oriented approach whereby students find a specific solution to a specific problem. Mathematical modeling is an experimental approach where a problem is solved and continually refined over time in order to be more efficient, faster, or more accurate. Problem solving in many cases has a solution that is either correct or incorrect. Mathematical modeling is a process where few answers are incorrect, they just require continual revision.
5. Mathematical modeling focuses primarily on the "general case." Students must at least generally understand the concept of a variable, which is why modeling activities below the fifth grade are difficult for teachers to construct.
6. Mathematical modeling activities are difficult to assess. An elegant solution may be an approach that works in a way that appears to be coincidental, but a student can justify why. Another solution to the same problem may utilize some specific procedure from the textbook, yet the student has no understanding of why they chose that method nor why it works.

The premise of the mathematical modeling concept is not that the traditional courses in the curriculum need to be replaced, but rather accented in the appropriate spots to better emphasize the practical use of the concepts we do teach. Because mathematical models can take on many forms, the processes by which problems are approached are numerous and varied. Some of the more basic modeling structures lend themselves very well to established secondary level curriculum (i.e. numerical tables and patterns, graphs, systems of equations, etc.). Others may be more algorithm-based problems that require a computer or graphing calculator as an extension. Although no one set of rules is inherent to all mathematical modeling activities, the following set of steps can act as general guidelines for students engaged in mathematical modeling activities:

1. Identify what the problem and resulting model should look like
2. Establish the factors that affect the outcome
3. Define which of the factors are parameters and which are outcome variables
4. Establish a relationship between the parameters and the variables to derive a formula or alternately defined model or algorithm
5. Test the model with known values from previously collected data
6. Refine the model for accuracy and efficiency

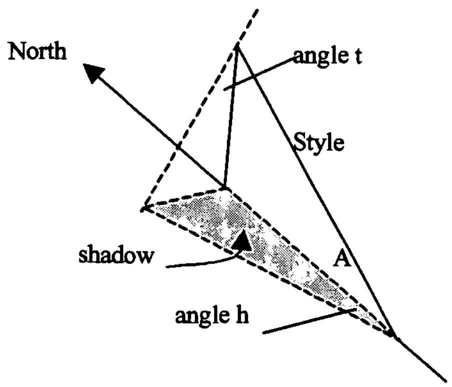
Using Web Pages for Modeling Activities

Although modeling activities in the mathematics classroom don't have to be technology driven, the interactive nature of Java applications on many web pages can provide a physical context which students can use to test conjectures and build generalizations. Because the scientific process is emphasized as the general operating framework, situations where students can hypothesize, experiment, and create data tables are most valuable. Well designed web pages using Java allow for the kind of interactive experiments needed for success without the hassle of setting up a physical lab situation. The following example illustrates a possible modeling problem that could be practically used on the web:

Problem

Suppose we wanted to find the time of day without using a clock. In ancient times, sundials were used for this purpose, and were fairly accurate. The first step in finding the time without using a clock is to use the relative movement of the sun and earth to predict how shadows might fall at different times of the day. Assuming that the meridian line (or noontime mark) has been established and the gnomon has been angled, we must find a way to mark the hour lines on the dial plate. Create a mathematical model that uses the angle of the sun on the style (top of the gnomon that creates the shadow) to mark hour lines on the dial plate of the sundial. Using angle A as the base angle of the gnomon, and angle t as the angle of the arc the sun passes through in a given time frame, we should be able to calculate angle h by using the length of the resulting shadow. This is illustrated in figure 1.

Figure 1: Shadow used to mark the dial plate



One Possible Solution

Angle t is perhaps the first angle that needs to be defined. Because the earth rotates through a central angle of 360° in 24 hours, we can assume that each hour is defined by a 15° arc of the sun's apparent movement over the surface of the earth. This is true at any longitude. Angle t then measures 15° for each hour away from the noon hour.

1. If the length of the style on the gnomon is known, the vertical side of the gnomon can be calculated as follows: Height = sin A (S) ; where S is the length of the style.
2. At 11:00, angle t = 15°. So, if we want to mark the 11:00 hour on the dial plate, angle h can be calculated by measuring the length of the shadow from the noon mark and subsequently estimating the length of the adjacent side as equal to the length of the style, so that the tangent ratio can be used. The side of the shadow opposite angle h = (tan t)(sin A)S.

3. Also, $\tan h = [(\tan t)(\sin A)S]/S$ since the tangent ratio is opp/adj and S is being substituted for the adjacent side in this ratio.
4. Therefore, our model could be as follows: $\tan h = (\tan t)(\sin A)$.

Because we know the longitude of our specific location, we also know the measure of angle A. Let us assume for the sake of easy calculations that we are at a 30° longitude, and that our style length is 8 inches. Because we are marking the 11:00 hour line, angle $t = 15°$. We need to find angle h for several different hours in order to mark the dial plate appropriately. The following is a test calculation:

1. $\tan h = \tan 15°(\sin 30°)$
2. $\tan h = (.268)(.5)$
3. $\tan h = (.268)(.5)$
4. $h = \tan^{-1}(.134) = 7.63°$

Therefore the 11:00 hour line would lie at an angle of 7.63° to the left of the meridian mark. Also, since the hour marks are symmetrical with respect to the noon mark, it is an angle of 7.63° to the right of noon for 1:00. We could continue in this fashion to mark the rest of the dial plate for each hour of daylight.

Other modeling activities would be used as primers to get the students to the point where they could successfully manipulate the web experiment in such a way as to define an answer. Because students and teachers both like self contained educational packages, much of what is provided on the web page can really help smooth out problems that might arise during the course of the activities. Other hints that create successful web experiments are as follows:

1. Help students define and modeling heuristic similar to that found on page 2 of this paper, and have this listed on the page as they progress through the activity.
2. Create an on-line hint button that directs students when they are off track. This may even be a step by step derivation of a sample approach to the problem.
3. Use data tables on the web page where students can enter the data from their experiments.
4. Provide a virtual notepad where their models can be entered.
5. Have specific objectives that the activity will highlight, but don't be afraid to deviate. Modeling activities sometimes lead us in directions we may not think of, but turn out to be valid solutions.

As in any educational activity, good planning and lesson design are key to successful implementation. It is important to remember that for every minute of planning on the front end, we save ourselves headaches during the activities themselves.

Conclusion

Of course the models being presented here take some time to develop and even more time for the students to research. Workload is perhaps the biggest obstacle when it comes to developing on-line math modeling activities. In addition, students and teachers both need to reconceptualize effective mathematics instruction in order to really embrace a modeling approach. Those students who are comfortable in an environment where a math problem can be done in a matter of a few seconds will need to embrace a more realistic view of "scientific" mathematics. In some cases, the students may not come up with the models that we have intended even after hours of work; however, through careful investigation, and with some guidance, students can learn many things that we haven't even thought about. Yet, it is important to remember that many of the greatest inventions of our times have been accidents. Mathematical modeling though provoking problems appears to be a great way to pave the road to accidental learning, and history has taught us that accidents can sometimes be good!

Technological Tools to Develop Mathematical Problem Solving

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Abstract: Problem-solving processes should extend beyond mere working problems by type where students are provided algorithmic approaches to fit situations (e.g., rate, mixture, coin, investment, work) since reducing these typical problem situations to "algorithmic processing" is counter-productive relative to higher-level problem-solving goals (NCTM, 1989,1991, 1996). By incorporating technological tools (CABRI Geometry II, spreadsheets, and graphing calculators) coupled with the problem solving principles espoused by George Polya (famous mathematician and teacher of mathematics and mathematics teachers), secondary school algebra problems can be taught as recommended by the NCTM curriculum standards to appropriately meet recommended problem-solving goals. Even typical problems can therefore be used to expose students to multiple problem-solving approaches that extend understanding and meta-cognitive abilities.

In the quest to teach Atype@ problems as genuine problems versus exercises as defined by Baroody (1993), technological tools, when appropriately used, bolster opportunities for students to think mathematically. For example, using computer and graphing calculator simulations and spreadsheets, even with typical problems one can expose students to multiple approaches that extend cognitive abilities to learn mathematics concepts, discover patterns, detect relationships between variables, and to apply processes and strategies to explore systems and structures of mathematics. By specifically utilizing George Polya=s (1957) four-step problem solving model and appropriate technological tools, typical Arate@ problems can be explored and solved so that students further their intuitions and knowledge about the interrelationships between mathematical ideas, thereby fostering the learning of problem-solving skills in a responsible and enriching manner.

Paraphrased, in the problem to be solved, entitled **AThe Biker and the Nearby Town Problem@** shown on the next page the goal is to find how many kilometers it is to the town from where Bill started. By utilizing three technological settings: (1) a simulation model programmed in **Cabri Geometry II**; (2) a trial and error simulation model programmed in **Microsoft ExCEL**; and (3) an algebraic and related geometry representation shown in a **TI-83 Graphing Calculator** setting, the traditional Arate@ word problem selected which normally provides a context for using particular formulas or algorithms will be re-visited in such a way that critical thinking will be encouraged In each setting, the aim besides solving the problem, as per Polya=s Problem Solving Model, is to promote better understanding of what problem solving is while concurrently enhancing the learner=s problem solving ability. In the **AUnderstanding the ProblemA** phase of Polya=s model, the problem solver is encouraged to spend time and effort developing an understanding of the problem. Prominent in this, is to identify that which is the goal, what it is that is to be found, proved, accomplished, or whatever. Also among the essentials is to obtain a clear understanding of the given(s) and requirements or conditions of the problem. In the **ADevising the Plan@** phase, it is common that a plan or at least a part of a plan evolves from an understanding of the problem. This may involve knowing relevant definitions (concepts), non-definitional generalizations (axioms, postulates, formulas), principles (generalizations, theorems), skills (operations, processes, algorithms, prescriptions), logical reasoning, and problem solving strategies (heuristic or otherwise) that might be applied, and in what order. Often plans change as steps are carried out (see the next phase) and/or new understanding arises. Thus, one should not restrict this phase to a lock-step position that keeps one from moving on if a complete plan is not known, nor should one erroneously keep from returning to a search for understanding after embarking on this phase. In the **ACarrying Out the Plan@** phase, a systematic, step-by-step guided "straight-line" sequence of operations, deductions, and processes is ideal, but often unrealistic when one is working on a REAL problem. Expect some blockage, some dead-ends, some back-tracking, and so on. Persistence (related to motivation) may be one of the most essential qualities of a problem solver. There is a need to be tolerant of confusion, uncertainty, frustration, errors, and the like. Expect also that new insights and understanding may lead to changes in plans. Assuredly, REAL problem solving is often a dynamic situation. In the last phase, the **ALooking Back@** phase, is the idea of CHECKING a possible solution to see if it really satisfies the requirements of the problem, has the problem really been solved? But, there is more beyond mere checking. Here, one should be encouraged to check if there are other solutions, other strategies for solving the problem, or if applicable, whether there is an extension to the problem. Looking back should not be a mere review of what has occurred to arrive at a solution,

but rather, looking back should allow for additional thought-provoking stimulation about the problem-solving process undertaken. Polya, in his model, views the looking back phase as an opportunity to have the student rise to a higher level of metacognition relative to the problem-solving process in general, as well as to the local subject-specific matter.

The Problem

Bill bikes to a nearby town at 12 kilometers per hour and returns at 10 kilometers per hour. How far away is the town if the entire trip took 3 and 2/3 hours?

A. The Cabri Geometry II Setting

Figure 1

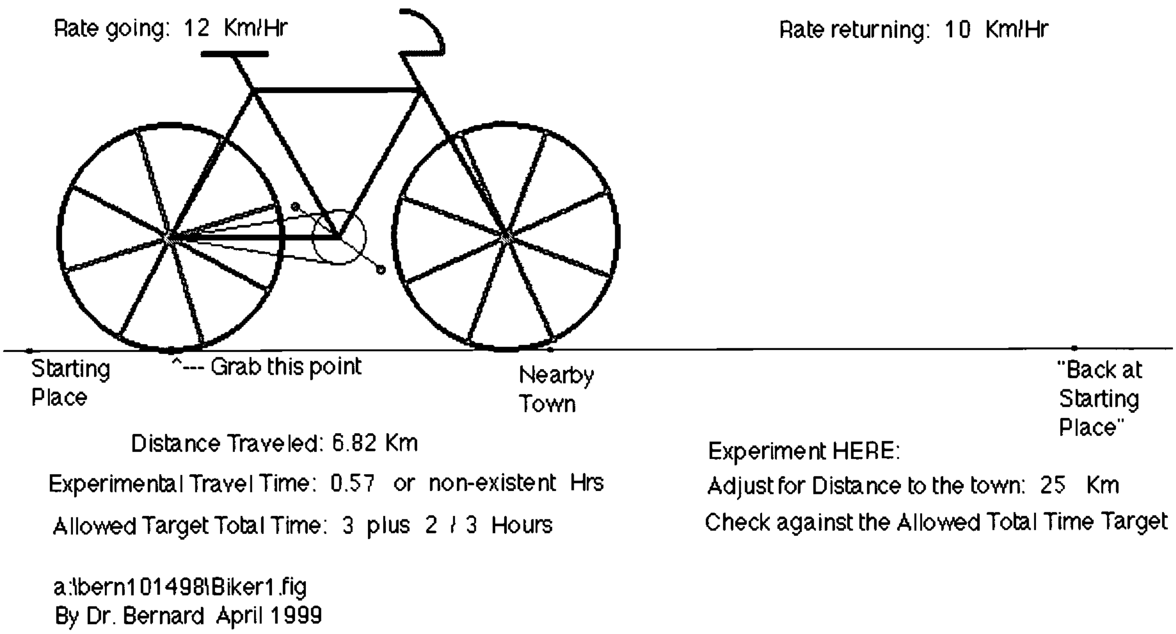

Figure 1, programmed using **Cabri Geometry II** (see Keyton, 1996, Laborder et al., 1994-1997, Vonder Embse, et al. 1994-1997, Vonder Embse et al., 1996) suggests the use of a simulation to depict how Bill, in the problem, might be traveling to the nearby town. The figure makes a major adjustment from reality in laying the trip out linearly and consecutively without overlap. It explicitly shows the two parts, first the part going to the town, then the part returning from the town to the starting point. Other things "fall into place" once viewers have made this adjustment. The model provides for experimenting (guessing) with the distance to the town. Following a given guess, one can then act the trip out using the **Grab** point, a built-in feature in **Cabri Geometry II.** Readouts of the distance traveled and the lapsed travel time (Experimental Travel Time) enable one to evaluate what is happening as the bicycle moves from the starting point to the town and from the town back to the starting point; i.e., over the course of the entire trip. If the distance guess is correct, the dependent total trip time (when the **Grab** point is at the right "starting Point") will match the target total time. Experimenters can distinguish when the dependent time does not match the target total time and separate such into two cases; those when the dependent time is too large, and those when it is too small. One compensates for the former by reducing the distance setting and for the latter by increasing the experimental distance setting (guess).

B. The Spreadsheet Setting

In the first spreadsheet setting (see Spreadsheet #1), **AA = the distance to town traveled at 12 km/hr and B = the distance to town traveled at 10 km/hr@**. Once students understand that the distance to and from town Amust@ be equal they can be encouraged to Aguess and check@ which time to town and from town, at the rates given, yield the

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closest distance between **A** and **B**. This can occur by having students guess, as shown below, in the column denoted by the variable x for the "**Time in hours it takes Bill to bicycle into Town**" and the other information calculated on the basis of this guess. Students and teacher can develop the spreadsheet together, in parts, until Adiscovery@ of the need to approximate the difference between **A** and **B** to zero is developed.

Spreadsheet #1							
Rate	**Time**	**Rate**	**Time**	**Distance**	**Time**	**Distance**	**Distance**
12	**Fixed Total Hours**	**10**	**x**	**A = x/12**	**(3+2/3)-x**	**B = x/10**	**A - B**
Bicycle Speed To Town in Km/hr	**Total Time Held Constant**	**Bicycle Speed From Town in Km/hr**	**Time in hours it takes Bill to bicycle into Town**	**Distance in miles to Town at 12 km/hr**	**Time in hours it takes Bill to bicycle from town at 10 km/hr**	**Distance in miles to Town at 10 km/hr**	**Difference Closest To Zero**
12	3 2/3	10	1.0000000	12.0000000	2.6666667	26.6666667	-14.6666667
12	3 2/3	10	1.3333333	16.0000000	2.3333333	23.3333333	-7.3333333
12	3 2/3	10	1.6666667	20.0000000	2.0000000	20.0000000	0.0000000
12	3 2/3	10	2.0000000	24.0000000	1.6666667	16.6666667	7.3333333
12	3 2/3	10	2.3333333	28.0000000	1.3333333	13.3333333	14.6666667

In the second spreadsheet (see **Spreadsheet #2**) that follows, a different approach to Aguessing and checking@ occurs. The guess is for distance to the town being varied until the total time given, 3 and 2/3, is reached after multiple guesses at the rates provided. This approach coincides with the **Cabri Geometry II** simulation shown previously.

Spreadsheet #2					
Distance	**Rate**	**Rate**	**Time**	**Time**	**Total Time**
X	**12**	**10**	**x/12**	**x/10**	**x/12 + x/10**
Guess (distance in Km to town)	**Bicycle Speed To Town in Km/hr**	**Bicycle Speed From Town in Km/hr**	**Time in hours it takes Bill to bicycle into Town**	**Time in hours it takes Bill to bicycle back from Town**	**Time in hours it takes Bill to bicycle to and from Town**
1	12	10	1/12	1/10	11/60
2	12	10	1/6	1/5	11/30
3	12	10	1/4	3/10	11/20
4	12	10	1/3	2/5	11/15
5	12	10	5/12	2	11/12
10	12	10	5/6	1	1 5/6
12	12	10	1	1 1/5	2 1/5
15	12	10	1 1/4	1 2	2 3/4
20	12	10	1 2/3	2	3 2/3

C. The TI-83 Graphing Calculator Setting

Using a **TI-83 Graphing Calculator** (see Texas Instruments Guidebook, 1996), techniques that are similat to the spreadsheet methods shown above can be used. In this case, a method referred to as the **AIntersection Method@** for solving a system of equations has been utilized. The equations $\mathbf{Y_1 = 3 + (2/3)}$ **and** $\mathbf{Y_2 = X/12 + X/10}$ (where **X** is the varying guesses for distance) shown in **Figure 2** represent the target total time to and from the town and the partial times necessary to travel to town and back, respectively. After graphing the equations (**see Figure 3**), the intersection point **(20, 3.6666667)** indicates that when the distance is 20 miles to and from the town, the exact total time traveling to and from town is 3.6667 hours (an approximation to 3 and 2/3). Using the **TRACE** feature of the **TI-83 Graphing Calculator** to Atravel@ along the linear graph of $\mathbf{Y_2}$ toward the horizontal line $\mathbf{Y_1}$ helps to visualize the relationship between the total time and the partial times, **as X or distance varies**, to and from town. **Figure 4** obtained using the **TABLE** feature of the **TI-83 Graphing Calculator** captures this same relationship by denoting the incremental changes between total time and partial times as distance varies. This is a powerful way to bridge algebra and geometry to solve problems!

Figure 2.

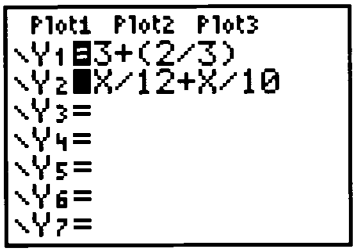

Figure 3.

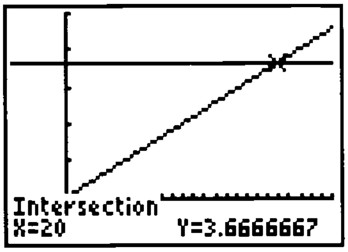

Figure 4.

X	Y1	Y2
15	3.6667	2.75
16	3.6667	2.9333
17	3.6667	3.1167
18	3.6667	3.3
19	3.6667	3.4833
20	3.6667	3.6667
21	3.6667	3.85

X=20

Regarding The Problem-Solving Phase

In either setting, or cumulatively, **understanding** began as a result of a diagram, table of data, graph, and or probes, and continues throughout. What can we say about the nature of the answer? We can say that it is a number. Moreover, it cannot be negative and is unlikely to be zero; so it must be some non-negative real number (imaginary numbers would not make sense in this situation). Distance is a kind of measure and non-negative real numbers are the kind of numbers used for measures. **More understanding;** but first a **devising a plan** idea - That algebra can be used to solve this problem; specifically, this is a place where a letter may be used to represent the unknown. The letter, in this case, serves as a "pronumeral," that is, a symbol representing a number. Here the interpretation may be that of a fixed unknown number rather than a variable, per se. Let d correspond to the number of kilometers measured from Bill's starting point to the town.Thus, d 0 {x 0 Y | x > 0 }, where Y represents the set of real numbers. **More understanding** (real-world knowledge): The problem mentions the entire trip, this includes Bill's traveling to the town and the return trip from the town to where Bill started. From the fact is that the distance for the return trip is the same as that for initial trip, we can conclude that the return trip was d kilometers as well, and that the distance measure for the entire trip was d + d or 2d kilometers. **More understanding** (more real-world knowledge): We should not only think about kilometers of distance since the problems, in addition, also mentions time/hours of travel - "the entire trip took $3\frac{2}{3}$ hours." Our real-world knowledge tells us that this is made up of the time it took to travel from the starting place to the town, plus the time for the return trip; the $3\frac{2}{3}$ is the sum of two other numbers/times. **More understanding**: Reflecting on the information generated thus far, we seem to have two disconnected pieces/ideas. The first part talks about three related distances. The second part talks about three related times. What we seem to need is some connection between these two things (some way to "bridge the gap", this is a problem-solving meta-level notion or heuristic. The solver "sees" that this problem has a "missing link" or "gap to be filled" quality to it, and brings into play problem-solving organizational and planning strategies to make the connection/fill the gap.). **More Understanding** (prior knowledge): Prompting recall, we need to "hit" on a relationship that involves distance and time. This relationship need not be to the exclusion of other entities/concepts; we just need one or more relationships whose ingredients include distance and time. This need (sub-goal) identified may be enough to activate the solver's memory, bring to mind some such relationship as "distance is equal to rate times time." Should this not naturally occur, perhaps that potential solver never learned the principle or temporarily experiences recall difficulties at a particular point in time, more consciously controlled or directed mental processing activities may be generated. This is a carrying out the plan item for the particular sub-goal, within the activities for solving the problem as a whole. However **memory is activated** or even if the solver gets help or looks up/finds the relationship in a book (on the internet, or whatever) is not of concern for this discussion, only that it (the relationship "rate times time equals distance") does surface. **Variations are acceptable,** from "rt = d" to $\text{Time} = \frac{\text{Distance}}{\text{Rate}}$; whatever equivalent forms one might generate (restricted to avoid division by zero and negative numbers for measures). The formula/relationship $\text{Time} = \frac{\text{Distance}}{\text{Rate}}$ provides a mental frame or "template" that can and should be applied in at least two ways in this problem, for the time traveling from the starting place to the town and for the time of the return trip; measured in hours. Thus, we have the following execution (**carrying out the plan**) activity.

More understanding coupled with carrying out part of a plan:

The time going $= \frac{\text{The distance to the town}}{\text{The rate traveled going}} = \frac{d}{12}$ and The time returning $= \frac{\text{The distance from the town}}{\text{The rate traveled returning}} = \frac{d}{10}$.

More understanding, "seeing" mental connections and acting to integrate the "pieces of the puzzle" that fit together (**carrying out the plan**):

The latter two specific instances of the time and distance relationship connect to the real-world knowledge mentioned earlier citing that the total time is equal to the time going plus the time returning (which itself is semantically equivalent to the equation: The time going + the time returning = the total time). Instantiating more concretely, we have

$$\frac{d}{12} + \frac{d}{10} = 3\frac{2}{3}$$

At this point in time, a major problem sub-goal has been attained. Whether stated explicitly or left implicit, **producing a model** equation involving the unknown and givens in a valid solvable relationship is part of the algebraic problems solving method/strategy. In essence, this "translates" the problem from one expressed in words (in this case) to one expressed in the "realm" of algebra. Solving the problem is thereby reduced to solving an equation (here, a linear equation in one unknown) which is a skill that is an object of learning in the algebra curriculum.

Carrying out the plan has been going on already. At this point in time, however, an appropriately educated/trained solver might exhibit relatively routine activity in a relative short time. Say:
$\frac{d}{12} + \frac{d}{10} = 3\frac{2}{3}$ >–[Multiplying through by the LCM 60]→ $5d + 6d = 220$ >–[Adding like terms]→
$11d = 220$ *and* $11d = 220$ >–[dividing by 11]→ $d = 20$. Here again, **a sub-goal has been reached within this problem-solving episode**. Interpretation mental activity takes over, noting that unknown value d stood (stands for) 20 has been revealed. Thus, 20 is the number of kilometers distance from the starting place to the town.

Looking Back: Looking back includes, but is **not limited to checking**. Checking will be followed by additional **Looking Back** ideas.

Checking: Here, checking might take the form of critically re-reading the problem in "light" of now knowing that the town is 20 kilometers from the starting point. In the critical re-reading process, one might do associated computations that reveal the specific values of other conceptually defined and formerly not known values. To illustrate: Bill bikes to a nearby town >–[now becomes]→ Bill biked 20 kilometers. He did this at 12 km/hr. Hence, it took him $\frac{d}{12} = \frac{20}{12} = \frac{5}{3} = 1\frac{2}{3}$ hours to bike to the town.

Bill returns by bike from the nearby town >–[now becomes]→ Bill biked 20 kilometers, this time at 10 km/hr. Hence, it took him $\frac{d}{10} = \frac{20}{10} = 2$ hours to return from the town.

Our real-world knowledge directs us to add these two amounts, giving us $2 + 1\frac{2}{3} = 3\frac{2}{3}$ hours; which is consistent with the given total time. Observe that revealing 20 as the value of d is consistent with the understanding the d be an positive real number. **Checking may take or include other forms** such as checking the steps in the algebraic solution of the equation, but consider checking for this presentation to now be completed. **Looking Back** includes seeing the solving of this problem in the bigger context of solving problems. One can sub-categorize this problem as one which can make efficacious use of elementary algebraic structures (a model equation) and processes. It demonstrates the value of the "try using algebra" problem-solving heuristic. **Looking Back** includes transfer, both near and far. The following item might seem routine (near transfer) for someone who was able to develop the above solution.

An airline flight to a certain airport travels 500 kilometers per hour and returns at 550 kilometers per hour. How far is the airport if the entire trip took 11 hours?

To add some transfer distance, consider the item and comments that follow.

Bill bikes to a nearby town at 12 kilometers per hour and returns at 10 kilometers per hour. If the town is 20

kilometers away, how long did the entire trip take? [Like the variation before this, roles are switched. Here, the formerly unknown distance is now given, and the formerly known time is now unknown.

Overall, what=s important in promoting NCTM=s problem-solving goal is not that technology has been used, but that it has been used appropriately. As in the activities suggested by this paper, sufficient and appropriate utilization of technology ought to be the norm rather than the exception if one is to meet the goal proposed.

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The *Graph* System for Function Graph Construction

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Abstract: The system *Graph* intended for drawing of the function graphs is described. The general algorithm of the graph drawing is described. The function can be set in an explicit, implicit, parametric form and as a sequence of the more simple formulas. With drawing the asymptotes of graph and the limits of function in points specified by the user are calculated. For the analysis of the graph (allocation of maximums, minimums and inflections) derivatives of function can be calculated in an analytical form. The allowable elementary transformations above the constructed graph are listed. The resulting figure can be made out as the appropriate file for the most popular textual and graphic editors. The function and its derivative can automatically be presented as the descriptions in languages C++, Fortran and Pascal. In system there will be a library of frequently used functions, set of the helps and recommendations, and also mode of examples demonstration. The system Graph is realized in language C++ under Windows 95/97/98.

Introduction

The function graph is powerful and convenient tool for research of functional dependencies in mathematics and applications. The graph drawing is widely used in various activities at schools, colleges, universities, R&D institutes, in business, in a science, industry etc. This activity is realized in many applied programs, for example, in (Baiakovski et al., 1985), and also in a number of universal systems of numerical and analytical manipulations (Mathematica, 1989, MATLAB, 1979). The universality and the multipurpose of such systems results that the user is compelled in the beginning honesty them to study, and only after that he/she be able to modest solve the simple task - to draw the graph of interesting his/her function. (For example, the *Mathematica* user's guide occupies 1400 pages).

The purpose of our work - to create the simple and effective system for graph drawing not requiring any appreciable efforts to its mastering by the novice. At the same time for the experienced user a lot of additional possibilities allowing to build and to analyze the complex graphs of functions and to represent result in a convenient form is offered. It is permitted to make some transformations over graph for reception of the required image or analysis of function. The system will be realized in two variants: *school*, destined for the beginners, and *basic*, in which all opportunities of system will be accessible. The *Graph* system will work in a semi-automatic mode and addresses to the user in inconvenient situations at the help. Basically it occurs with updating of the singular points and work to infinity.

The system will have the built-in library of the most widespread functions, in which for each function will be given its formula, graph with some typical values of parameters and brief explanation. The library will consist of two parts: libraries of school functions (algebraic functions, trigonometrical functions and inverse to them, exponent, logarithm, power, hyperbolic and other functions) and basic library (special functions).

The *Graph* system will have the interconnected set of the helps and demonstration examples. There will be rich means of polygraph representation of the graphs for the most popular textual and graphic editors.

Construction of Function Graph

The process of graph drawing consists from the following steps:

1) To determine domain of function definition.

2) To calculate the singular points, points of maximum and minimum, points of inflection and points of function discontinuity.
3) To calculate asymptotes vertical, horizontal and sloping. To find limits of function in the chosen points, including indefinitesses of a kind 0/0, ∞/∞, $0\cdot\infty$, $\infty-\infty$, 1^{∞}, 0^0, ∞^0.
4) To set the sizes of the graphs, to draw axes to put inscriptions.
5) To draw the graph of function.
6) To edit a figure before printing or insert in the document.

The domain of definition. The *Graph* system calculates the domain of definition for what writes out restrictions on argument of function: the denominator is not equal to zero, the argument of the "log" function is positive, the subradical expression for a root of an even degree is non-negative etc. For example, for function $y = [(2x - x^4)^{1/2} - x^{1/3}] / \log(1 - x^{3/4})$ the *Graph* system will give out inequalities $2x - x^4 \geq 0$, $\log(1 - x^{3/4}) \neq 0$, $1 - x^{3/4} > 0$ and also will ask the user to refine domain of function definition. By solving inequalities, the user can receive restrictions on allowable values of argument, i.e. the segment $[a, b]$, on which the function is given, can appear broken on smaller segments $[a_1, b_1]$, $[a_2, b_2]$, ..., $[a_n, b_n]$, on which the function is meaningful and can be calculated.

The singular points and function breaks points, points of maximum and minimum, points of inflection and points of function discontinuity are defined. The points of a maximum and minimum, and also point of inflection are calculated with use of the first and second derivatives.

The calculation of asymptotes vertical, horizontal and sloping. The parameters k and b of sloping asymptote $y = k\cdot x + b$ calculated on formulas

$$k = \lim_{x\to\infty} f(x)/x, \quad b = \lim_{x\to\infty} [f(x) - k\cdot x].$$

The uncovering of indefinitesses 0/0, ∞/∞ and others with use of l'Hospitale's rule is made up in a semi-automatic mode, when the user can see intermediate result and to operate the analytical calculations.

The setting of the graph sizes, drawing of coordinate axes and inscriptions. Before drawing of the graph it is necessary to specify its sizes, to draw axes of coordinates, to choose types of scales for axes of coordinates (usual, logarithmic, half-logarithmic), to superscribe numbers on them, to set drawing a coordinate grid, if it is necessary. The graph can be supplied with inscriptions and explanatory text.

Drawing of the graphs. The *Graph* system works in a dialogue mode and can simultaneously build the graphs of two functions $f(x)$ and $g(x)$ in two different windows or in one window by superposition. The graphs are drawn in Cartesian coordinates.

The function can contain no more than one parameter. The *Graph* system can build family of the graphs with various values of parameters. Each graph is represented by a curve, at which the color, thickness and type of a line (from an offered set) are easy selected.

The system updates simultaneously two functions, which graphs can be imposed one on other. It is convenient for the various purposes, for example, for the approached definition of roots of the equation $f(x) = g(x)$.

The function is set analytically in one of the following forms:

1) Explicitly, as $y = f(x)$, $a \leq x \leq b$.
2) Parametric, as $x = X(t)$, $y = Y(t)$, $a \leq t \leq b$.
3) Implicitly, as $f(x, y) = 0$, $a \leq x \leq b$ or $c \leq y \leq d$.
4) It is possible to set function as consecutive of formulas. For example, the function $f(x)$ can be set as $u(x) = (x-1)/(x+1)$, $v(x) = \exp(2*u-x*\partial)$, $f(x) = u$^2-3*sin(v)+∂, where p is a parameter.

Edition of a figure for printing or insert in the document. The user can transform a figure to a textual or graphic file of the appropriate textual or graphic editor. It is supposed to use such formats, as .doc, .rtf, .pdf, .bmp, .html, .pcx, .gif, .jpg. It is possible also to convert symbolic expression for function and its derivatives into a textual file of WinWord, Word Perfect, Latex, Adobe Acrobat etc. The *Graph* system can translate the function definition and its derivatives in languages C, Fortran, Pascal.

We will demonstrate an example of work of *Graph* system. Let user needs to select parameters a and b by such, that the equation $a/(1+x^2) = b\cdot \sin(x)$ had two positive roots on [-3, 3]. With the help of an input field "f = " in the bottom part of a window (see Fig. 1) user sets the first function "f = a/(1+x^2)" and in a field "[f] = " specifies its limits of change " 0, 4". The trial value of parameter a, equal "4", is set in an input field "prm = ". The second function "g(x) = b*sin(x)" and corresponding parameters is similarly given. In a field "[x] = " the segment, interesting for the user, [-3, 3] is set, in which the limits of functions $f(x)$ and $g(x)$ are analyzed. Then

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the graphs of these functions are drawn: $f(x)$ in left window, $g(x)$ in the right one. Finally after pressing a key "g→f" the graph of function $g(x)$ is lain on the graph $f(x)$. Resulting picture is shown on Fig. 1. It is obviously, that with values of parameters $a = 4$ and $b = 2$ there are two positive roots of the analyzed equation on a segment [-3, 3]. (Note: In an input field "df/dx = " the symbolic record of derivative f(x), received by the user on one of stages of processing f(x), was stored).

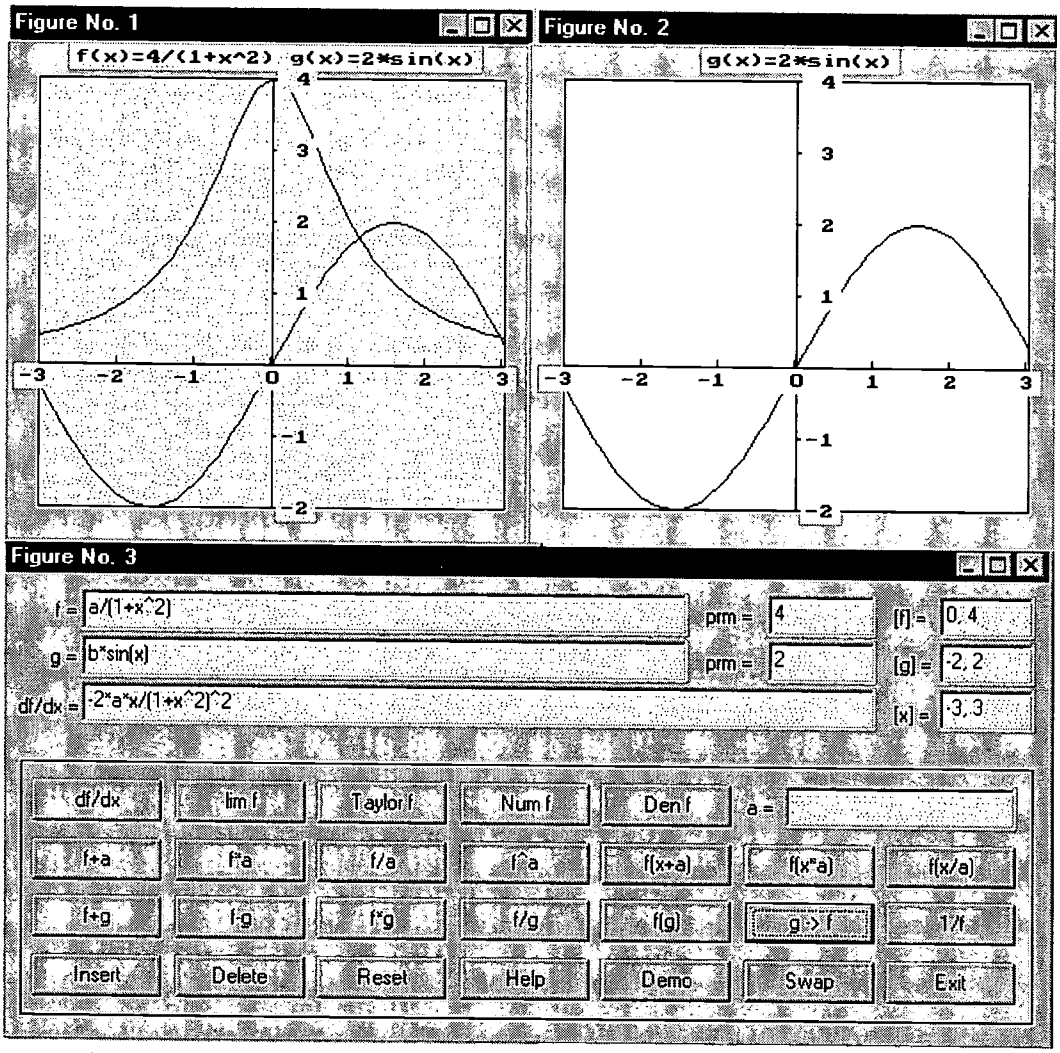

Fig. 1: The example of work of *Graph* system

Transformations of Functions and Graphs

It is possible to execute simple transformations above function and its graph with help of the ñîntrol menu (see Table 1). Such transformations are necessary in themselves, and also for the purposes of training of pupils and students at schools, colleges and universities. All transformations are carried out above function f(x). However, by changing f(x) and g(x) by button "Swap", it is possible to execute necessary transformations above function g (x).

Button	Action (*a* is given value)	Button	Action (*a* is given value)
df/dx	To differentiate function $f(x)$	f(x / a)	To replace on $f(x / a)$
lim f	To calculate a limit of $f(x)$ at $\tilde{o} \to \grave{a}$	1 / f	- " - $f(x)$ on $1/f(x)$
Taylor f	To expand out $f(x)$ in Taylor's series	f + g	- " - $f + g$
Num Den	To extract from $f(x)$ numerator and denominator of rational expression	f − g	- " - $f - g$
f + à	To replace $f(x)$ on $f(x) + a$	f * g	- " - $f * g$
f * a	- " - $f(x) * a$	f / g	- " - f / g
f / a	- " - $f(x) / a$	f(g)	- " - $f(g)$
f ^ a	- " - $f(x)$ ^ a	g → f	To lay $g(x)$ on $f(x)$
f(x + a)	- " - $f(x + a)$	Swap	To swap the functions $g(x)$ and $f(x)$
f(x * a)	- " - $f(x * a)$		

Table 1: The list of transformations over functions and its graphs

The *Graph* system stores in inner list (with name f_list) the restricted set of functions and their graphs, with which the user worked earlier and has stored for future use. The set of actions above this list is given in table 2.

Button	Action	Button	Action
Insert	To insert current function in f_list	Show	To show selected function from f_list
Delete	To delete selected function from f_list	Reset	To set f, g and f_list in an initial state
Help	To give out the help or explanatory	Demo	To run a demonstration example
Exit	To finish work and to exit from system		

Table 2: The set of actions over f_list

Debugging of the *Graph* system nowadays is completed. The system is designed on language Visual C++ and will work on IBM PCs under Windows 95/97/98.

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San Antonio Technology in Education Coalition: A Mathematics and Technology Curriculum Integration And Staff Development Project

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Abstract: SATEC seeks to connect student learning to concrete experiences through the seamless and appropriate integration of technology into instruction. A training and application model is being piloted in the coalition's critical need area of mathematics through a hands-on, data-driven approach to the learning of mathematical concepts using such tools as computer-interfaced probes, image analysis software, and spreadsheet based simulation activities. While radically changing the environment of the teaching/learning process for mathematics, these tools are allowing teachers to introduce students to concepts by permitting them to discover patterns in their own collected data. The previous focus on skills has shifted to a focus on concepts and connections to the real world.

Introduction

Many adults who took high school algebra remember calculating the slope of a line from a memorized equation: m=¯y/¯x. Unfortunately, few learned the applications of m or understood the concept of slope. Though this abstract approach was deemed adequate for some children, most of today's students are not responding to this approach, and they are not learning. For example, only 17% of students taking Algebra I in the San Antonio Technology in Education Coalition (SATEC) target schools passed the state mandated End-of-Course Algebra I Exam in 1996. We believe that sound teaching begins with questions about real events that are interesting and familiar, not with abstractions out of context. Students cannot learn to think critically, analyze information, make logical arguments, explain natural phenomena, or work as part of a team unless they are often permitted and encouraged to do so. When students connect their learning to concrete experiences, they develop a foundation for understanding more complex ideas. Because computers help to rapidly collect, organize, and analyze data, technology enables students to quickly and easily replicate time consuming and laborious experiments. Inductive reasoning is used more frequently when students collect their own data and make generalizations about properties and events in the natural world. This approach allows students to grow in their ability to make observations and generalizations, reason logically, manipulate symbols, and derive formulas. The ability to communicate abstractions and to connect that kind of reasoning with the world around them makes students more likely to succeed in a society that demands problem solving rather than repetitious tasks.

Over the past twenty years educational institutions have embraced technology as a means to improve school and student performance with a major emphasis on hardware acquisition and on building a sophisticated network infrastructure. Only recently has there been a realization that staff development and quality curriculum modules are important components of successful technology curriculum projects. We cannot expect technology alone to impact student performance. Knowledgeable, well-trained teachers must participate in the development of rich curriculum that incorporates technology where it is appropriate to do so. Putting computers in the classroom of an unmotivated and untrained teacher may do more harm than good. It is certainly not cost effective. While our project is in the preliminary stages of data collection, we are able to suggest several outcomes from our study.

Suggested Outcomes

First, technology training for the teachers out of the context of curriculum content does not transfer in to appropriate integration of technology tools into teaching. Many teachers do not see the relevance of the tools to their instruction unless they are given sample lessons to work through as the venue in which the technology tool is taught. Second, since most teachers have been trained in presenting pencil and paper algorithms, the transition into conceptual learning in very difficult for them. We are also seeing that when faced with a concept to explore and no exploration lesson readily available, the teacher will abandon conceptual learning aided by technology and return to the comfort zone of teaching a pencil and paper process. Third, many teachers are deficient in mathematical content. Asking teachers to let students explore the bigger picture of how all the concepts fit together is not part of their comfort level. Usually this is due to the fact that mathematics teachers have traditionally asked students to imitate and memorize procedures to accomplish disconnected tasks. Our staff development always includes the "bigger picture." Fourth, teachers are limited in their understanding of mathematical application to the real world. We feel this is primarily due to the fact that teachers have been trained to use procedures to produce solutions to abstract mathematical problems. Consequently, all of our training is done with respect to a real world application. Fifth, professional development must model the methods the teacher is expected to reproduce in the classroom. Teachers must experience the training in the same way with the same materials that we expect them to use with the students. Finally, teachers must be held accountable to implement what they have learned in the classroom. We are attempting to accomplish this with actions plans and with commitments to use the things learned in professional development in an actual lesson with in the month of attending training.

Sample Activities

The following activities are two of the units we use to work with teachers. They are expected to then use these materials with the students in their classroom. The teacher is actively engaged in using the tools the student will be using to complete the lesson. The activity called "Letter of the Law" provides teachers with training and experience in the use of a motion detector. During the training, the trainer uses questioning techniques that mirror those the teacher will be expected to use in the classroom. The central concept covered in the lesson is mathematical functions. The second activity, "Life Expectancy," incorporates the use of a software piece called Graphical Analysis. With this software the teacher is expected to create a scatter plot with a given set of data. Next the teacher will work with creating an equation that best models the data. Central to the lesson is the concept of correlation.

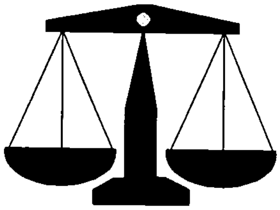
As you examine the activities, you will notice that our training models the points we have mentioned above. We mention them again for reinforcement:

- Teachers learn to use the technology tools in the context of a lesson they will use.
- Mathematical concepts are stressed throughout the lessons.
- The rich discussion by the trainer during the training session improves teacher content knowledge.
- The lessons are drawn from real world experiences.
- The training experienced by the teacher models the way the lesson should be presented to children.
- The teacher will be expected to present the lesson in a class.

Conclusion

We believe that training accomplished in this way will improve teacher self-confidence and content knowledge. Teacher growth in these areas will improve their ability to provide instruction in the classroom that engages the students. Improved instruction in which the students are working instead of watching will result in improved student achievement.

Letter of the Law



Objective

In this activity, you will

- Use the motion detector to create graphs that resemble letters of the alphabet.
- Predict which letters of the alphabet you can make using the motion detector.
- Analyze why you can do some but not other letters.

Setting up your experiment
- *Logger Pro* Program
- ULI with Motion Detector connected.

Instructions:
1. Launch *Logger Pro* on the computer (Make sure the ULI is properly connected)
2. Open the **Motion Detector** file.
3. From the **Window** menu, select **New Graph**.
4. Stand about five feet from the motion detector.
5. Start collecting data.
6. Move in the appropriate directions to make the letter V on the data collection screen (This may take several attempts).
7. What direction(s) did you move in order to create the letter V? ____________________

____

8. Repeat Steps 1- 3 to create an **M**.
9. What direction(s) did you move in order to create the letter M? ____________________

____

10. Predict what direction(s) you should move in order to create the letter W? ________

____

11. Try out your suggestion to see if the letter W is drawn.

12. Make a sketch in the empty space at the right of what graph appeared when you followed your instructions.

13. Predict what actions would you have to take to make a P. ____________________

____

14. Try out these actions to determine if you were correct. Were you?____________________

15. What are some other letters you could make?____________________

16. What are some other letters you could not make? ____________________

17. Describe why you could not make the P but you could make the V, M and W.

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Correlation Study: Life Expectancy

LIFE EXPECTANCY		
Year	**Male**	**Female**
1900	49.6	49.1
1910	50.2	53.7
1920	54.6	56.3
1930	58	61.4
1940	60.9	65.3
1950	65.3	70.9
1960	66.6	73.2
1970	67.1	74.8
1980	69.9	77.5
1990	71.8	78.6

Data from
Parade Magazine,
"Must We Age?"
Hugh Downs, 1994
Used by Permission

1.Double click on the icon for **Graphical Analysis** on your desktop.

2. Label the axes appropriately. To do this, click once on the blue X in the Data Table window. A **Column Options** window will appear. Type the word **YEAR** and hit the **Return** key on your keyboard. Repeat the procedure for the Y-axis Label but use the words **LIFE EXPECTANCY**.

Which is the independent variable? Explain.______________________________

____

Which is the dependent variable? Explain.______________________________

____

3. Input data for *either* gender on the x-y table. To do this, click once in the first cell of the left-hand column of data. This is cell X1. Type in the number for the first year reported in your data set, 1900. You may use left and right arrow keys to move from cell to cell or you may use the **Return** or **Enter** keys to move from cell to cell. Experiment with these keys to find a method that works well for you. Enter the rest of the data - **year** in the X column and **life expectancy** (*either* male *or* female) in the Y column. The points will automatically be plotted on the graph.

Looking at the data table, what do you notice about the life expectancy as the years increase from 1900 to 1990?______________________________

4. When examining how variables relate to each other in a scatter plot, you are studying **CORRELATIONS**. There are three types of CORRELATIONS (relationships between variables): positive correlation, negative correlation, or no correlation.

Positive Correlation As the values of one variable increase, the values of the other variable also increase.
Negative Correlation As the values of one variable increase, the values of the other variable decrease.
No Correlation As the values of one variable increase, you cannot tell if the values of the other variable are increasing or decreasing.

Identify the type of correlation illustrated in your scatter plot.__________________

5. Give two other examples from your experiences of this type of correlation.________

____

____

6. Identify the domain and range for the data displayed in the scatter plot.

DOMAIN____
RANGE____

- Change the scale for your "x-values" by clicking on the last value at the right. Replace this value with 2050. Repeat this procedure for the "y-values" and replace the value with 110.
- Title the graph. To do this, select **Double click on the title. After the current title,** type the gender you selected (male or female) and then type a dash followed by your initials.
- From the **File** menu, Click on **Print** and choose **Selected Display.**

Using a straight edge, draw a **Line of Best Fit** on your graph and use it to answer the following questions.

7. According to this information, what is the best prediction of the Life Expectancy for your gender in the year 2000?____________________

8. According to this information, what is the best prediction of the Life Expectancy for your gender in the year 1958?____________________

9. What is the best prediction of the Life Expectancy for your gender in the year 4 B.C.?________________

____

Double click on your Data table window. Click **Edit** and choose **Select All.** Now hit the icon containing R= at the top of the screen. Notice how the computer creates a **Line of Best fit.** Now select **Analyze,** and click **Interpolate.** ***Using your cursor, scroll up and down the line of best fit.*** With the aide of this feature, answer the following questions:

10. What is the best prediction of the Life Expectancy for your gender in the year 2000? How does this compare to your previous answer?________________________________

____

11. What is the best prediction of the Life Expectancy for your gender in the year 1958? How does this compare to your previous answer?________________________________

____

Click **File** menu. Select Exit. **DO NOT SAVE ANY PREVIOUS DATA.**

NEW MEDIA

Section Editor:
Sara McNeil, *University of Houston*

This is my sixth year introducing this section of the SITE Annual, and every year I am renewed both academically and creatively by the papers in this section. This year is no exception. In this section you will see that the authors have approached the subject of multimedia in many diverse ways. In the preface to the book, Integrating Educational Technology into Teaching, Roblyer and Edwards and (2000), state: "As we stand at the edge of this new millennium, gazing out into its uncharted expanse, some of us feel as if we are stepping out onto a launching pad; others feel at the brink of an abyss. Some see the challenges and marvels to come and are exhilarated; some see only the certainty of change and its uncertain outcomes and are apprehensive. How amazing it is that the influence of technology is a primary force shaping both perspectives." (p. v). These authors are certainly standing on the launching pad. I've organized the papers in this section around four themes involving multimedia: assessment, design and development, tools, and distance learning.

Assessing Learning with Multimedia

This year, the New Media section contains five papers that describe and document different methods of assessing student learning with multimedia tools. Three papers specifically describe and discuss the rationale for and creation of electronic portfolios. For many of us, who are just beginning to use electronic portfolios, these articles provide an excellent description of both the process and current literature about creating and effectively using electronic portfolios. These papers illustrate the many roles that portfolios have in complimenting the teaching certification process, providing information for special endorsements in educational technology, helping educators demonstrate state and national teaching standards, and guiding long-term professional development.

Helen Barrett, University of Alaska Anchorage, discusses two bodies of literature that guide electronic portfolio development: multimedia development and portfolio development. She cites the benefits of portfolio development, which include developing the multimedia technology skills of both teachers and students and contributing to professional development and life-long learning. Barrett also describes five stages of electronic portfolio development and illustrates the different levels for digital multimedia development and electronic portfolio development that are closely aligned with the technology skills of the student or teacher portfolio developer. For each stage, Barrett has identified the tasks and appropriate technology tools. This article provides an excellent step-by-step guide for others who are interested in using electronic portfolios as a means of assessment.

Melissa Pierson and Siva Kumari, University of Houston, summarize initial plans to implement Web-based portfolio assessment for graduate students in the Instructional Technology program. They outline the goals for implementation that include a plan for informational seminars, criteria for item selection, portfolio components, anticipated barriers, and the role portfolios will play in the graduation process for students. One of the most important reasons for using portfolios, they state, is that it reflects a jointly negotiated process, reached by the teacher and the student, that entails detailed discussions and customized evaluation of learning. This paper also provides an excellent review of the electronic portfolio literature.

Dennis Holt, University of North Florida, reports on the development of multimedia portfolios by pre-service teachers who have completed their undergraduate internship. The portfolios were created in PowerPoint and depict the accomplishment of select Florida Sunshine State Standards. Holt also describes the participants and important outcomes of the Technology 2000 project, a collaboration between the University of North Florida and the Duval County Public School District in Jacksonville, Florida.

Lynda Abbott, Holly Siskovic, Val Nogues, and Joanne Williams, University of Texas at Austin, discuss learner assessment in multimedia instruction and the related considerations for the instructional designer. They state that the most critical issues for instructional designer are those regarding how best to plan, present, and evaluate objectives and outcomes for both computer-based and Web-based instructional materials. This article provides an overview of several factors to consider in the assessment process including portfolio and project assessment ideas. The authors emphasize the role of the instructional designer in

establishing educational objectives and selecting appropriate assessment instruments and procedures.

Finally, Fern Tavalin and David Gibson, the WEB Project, describe the construction of simple assessment tools to foster improvement by focusing on discussions that lead to high quality work and sustained professional growth. Tavalin and Gibson describe the development of successful advanced technology strategies in three broad areas of work: developing and using online assessment systems, achieving high quality work, and sustaining professional growth. Their description is illustrated with examples of student work that provides a clear link between theory and practice.

Multimedia Design and Development

Five papers in the New Media section report specifically on the design and development of innovative multimedia projects. These examples are certainly imaginative and provide exciting examples of multimedia product development. Even though each project is very different both in content and purpose, all projects have several things in common. First, collaborative teams complete the design and development of each project. In addition, each project developed strategies for understanding the needs of the target audience. Finally, formative evaluation is a critical element of each project throughout the design and development process.

Stephen Victor and Sherry Vafa, University of Houston, describe the design and development of an interactive multimedia project for library research. A collaborative team of instructional designers, content experts, and media consultants used Authorware to develop the program for a faculty member who served as a client. The authors describe the program that uses multimedia elements, interactivity, Web-based media, and games to enhance the learner's experience of the instruction. Illustrations of the interface are included to provide a complete description of the program. The paper also briefly discusses the use of interactive multimedia for instruction.

Tomohiro Miyamoto, Tsuneo Yamada, and Yuko Hiraga, the National Institute of Multimedia Education in Japan, and Delwyn Harnisch, University of Illinois at Urbana-Champaign, describe the development of a prototype of counseling materials on DVD-video to assist in the training of both college students and in-service teachers learning counseling skills. Like the previous paper, this project is also a collaborative effort of multimedia developers working with professional teaching/counseling experts. The prototype provides a multilateral learning environment for students to observe and analyze the counseling process and includes multi-angle scenes depicting client, counselor, and complete classroom views for three counseling cases. A flowchart of the project is provided as well as screen shots. The authors note that it is important for users to be presented with several examples of how to use the educational materials rather than to be provided a single model.

Marlo Steed, University of Lethbridge, Canada, describes an ongoing research project that uses a set of formative evaluation activities involving peer and target population evaluation. These activities are designed to help students involved in multimedia production to develop a greater sense of audience. Peers as well as individuals from the target population will review multimedia projects, and changes and non-changes to the design will be documented. Steed describes the manner in which data will be gathered and categorized and speculates that feedback from an audience is a powerful influence on implementing changes to multimedia.

Peggy A. Ertmer, Sangeetha Gopalakrishnan, and Eva M. Ross, Purdue University, describe VisionQuest, a project to help current and future educators envision and achieve technology integration by providing access to electronic models of technology-using teachers. The authors discuss both the development and organization of the VisionQuest CD-ROM, which includes six case studies that illustrate the beliefs and practices of exemplary technology-using teachers from across the state of Indiana. The application and selection process is described, as well as brief descriptions of the development process. The authors also describe future plans and potential uses.

Susan Berteaux, University of California San Diego, and Sandra Strong, Norwich City Schools, NY, describe the Database Advisor, a search tool designed to guide users to the most appropriate Web-based databases for their research. The authors describe how the Database Advisor works, the equipment and resources necessary to implement, where to get the source code, and why K-12 schools should seriously consider this product. Berteaux and Strong include many screen shots of the Database Advisor in their description.

Multimedia Tools

Three papers discuss the use of specific multimedia tools for capturing images, sound and video. Kenneth Clark, Alice Hosticka, and Jacqueline Bedell, Georgia Southern University, discuss the use of digital cameras in the K-12 classroom. The authors describe the digital camera as a powerful tool for customizing and transferring information. They include many examples of the integration of visual images into the instruction process of common content areas. The authors also include a brief discussion of both the advantages and disadvantages of using digital cameras and an overview of the basic features found on many cameras. Web sites for obtaining more information are also given.

Jeffrey Bauer, University of Northern Colorado, describes several emerging audio and video technologies including DVD, digital television, high definition television, and new audio formats such as MP3. He focuses on

technologies that have high adoption rates and appear to have some potential in educational settings, including distance delivered instruction. Bauer shares some interesting insights about the younger, X-tronic generation, and states that the classroom experiences for these students should not be so far removed from their daily lives outside of school.

In the third paper dealing with multimedia tools, Ronald McBride and Robert Gillan, Northwestern State University, review the process that involved selecting desktop video conferencing as the "next generation" distance learning technology. In addition, the authors discuss the creation of a multi-site desktop video conferencing network designed to serve central Louisiana and provide an array of program possibilities including courses for credit, teacher certification, and training to participating sites. A useful table that compares three distance learning technologies, desktop video conferencing, satellite and video compression is included.

Multimedia Courses and Distance Learning

Sandra Flank and Jeanine Meyer, Pace University, describe a graduate course in multimedia for teachers taught as a one-week intensive summer course. The background and rationale for course design is discussed along with content, course schedule and style of instruction. The authors describe their experiences during the past offerings of the course as well as issues that have arisen. The paper closes with comments on the assessment of students and assessment of the course itself.

Christine Vaillant-Sirdey, Université Toulouse, France, discusses a 10-year experiment in multimedia distance learning in English for specific purposes within the general frame of a 3-year management diploma in the French higher education system. Vaillant-Sirdey defines, analyzes and rationalizes key elements and briefly describes the content, tools, and assessment techniques. She also gives an overview of the milestones of the experiment and discusses some successes to adopt and pitfalls to avoid.

Marlo Steed and Richard Mrazek, University of Lethbridge, Canada, reports on an ongoing project to implement an interactive online multimedia web site for communicating research and development results. A research and development project into online distributive education is used as an example of how this can be implemented. The web site is designed to showcase the results of the research and development efforts through various types of media. The media includes pdf files, images, video clips, demonstration of interactive tools (shocked files), and linked resources.

Evangelos Kopsacheilis, Emedia EVK Ltd., Greece, describes two educational packages developed using a Web-based system called Dynamic Virtual Trainer that is designed to support online educational procedures. The two packages cover telecommunications and Mount Athos. This Web-based system allows the dynamic composition of online lessons based on the combination of educational units according to varying user needs. The educational units are short composite entities of a variety of types like modules in HTML, virtual reality representations, text, audio and video clips.

Peter McAllister, Ball State University, provides a short description of the creation process and the uploading procedure of selected teaching segments for an undergraduate music methods course.

Finally, Sara McNeil and Bernard Robin, University of Houston, presents an overview of database tools that dynamically generate web materials. Their article focuses on the use of these tools used for educational purposes to support research activities as well as teaching and learning. The paper builds a theoretical framework for using web-based databases to support constructivist learning and describes several specific applications of dynamic databases used to facilitate the construction of knowledge and support collaborative activities in online teacher education courses.

Electronic Teaching Portfolios: Multimedia Skills + Portfolio Development = Powerful Professional Development

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Abstract: Two bodies of literature define the process for developing electronic teaching portfolios to support long-term professional growth: the multimedia development process (Decide/Assess, Design/Plan, Develop, Implement, Evaluate) and the portfolio development process (Collection, Selection, Reflection, Projection/Direction, Presentation). As further defined, the Electronic Portfolio Development Process covers the following stages: Defining the Portfolio Context and Goals, the Working Portfolio, the Reflective Portfolio, the Connected Portfolio, and the Presentation Portfolio. In addition, there are at least five levels of technology for developing electronic portfolios, based on ease of use, including technologies that are appropriate at each level and stage. This combined process creates a foundation for powerful professional development.

The process of developing electronic teaching portfolios can document evidence of teacher competencies and guide long-term professional development. The competencies may be locally defined, or linked to national teaching standards. Two primary assumptions in this process are: 1.) a portfolio is not a haphazard collection of artifacts (i.e., a scrapbook) but rather a reflective tool which demonstrates growth over time; and 2.) as we move to more standards-based teacher performance assessment, we need new tools to record and organize evidence of successful teaching, for both practicing professionals and student teachers.

Electronic portfolio development draws on two bodies of literature: multimedia development (decide, design, develop, evaluate) (Ivers & Barron, 1998) and portfolio development (collection, selection, reflection, projection) (Danielson & Abrutyn, 1997). Both processes are complimentary and essential for effective electronic portfolio development. Understanding how these two processes fit together, along with understanding the role of standards in electronic portfolio development, will provide teachers and students with a powerful tool for demonstrating **growth over time** which is the primary value of a portfolio.

For the last decade, students at the University of Alaska Anchorage (UAA) School of Education have developed exit portfolios, initially in the Adult Education Masters Program and most recently to earn an institutional recommendation for a teaching certificate under UAA's MAT in Secondary Education. An electronic portfolio based on the ISTE/NCATE Standards is now required to earn the new competency-based Educational Technology Endorsement for the state of Alaska. In addition, teachers have been developing electronic portfolios to demonstrate their achievement of the Alaska Teaching Standards, and their reflections show the power of the teaching portfolio to guide long-term professional development.

Benefits of Electronic Portfolio Development

Based on research into the implementation of electronic portfolios since 1991, the following benefits appear to result from developing electronic portfolios with teachers and students:

1. Creating an electronic portfolio can develop teachers' as well as students' multimedia technology skills. The **multimedia development process** usually covers the following stages (Ivers & Barron, 1998):

- Decide/Assess - determining needs, goals, audience for the presentation
- Design/Plan - determining content, sequence of the presentation
- Develop - Gather and organize multimedia materials to include in the presentation
- Implement - Give the presentation
- Evaluate - Evaluate the presentation's effectiveness

2. Modeling: If teachers develop electronic teaching portfolios, their students will be more likely to have their own electronic portfolios.

3. Each stage of the **portfolio development process** contributes to teachers' professional development and students' lifelong learning:

- Collection - teachers and students learn to save artifacts that represent the successes (and "growth opportunities") in their day-to-day teaching and learning
- Selection - teachers and students review and evaluate the artifacts they have saved, and identify those that demonstrate achievement of specific standards (this is where many electronic portfolios stop)
- Reflection - teachers and students become reflective practitioners, evaluating their own growth over time and their achievement of the standards, as well as the gaps in their development
- Projection (or Direction) - teachers and students compare their reflections to the standards and performance indicators, and set learning goals for the future. This is the stage that turns portfolio development into professional development and supports lifelong learning.
- Presentation - teachers and students share their portfolios with their peers. This is the stage where appropriate "public" commitments can be made to encourage collaboration and commitment to professional development and lifelong learning.

Robin Fogarty, Kay Burke, and Susan Belgrad (1994, 1996) have identified ten options for portfolio development, further defining the stages and increasing the quality of the portfolio process:

1. PROJECT purposes and uses
2. COLLECT and organize
3. SELECT valued artifacts
4. INTERJECT personality
5. REFLECT metacognitively
6. INSPECT and self-assess goals
7. PERFECT, evaluate, and grade (if you must)
8. CONNECT and conference
9. INJECT AND EJECT to update
10. RESPECT accomplishments and show pride

Figure 1: Portfolio Development Options

The Electronic Portfolio Development Process –Five Stages and Five Levels

From the discussion of both the Multimedia Development Process and the Portfolio Development Process, along with a discussion of the appropriate technology tools, five stages of **Electronic Portfolio Development** emerge. Here are the issues to address at each stage of this process.

Portfolio Development	**Stages of Electronic Portfolio Development**	***Multimedia Development***
Purpose & Audience	**1. Defining the Portfolio Context & Goals**	*Decide, Assess*
Collect, Interject	**2. The Working Portfolio**	*Design, Plan*
Select, Reflect, Direct	**3. The Reflective Portfolio**	*Develop*
Inspect, Perfect, Connect	**4. The Connected Portfolio**	*Implement, Evaluate*
Respect (Celebrate)	**5. The Presentation Portfolio**	*Present, Publish*

Table 1: Stages of Electronic Portfolio Development

Differentiating the Levels of Electronic Portfolio Implementation

In addition to the stages of portfolio development, there appear to be at least five levels of electronic portfolio development. In reviewing the electronic portfolios that are produced, it is important to establish different expectation levels for development. Just as there are developmental levels in student learning, there are developmental levels in digital portfolio development. Below are different levels for digital multimedia development and electronic portfolio development, which are closely aligned with the technology skills of the student or teacher portfolio developer.

0	1	2	3	4	5
All documents are in paper format. Some portfolio data may be stored on video tape.	All documents are in digital file formats, using word processing or other commonly-used software, and stored in electronic folders on a hard drive, floppy diskette or LAN server.	Portfolio data is entered into a structured format, such as a database or HyperStudio template or slide show (PowerPoint or AppleWorks) and stored on a hard drive, Zip, floppy diskette or LAN server.	Documents are translated into Portable Document Format with "hyper-links" between standards, artifacts, and reflections using Adobe Acrobat Exchange and stored on a hard drive, Zip, Jaz, CD-R/W, or LAN server.	Documents are translated into HTML, complete with "hyper-links" between standards, artifacts, and reflections, using a web authoring program and posted to a WWW server.	Portfolio is organized with a multimedia authoring program, incorporating digital sound and video is converted to digital format and pressed to CD-R/W or posted to WWW in streaming format.

Table 2: Levels of Digital Portfolio Software Strategies based on Ease of Use

STAGE 1: DEFINING THE PORTFOLIO CONTEXT & GOALS

Multimedia Development: **Decide/Assess** Portfolio Development: **Purpose & Audience**

Tasks:

- Identify the assessment context, including the **purpose** of the portfolio.
- Identify the learner outcome goals (which should follow from national, state, or local standards and their associated evaluation rubrics or observable behaviors). This is a very important step, setting the assessment context, which should help frame the rest of the portfolio development process.
- Identify the **resources** available for electronic portfolio development.
- Identify the hardware and software available and how often students have access.
- Assess the technology skills of the students and teachers
- Identify the **audience** for the portfolio--student, parent, college, employer (often based on the age of the student). The primary audience for the portfolio will contribute to the decisions made about the format and storage of the formal or presentation portfolio. Choose a format that the audience will most likely have access to; i.e., parents may not have a home computer, but may have a VCR.

Appropriate Technology Tools at this Stage:

- Use whatever software tools are currently being used to collect artifacts, storing them on a hard drive, a server, or videotape.
- Set up electronic folders for each standard to organize the collection of artifacts (any type of electronic document). *[Level 1]* **AND**
- Use a word processor, database, hypermedia software or slide show to articulate the standards to be demonstrated in the portfolio and to organize the artifacts. *[Level 2]* **OR**
- Use an HTML editor to articulate the standards to be demonstrated in the portfolio and to organize the artifacts. *[Level 4]* **OR**
- Use a multimedia authoring program to organize by the standards to be demonstrated in the portfolio. *[Level 5]*

STAGE 2: THE WORKING PORTFOLIO

Multimedia Development: **Design/Plan** Portfolio Development: **Collect, Interject**

Tasks:

- Identify the content of portfolio items (determined by the assessment context) and the type of evidence to be collected. This is where the standards become a very important part of the planning process. Knowing which standards are being demonstrated should help determine the types of portfolio artifacts are to be collected and then selected.
- Select the software development tools most appropriate for the portfolio context and the resources available. Just as McLuhan said, "The medium is the message", the software used to create the electronic portfolio will control, restrict, or enhance the portfolio development process. Form should follow function as well, and the electronic portfolio software should match the vision and style of the portfolio developer.
- Identify the storage and presentation medium most appropriate for the situation (i.e., computer hard disk, videotape, local-area network, a WWW server, CD-ROM, etc.). The audience for the portfolio will have a major impact on this component. There are also multiple options, depending on the software chosen.
- Gather the multimedia materials that represent a learner's achievement. Once the questions on portfolio context and content have been answered, as well as the limitations on the type of equipment available and the skills of the users (teachers and students), the portfolio developer will be able to determine the type of materials to digitize, such as: student written work, images of student projects, sounds of students speaking or reading, and video clips of student performances. Of course, if will be appropriate to collect artifacts from different points of time to demonstrate growth and learning that has taken place.
- Interject personality into the portfolio design. Use some of the graphics capabilities of current computer systems to add style and flair to the portfolio.

Appropriate Technology Tools at this Stage:

Select software tools to organize selected artifacts:

- Use Word Processing, Slide Shows, Hypermedia, or Database programs to list and organize the artifacts that will be placed in the Working Portfolio. *[Level 2]* **OR**
- Use an HTML editor (or any tool that is normally used) to develop and organize the artifacts for the Working Portfolio. *[Level 4]* **OR**
- Use a multimedia authoring program to organize the selected artifacts. *[Level 5]*

Convert portfolio artifacts into digital format

- Use appropriate multimedia to add style and individuality to portfolio.
- Use a scanner (or camera) to digitize images *[Level 2]*
- Use a microphone and sound digitizing program to digitize audio artifacts *[Level 4]*
- Use a video camera, digitizing hardware and software to digitize video artifacts *[Level 5]*

1	2	3	4	5
Text Only	Add Images	Add Navigation (hypertext links)	Add digitized sound	Add digitized video

Table 3: Levels of Digital Multimedia Development

STAGE 3: THE REFLECTIVE PORTFOLIO

Multimedia Development: **Develop** Portfolio Development: **Select, Reflect, Direct**

Tasks:

- Record **self-reflection** on work and achievement of goals. The quality of the learning that results from the portfolio development process will be in direct proportion to the quality of the self-reflection on the work. One challenge in this process will be the need for confidentiality of these reflections. This is the place where the personal, private reflections of the learner need to be guarded, and not published in a public medium.

- Record **feedback** on work and achievement of goals. Even more critical is the confidential nature of the assessment process. Feedback should also be kept confidential so that only the student, parents and other appropriate audiences have access, and not published in a public medium.
- Write general reflective statements on achieving each standard.
- Select the artifacts that represent achievement of the standards or goals.
- Write reflective statements for each artifact, elaborating on why it was selected and its meaning and value in the portfolio.
- From the reflections and feedback, set learning goals for the future.

Appropriate Technology Tools at this Stage:

- Use Word Processing, Slide Shows, Hypermedia, or Database programs to record the reflections and future goals that will become the Reflective Portfolio. *[Level 2]* **OR**
- Use an HTML editor (or any tool that is normally used) to record the reflections and future goals that will become the Reflective Portfolio. *[Level 4]* **OR**
- Use a multimedia authoring program to record the reflections and future goals that will become the Reflective Portfolio. *[Level 5]*

STAGE 4: THE CONNECTED PORTFOLIO

Multimedia Development: **Implement, Evaluate** Portfolio Development: **Inspect, Perfect, Connect**

Tasks:

- **Organize the digital artifacts**. Use software that allows the creation of **hypertext links** between goals, student work samples, rubrics, and assessment. The choice of software can either restrict or enhance the development process and the quality of the final product. Different software packages each have unique characteristics which can limit or expand the electronic portfolio options.
- **Identify patterns** through the "linking" process.
- **Final review** of the portfolio and goals.
- **Share** the portfolios with an appropriate audience. This will be a very individual strategy, depending on the context. An emerging strategy is the use of student-led conferences, which enable learners to share their portfolios with an appropriate audience, whether parents, peers, or potential employers. This is also an opportunity for professionals to share their teaching portfolios with colleagues for meaningful feedback and collaboration in self-assessment. This "public commitment" provides motivation to carry out the plan.
- **Evaluate** the portfolio's effectiveness in light of its purpose and the assessment context. In an environment of continuous improvement, a portfolio should be viewed as an ongoing learning tool, and its effectiveness should be reviewed on a regular basis to be sure that it is meeting the goals set.
- Depending on portfolio context, use the portfolio evidence to make instruction/learning or professional development decisions. Whether the portfolio is developed with a young child or a practicing professional, the artifacts collected along with the self-reflection should help guide learning decisions. This process brings together instruction and assessment, portfolio development and professional development, in a most effective way.

Appropriate Technology Tools at this Stage:

- Convert word processing, database or slide show documents into either PDF *[Level 3]* or HTML *[Level 4]* **AND**
- Create hypertext links between goals, student work samples, rubrics, and assessment.
- Insert multimedia artifacts *[Level 3 & 4]* **OR**
- Create a hypermedia presentation using a multimedia authoring program, creating links between goals, multimedia work samples, rubrics, and assessment. *[Level 5]*

STAGE 5: THE PRESENTATION PORTFOLIO

Multimedia Development: **Present, Publish** Portfolio Development: **Respect (Celebrate)**

Tasks:

- **Record** the portfolio to an appropriate presentation and storage medium. This will be different for a working portfolio and a formal or presentation portfolio. The best medium for a working portfolio is video tape, computer hard disk, Zip disk, or network server. The best medium for a formal portfolio is CD-Recordable disc, WWW server, or video tape.
- **Present** the portfolio before an audience (real or virtual) and celebrate the accomplishments represented.

Appropriate Technology Tools at this Stage:

- Post the portfolio to WWW server **OR**
- Write the portfolio to CD-ROM **OR**
- Record the portfolio to videotape

1	2	3	4	5
Floppy Diskette Hard Disk Drive	Zip Disk/Super Disk Jaz Disk	LAN Server	CD-R/W	WWW Server

Table 4: Levels of Digital Storage

Conclusions

The process of creating an electronic teaching portfolio should incorporate not only multimedia technology skills, but also the portfolio development process. Otherwise, we will continue to produce web pages or multimedia presentations masquerading as electronic portfolios; a portfolio without goals (or standards) and reflections is just a multimedia presentation, or a fancy electronic resume, or a digital scrapbook. By following the portfolio development process as defined above, including reflection, direction (goal-setting) and connection (dialogue with others about the portfolio), a teacher creates a foundation for powerful professional development.

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Web-Based Student Portfolios in a Graduate Instructional Technology Program

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Abstract: This paper summarizes our initial plans to implement portfolio assessment for graduate students in our Instructional Technology (IT) program. Specific advantages of portfolios, and electronic and Web formats in particular, hold promise for the development and assessment of our student population. We outline the goals we have for implementation that include a plan for informational seminars, criteria for item selection, portfolio components, anticipated barriers, and the role we intend portfolios to play in the graduation process of our students.

Introduction

Performance-based portfolios are gaining acceptance as a viable alternative form of assessment in educational settings. Teacher education programs, in particular, have found portfolios to be an elastic assessment format capable of addressing criteria not a part of traditional assessments, such as continuous student reflection, individual assessment of growth and change, iterative evaluation of learning goals, and the contextual examination of created products in relation to complex teaching processes (Barton & Collins, 1993; Guillaume & Yopp, 1995; Levin, 1996; Richards, 1998; Snyder, Lippincott, & Bower, 1998; Wade & Yarbrough, 1996). Portfolio assessment allows for the development of pedagogy and discipline-oriented philosophy (Carroll, Potthoff, & Huber, 1996), as well as the evolution and expression of a professional voice (McKinney, 1998). The distinct advantage of portfolios that appeals most to us, as faculty in an Instructional Technology program, is that the ownership of learning and product production shifts away from the teacher (Wiggins, 1989). Instead it reflects a jointly negotiated process, reached by the teacher and the student, that entails detailed discussions and customized evaluation of learning. In compiling a portfolio, the student selects multiple samples of work for the purpose of demonstrating personal competence in various facets of learning required by the program.

In an Instructional Technology (IT) program, essentially all artifacts of learning, whether products that demonstrate skill or reflection, are by definition *digital* products. Thus, we assert that as a storage and display medium, electronic portfolios in particular would provide a natural solution to representing student learning in Instructional Technology. Philosophically, we adhere to the notions of constructivism, and with regards to the assessment of digital products, we subscribe specifically to "constructivism" as expressed by Resnick (1998) as the idea that people construct new knowledge with particular effectiveness when they are engaged in constructing personally-meaningful products. We argue that the processes of learning, implementation, and production common in IT programs can be best represented through the use of digital portfolios. Further, the emergence of the Web as a predominant learning environment in education and business led us to consider this particular medium as the portal to student portfolios. The Web format encourages individuality by allowing students to demonstrate creativity in presentation and organization, to create multiple design formats for multiple audiences (Watkins, 1996), and to easily establish connections

among related portfolio components (McKinney, 1998). The Web, as both a technology and an interface, enables the student ultimate control in assembling and ease of re-organizing, as well as the ability to integrate narrative captions among the learning evidence to emphasize the interrelated nature of the learning (Watkins, 1996). The Web environment permits students the flexibility to maintain their portfolios in a Web-space that can be remotely accessed from anywhere at any time, by the student, faculty, peers, and potential employers. Finally, Web-based portfolios promote seamless access to student work by eliminating software and platform incompatibilities encountered when viewing electronic portfolios created with multiple authoring tools (Mills, 1997).

Our Context

The Instructional Technology program in the College of Education at the University of Houston offers both Masters and Doctoral degrees to primarily part-time, commuting students who hold full-time jobs in both education and industry. Assessment strategies currently vary among our courses depending on the course content, structure, and individual instructor preference. Digital design and multimedia projects are typically submitted on disk or uploaded to a specific course server location, while traditional reports and papers are turned in either electronically or on paper. As students progress through our program, we currently have no consistent standard for collecting and comparing the work they produce in separate courses, therefore there is no easy way to draw any type of comparisons of program-wide effectiveness.

While much of the literature on the use of portfolios describes implementation within preservice teacher education, our faculty sees the promise of a portfolio assessment strategy for our graduate program, for many of the same reasons. First and foremost, we value and encourage student ownership of learning, and we see the compilation of portfolios as the ideal instrument to coach students to observe and manage their own learning progress. We believe we can use portfolios to accomplish this goal not only because their creation helps make explicit the connections among seemingly discrete but realistically related courses, but also because portfolios will assist our students in valuing the course projects in relation to our larger program goals. We want to eliminate the prevalent idea that course products are produced in isolation merely to get a grade, destined only to collect dust on faculty shelves. Portfolios would allow our faculty the opportunity for more meaningful and interactive feedback to guide our students toward learning goals, dialogue which would ultimately allow students to originate and hone their individual professional voices within the diverse IT field.

We see Web-based portfolios, in particular, as the most versatile format for incorporating the multiple projects that our students produce using a variety of software. A key advantage for our commuting, and frequently telecommuting, population of students and faculty, is that Web-based portfolios could be revised and assessed from any computer at any time. We envision portfolio assessment as initially supplementing, and potentially replacing, our written comprehensive exams as a graduation requirement. Such a change would better reflect our constructivist teaching and learning philosophy, as well as the project-based nature of our program. Finally, we look forward to the ongoing feedback on the effectiveness of our program that portfolios would provide our faculty (McKinney, 1998; Snyder, Lippincott, & Bower, 1998). Such feedback, we believe, could directly feed the continuous improvement and development of our program.

Digital portfolios for our IT program seem to be the natural format whose time has come, both for our students and for us. Other plans we are considering for portfolios include capturing the work examples to provide our students with examples of exemplary models produced by their peers and archiving these products in an organization scheme that benefits the larger education community. The driving force behind our interest in portfolios, however, is the progressive and comprehensive review of the projects, process, and learning across courses and throughout the entire experience of the student in the program.

Initial Plans for Incorporating Portfolio Assessment

In planning for a portfolio strategy in the IT program, we began by asking questions relating to the nature of the knowledge, application, and synthesis level skills that students will encounter in the program. What information do we want students graduating from the IT program to know, and what skills should they be able to demonstrate? What kinds of evidence will verify that the information and skills have been

learned? How effective is our program at preparing future instructional technologists, and what could we do differently to give our students an even more meaningful preparation in instructional technology? These questions are aligned with portfolio development criteria discussed by others (Barton & Collins, 1993; Georgi & Crowe, 1998; Snyder, Lippincott, & Bower, 1998).

With those over-arching questions in mind, our portfolio process will begin with a, required seminar at the beginning of the semester for entering Masters-seeking students, allowing ample time to assimilate the concept of using portfolios before courses have begun (Stone, 1998). In this seminar, we will orient students to the ideas of "digital portfolios," articulate flexible criteria that will provide guidelines for the individual portfolio requirements, and enable them to think of the program and the learning process as one that is evaluated by more than the individual instructor. By presenting these criteria in the form of organized rubrics, students will be made aware of expectations we have for the demonstration of proficiency and skill, thus de-mystifying the evaluation process and allowing students to take an early and active role in the planning for and management of their own learning during the course of the program.

Instruction on technical considerations and style guidelines for the Web-based portfolio will be presented in an effort to ensure ease of accessibility of student work throughout the graduate experience. Upon entering our program, each student will be given permanent disk-space on the department server to be used for the duration of their studies. To assist with the details of file-management, we will establish a consistent hierarchy of file organization within each student's Web index that is based on our course numbering system. Sufficient hands-on time for practicing such procedures as file transfer and organization will be given at the seminar so that students walk away with a clear understanding of portfolio maintenance basics.

The seminar will conclude by addressing the actual work of compiling portfolio components. Substantial time will be spent demonstrating strategies for selecting portfolio items to represent a range of work quality and type, with a focus on ethnographic methods of collecting and analyzing data. By addressing portfolios with specific research and analysis methods, we will empower each student with the skills necessary to use the data to develop an individual theory of instructional technology as it relates to his or her own learning artifacts (Snyder, Lippincott, & Bower, 1998). Specific examples will be given to students to illustrate the process of authoring reflections on their work, or "sustained hard personal looks at oneself and one's practice" (p. 54). Final thoughts in this first seminar will involve establishing the focus of each student's portfolio through the writing of an individual goal statement.

Once established, the portfolio procedures will be regularly reinforced throughout the individual courses in the IT program, allowing us to design and adhere to standard policy and a consistent technical format for all of the various courses. We anticipate that this advanced and sustained attention to the portfolio construction, maintenance, and presentation will contribute to the overall success of the evaluation procedure.

The Balance among Utility, Reflection, and Creativity

Our IT portfolios will be useful only if they transcend a merely pleasing display of completed work to instead make compelling arguments of each student's knowledge and skill. At the same time, we hope that the portfolios will highlight interrelations among instructional theory, research, and practice, both intended and serendipitous, as evidenced in the products of learning and the ability of each student to articulate these ideas.

Despite our intention to provide a consistent overriding portfolio framework, we do not believe that the requirements of included work should be entirely prescribed. Such demands for conformity would counter our goals of reflection, individuality, and customized feedback, and might, in fact, preclude student creativity and individuality, thus resulting in artificially similar products from all students (Mills, 1997). Like others (Scanlan & Heiden, 1996; Snyder, Lippincott, & Bower, 1998), we recognize the need for a convergence of perspectives in the design of our portfolio process so that our portfolios can be useful for both summative purposes and individual student reflection. Therefore, we will strive for a balance between student-selected items chosen to illustrate personal learning and items suggested by the faculty to demonstrate learning in accordance with program goals. Consideration of item selection will be encouraged regularly at the conclusion of each semester, and items previously selected may be re-evaluated in comparison with newer projects. Students will compose narrative captions to rationalize the inclusion of each item in the portfolio, thus constructing a unique comparative thread linking skills and projects.

Student-written captions will enable faculty to evaluate learning products with the students' voices articulating the reasoning behind projects (Barton & Collins, 1993). In addition to formal narratives, students will have the opportunity to include personal reflections about the progress toward attaining their learning goals.

Considered along with the selected work examples and various written commentaries, the Web interface and navigational sequence will serve as the ultimate demonstration of creative design and systematic development expected of IT graduates. The final portfolio component will be a summative "epilogue" written by each student to bring closure to his or her graduate experience. This culminating document will address questions specifically posed by the faculty that are intended to guide the student to synthesize his or her understanding of theory and practice.

Successful completion of the portfolio process in our program will be marked by a "portfolio consultation" to occur during the last semester of the student's program and involve the participation of peers and faculty advisors. Consultations will take the tone of a collaborative forum, a collective "think tank" of instructional technology issues led by the portfolio author, as opposed to the generally one-sided, directed nature of an academic inquisition, a hurdle commonly seen as part of a graduation defense. This collegial approach will allow us to further capitalize on the portfolio as a tool for the continued growth of both students and faculty. Such examination of learning evidence and subsequent reflection, we argue, is not possible in our existing traditional written comprehensive exam format (Bali, Wright, & Foster, 1997; Barton & Collins, 1993).

Challenges and Future Directions for Portfolios

As our portfolio evaluation process matures, we foresee related research investigations, such as examining the impact of portfolio development on student learning and reflection, the benefits of increased student and faculty collaboration, the extent to which portfolios allow us to assess the validity of course objectives, and the role of the information gained through the process on ongoing improvement of course-to-program goal alignment. For now, portfolio assessment is scheduled to commence in our Instruction Technology program with the incoming Master's students in the Spring semester of 2000. We understand, however, that the best-laid plans will not ensure flawless implementation. The literature reviewed thus far has been clear about the potential challenges we may face by incorporating portfolios into our program. For example, we anticipate that ensuring grading consistency with this alternative assessment strategy can prove problematic, as can establishing the expectation that students honestly reflect on their learning rather than report back only what they think we want to hear (Scanlan & Heiden, 1996). We concur with the recommendation of Scanlan & Heiden that developing an evaluation rubric will address this issue by explicitly communicating our evaluation criteria to students early in the program. Genuine faculty participation with and commitment to the benefits of portfolio assessment, consistently communicated to students, should also invite more honest student participation. Another barrier we expect is the additional time commitment required from both students and faculty advisors to assemble the portfolios concurrently with fulfilling project requirements for individual courses (McKinney, 1998). Our goal of consistently addressing portfolio format and content as a component of each of our courses will, we believe, make the necessary time commitment more manageable and ultimately worthwhile. Our exploration of possible solutions to these and other perceived and anticipated obstacles will continue. We are convinced, however, that the authentic assessment and related benefits possible through the use of Web-based portfolios are much too advantageous to ignore.

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Harness the Power of Multimedia Portfolios for Teaching and Learning

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Abstract: This paper is a report on the development of multimedia portfolios by pre-service teachers who completed their undergraduate internship at the University of North Florida in Jacksonville, Florida. Included are samples from portfolios, which display Florida's pre-professional accomplished practices. Created in PowerPoint, the portfolios contain samples of electronic portfolios developed by PreK-12 students featuring the accomplishment of select Florida Sunshine State Standards.

Introduction

During the past six years the author has completed collaborative university – school district projects for improving teaching and learning using state-of-the-art educational technology. This work has involved the simultaneous improvement of PreK-12 education and teacher education. By appropriately using educational technology, the pre-service teachers and their directing teachers were engaged in the collaborative alignment of curriculum, instruction and assessment to facilitate student achievement. This article describes and illustrates important outcomes of the Technology 2000 project, a collaboration between the University of North Florida and the Duval County Public School District in Jacksonville, Florida. The participants believe that the outcomes of the project have important implications for the improvement of teaching and learning in other Pre-K education and teacher education settings.

Project Overview

The Technology 2000 project was a collaboration between the University of North Florida and the Chets Creek and Lone Star elementary schools of the Duval County Public School District, and Logical Business Systems, a collaborating IBM K-12 Division business partner. The project was designed to improve teaching and learning through the use of educational technologies.

Participants

Participants in the project included:

- Five directing teachers from Chets Creek and Lone Star elementary schools;
- The two school principals;
- A Media Specialist;
- Five University of North Florida pre-service teachers completing their internship semester;
- A University of North Florida professor who served as project director;
- A business partner technology trainer; and,
- Students in three first grades, a third grade, and a fifth grade classroom.

Project Focus

The project provided the five participating pre-service teachers with the educational technology skills necessary to excel in the schools of the twenty-first century. This included the ability to not only use computers and related technology for word processing and record keeping tasks, but as tools to significantly enhance classroom instruction, documenting student achievement and extending it through the creative uses of multimedia tools for teaching and learning.

Participants in the project:

- Learned to use multimedia computers, including laptops, scanners, digital still cameras, digital video cameras, and microphones for creating presentations and for instructional activities;
- Learned to use software, courseware, and related technology-based materials available at the schools for classroom teaching and learning activities, with an emphasis on IBM's Teaching and Learning with Computers (TLC) approach to instruction;
- Became knowledgeable about the available technologies for use with a single computer to present whole-class instruction while successfully conducting technology-infused lessons.
- Used the multimedia presentation tool, PowerPoint, to create instructional materials which incorporated text, video, sound, and graphics; and,
- Used instructional and assessment strategies to assist PK-12 students with the creation of multimedia portfolios using PowerPoint.

Technology Training

The Session One training topics included:

- Effective use of multimedia desktop and laptop computers, large screen projection devices, scanners and digital still and video cameras.
- Teaching and Learning with Computers (TLC), IBM's approach to classroom instruction utilizing technology.
- Training in the use of the School Vista Instructional Network Management program and instructional courseware available on the network for assessing, instructing and evaluating the effectiveness of computer-based instruction.
- Training in the use of PowerPoint for displaying student and pre-service teacher work in electronic formats.

Session Two topics included:

This session involved assistance to pre-service teachers in finalizing their multimedia portfolios and those of their students.

Outcomes

Each intern involved in the project:

1. Presented lessons to their respective students utilizing educational technology resources within the framework of Teaching and Learning with Computers using appropriate IBM courseware;
2. Created a personal multimedia portfolio with PowerPoint, providing information on their intern experiences, displaying examples of technology-based products which their students produced;

3. Facilitated the creation of student multimedia folders that displayed a knowledge of language arts, mathematics and science subject matter and evidence of newly acquired educational technology skills;

4. Developed diagnostic and prescriptive lessons which included educational technologies as instructional and assessment tools; and,

5. Created digitized photographs and video clips of their teaching and learning activities using a wide variety of educational technology.

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Software Sources

International Business Machines Corporation, New Orchard Road, Armonk, NY 10504. Available online [http://www.ibm.com/ibm/]

Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399. Available online [www@microsoft.com]

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Learner Assessment in Multimedia Instruction: Considerations for the Instructional Designer

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Become Aware of Current Practice in Learner Assessment

The designer of instructional multimedia needs to be aware of currently accepted practices to stay appraised of the array of methods and applications from which he or she will want to choose and also to be aware of practices that appear to be expected, appropriate, and functional. Most experts agree that several measures and methods should be used to determine course effectiveness.

Current computer-based instruction (CBI) and Web-based instruction (WBI) assessment practices include a variety of methods such as instructors evaluations of students, students' self assessments, peer to peer assessments, exams, project based assessment, and assessments that are tied into log-in and usage data. Bergman and Moore (1990) suggest three questions that designers should answer about the evaluation process: Is the evaluation voluntary or required? How much user activity is being assessed? What type of feedback is provided? Bergman and Moore believe that voluntary self-assessment "is a sound strategy for adults" (p. 63). However, they also list three more traditional categories, common in assessment, that they feel are appropriately used for specific circumstances: single items -- to test knowledge of single concepts; grouped items -- for assessing knowledge of "logical units" (i.e., on chunked material); and multiple groups of items -- for a final test. Nicholas Iuppa (1998) makes a useful distinction between test styles, specifically concept tests and simulation tests. Concept tests are used to assess learners' understanding, while simulations test learners' performance. In discussing how to assess concept and performance via digital media, Iuppa cautions that digital assessment has its limits. He says, for instance, that tactile skills are "among the very few" types of skills that digital media cannot assess and points out digital media cannot, for example, test how smoothly the student manages to screw in a spark plug, which is an important part of the process.

Current evaluation procedures range from "one shot grading, " such as taking a final or semester test, to mastery or "perfection-based" grading, which allows students to redo assignments, within an acceptable time frame, until they are perfected (Cox, 1999). Counter to traditional design theory is the growing need to specify instructional goals and learning outcomes to accept what is termed as a "diversity of outcomes." Duchastel explains that this can best be achieved by, "aligning evaluation not with knowledge, but with task accomplishment that utilizes knowledge" (1997, p. 225).

Planning and Presenting Instructional Objectives

The most critical issues for instructional designer are those regarding how best to plan, present, and evaluate objectives and outcomes for CBI/WBI instructional materials. Bannan and Milheim (1997) describe the issue in this manner:

> The World Wide Web is becoming a major source for educational material delivered to learners who prefer (or are required) to learn apart from a traditional classroom. While the educational

potential of this medium is just beginning to be realized, its utilization will certainly increase over time as larger numbers of educators and learners see the significant value in this type of instruction. However, while there is tremendous potential for this type of learning, there is also a significant need to describe these Web-based courses in terms of their overall instructional design characteristics, rather than defining each course only by the specific content it provides. Without this organizational process, courses will be perceived and categorized based primarily on their subject material, rather than the instructional strategies and tactics used for the delivery of the educational material (p. 381)."

These issues are also concerns of the designer of instructional programs delivered by means of CD-ROMs or other computerized stand-alone tutorial materials. In traditional instructional design, objectives are the critical, conceptual foundation on which the instructional designer constructs the framework of the instruction to be. The instructional objectives are usually the starting point, and serve as the basis for all other instructional design decisions made during the instructional design and development process (Dick and Carey, p. 5). As explained by Dick and Carey, the objectives establish the purpose of instruction in terms of desired learner outcome behavior or performance, conditions under which the behavior is to be evaluated, and standards for evaluation and assessment.

In terms of learner assessment, then, objectives tell the learner, at the outset, what he or she is expected to learn in the course of the lesson. For the instructional designer, identifying the objectives of the instruction to be delivered is a critical step in choosing the best cognitive and presentational strategies for the instructional material and involves awareness of the learner's needs as well as issues such as cognitive styles, need for learner interaction, and other related concerns (p. 126).

For the instructional designer who is developing CBI or WBI, instructional objectives appear to be as critical as they are to the designer of "traditional" instruction. That is, for the designer, objectives are a critical step in (1) the designer's choice of the best cognitive and presentational strategies for the instructional materials to be developed as well as (2) in the choice of best media for instructional delivery and other, similarly critical decisions in instructional development (Pernici and Casati, pp. 246-247). Basically, the designer of computer- or Web-based instruction has to know the outcome intended -- learning desired or task to be achieved -- and the assessment method that will be used to evaluate that outcome before the designer chooses the best way to inform the learner about those objectives.

Objectives' Role in Learner Orientation

The instructional designer has to plan so that the initial objectives provide, for the learner, clear and reasonable expectations about the assessment phase of instruction. In general, because multimedia instruction is usually at least one step removed from face-to-face teacher-to-student interaction, the statement of objectives at the beginning of a lesson plays a critical role in learner orientation. For distance learners, the stated initial objectives of an on-line course of study or a CD-delivered tutorial may be the chief means of allowing the learner to self-advise in selection of one course of instruction over another (Benson, 1994).

In addition, for "remote" or CBI instruction delivered as "automated" computer-tutorials, initial stated objectives have proved to be important as "advance organizers" for learners' outcome performance. For example, in an experiment by Beasley and Waugh (1996), groups of college students studying computerized units of instruction showed remarkably different test scores and significant differences in content retention that were affected by only one experimental factor. The experimental group of students was told that, after viewing the instructional materials, they would be asked to draw a concept map of how the topics of the lesson related to one another. Knowing the objective -- and the means of assessing what they were to study -- acted as a powerfully effective "advance organizer" in allowing the students to view the instructional materials in the context of the performance goal and to perform the target task far better than the control group, who were not told anything other than that they were to "cover" the unit of study. Not only did the experimental group -- the ones told the objective -- perform better than the control group, these differences in assessed performance were still present a week later when the two groups were given a "pop quiz" to check their retention of the information. Again, the group that was informed of the assessment objective performed significantly better than the "unknowing" control group.

Objectives and "Just-in-Time" Learning

The role of learning objectives as indicating performance outcomes and being critical in deciding on a course of study is also related to the issue of "just-in-time" learning, which is an important source for Web-based learning and instructional design. Just-in-time learning is information delivered "so that each individual may learn just what he or she needs at the time when he or she needs it" (Romiszowski, 1997).

The "just in time" learning concept is related to the idea of both goal-oriented learning and to performance-based assessment. It is therefore similarly related to the requirements that objectives and assessment outcomes be clearly established from the beginning of the instructional development process so that the instructional designer can choose which cognitive strategies and which presentation and assessment methods are most probably going to result in the desired learning.

Feedback to the Learner During Instruction

In addition to a final assessment, in the sense of an overall "grade" for the learner who completes the unit of multimedia instruction, Bergman and Moore discuss three types of more sophisticated feedback categories for learner interaction that they believe should be considered by the instructional designer: Informative feedback, that simply identifies a correct or incorrect response; Reinforcing feedback, that praises or critiques (both of which should be limited); Diagnostic feedback, that involves comments or suggestions about the learner's response.

Dick and Carey (1996) -- agree, believing that learners need a variety of types of feedback during the course of the lesson in order to improve their performance on the final examination for the instructional unit (p. 192), which applies whether the instruction is delivered in the electronic or the traditional classroom. Even more important, then, is feedback to the learner using multimedia instructional materials in lieu of an instructor's providing this type of interaction.

Learner Assessment via Computer-Scored Testing

Online or computer-based multimedia instruction can utilize instructor-based evaluation in a multitude of forms, just as the face-to-face classroom setting affords multiple methods of evaluation. One method of evaluation that is unique to CBI and WBI is the option of having the computer score the student's work and record a grade "automatically."

As more and more emphasis has been placed on behavioral objectives and "statements of explicit behaviors that learners must demonstrate, it has been increasingly obvious that a fair and equitable evaluation system is one that measures those specific behaviors. Although it is possible to create computer-based testing and scoring, there are many concerns related to this type of evaluation. Grades are grades, and students are sometimes ingeniously determined to improve their grade point averages or acquire credit where credit is definitely *not* due. One solution to the academic honesty issues appears to be administering "final" exams in proctored computer labs. Other possible approaches to the issues of academic honesty and reliability raised in relation to assessment of student learning in CBI/WBI instructional modules may involve use of the technology that has introduced the problem in the first place. For example, some virtual colleges and online universities are discussing use of security and identity-verification methods, such as voice recognition or fingerprint-recognition systems.

Online Course Assessment Methods

Two basic types of assessment for online college-level courses prevail: (1) those with CBI and "automated" or computer-administered types of instruction, the most typical final assessment method is the proctored exam, and (2) those with instructor-monitored distance learning types of instruction, with the most typical assessment method being criteria-based evaluation, with a final grade assigned by the instructor (Rasmussen *et al*, 1997).

Instructor-monitored distance learning courses tend to follow one of two models: (1) the "portfolio" or "contract" model, with students turning in frequent, small reports or completing a scheduled, sequence or series of assignments, and (2) the project model, in which the student turns in, at the end of the course, one big project or term paper (Hudspeth, 1997).

An example of typical statements about proctored tests and exams is this one from Indiana University's online Chemistry 101 course:

> Quizzes and Exams preferably can be taken on the Internet. This will require that you have a proctor with a computer system that meets the system requirements to administer the exam or quiz. Your proctor should be associated with a reliable office or agency in your community (employment supervisor, library, high school, bank, office, business personnel, etc., (no relatives or personal friends). If this is not possible, a second option is to find a proctor with faxing capabilities....We suggest you make arrangements with your proctor and have him/her complete and return a Proctor Agreement as soon as possible (by or before the orientation meeting). This signed agreement is a necessary prerequisite.
> (http://weblab.iupui.edu/oncourse/courses/c101demo/)

Clearly, age-old concerns about ethical practices in assessment (i.e., cheating) take on new twists in the distance-learning environment. The issue of authorship of student work has always been one that is difficult to resolve, even when the course is taught with traditional methods. A statement about expectations for online students, again from Indiana University, illustrates a common philosophical approach to the problem of authorship:

> Much of American life operates on the honor system — and so do a number of areas of this course. Thus the laboratory work and write–up, the homework assignments are done away from University supervision and are expected to be performed by you and you alone. Violation of this expectation ultimately hurts you more than anyone else.
> (http://weblab.iupui.edu/oncourse/courses/c101demo/)

Portfolio and Project Instructor-Based Learning Assessment

During the Web Based Training Online Learning '99 conference, Brad Cox, author of the award winning, *Taming the Electronic Frontier,* was asked how he evaluated instruction in his online course. He replied:

> Briefly, I rely primarily on experiential learning (action learning). Each task presents instruction, invites the student to put it in practice and report the results in the context of the material that preceded this task. Some tasks have students read web-based or paper-based materials, summarize what it says, and demonstrate that they have applied each lesson to the web-based portfolio. Other tasks, such as the desert crash simulation, portfolio peer assessment, and web-based sociometic tasks, take a more quantitative approach. Each student produces a web-based portfolio and participates in a semester project. These provide considerable insight into how well the student is doing, both by me and the student's peers.

Cox's approach recommends using a series of small, sequential, individualized tasks and student-centered personal responses to provide multiple checkpoints during the online course and ensure that students, in order to complete the assignments, have to keep up with the class readings and respond to class assignments themselves. Multiple, individualized tasks are harder to counterfeit because of the necessary coordination and planning involved for the student to arrange for someone else to do the work in a timely and appropriately specific manner.

Cox suggests a sequential, portfolio-style approach to the student's progress through a course and assessment of that progress. Another, somewhat similar, approach is recommended by DeLayne Hudspeth (1997) in discussion of "just in time" learning programs. Hudspeth (p. 356) recommends a "contract" approach, which he describes as:

> A written agreement, a learning contract, which defines what the instructor is proposing and what the student agrees to do. The initial syllabus might describe 20 possible assignments of which the learner must provide the first six or eight (the "must know" content), but could select another six or eight "nice to know" outcomes from an extended list. The final list could reflect individual interests or different career backgrounds. Perhaps two or three unique outcomes could be negotiated with the instructor. If a grade system is used, then a predetermined number of points could be required for a specific grade.

Hudspeth points out that the benefit of using a contract-type approach is that the course assignments and the criteria for their completion can be explicitly described for the student, but the student can use considerable flexibility in exploring issues and resources that have personal interest. This approach should encourage the student to see the benefit of actually doing the learning rather than trying to find a stand-in (p. 356).

Another method of online course assessment, particularly for adult learners, is the completion of one large end-of-course project (Mood, 1995). For example, in a business course, students may submit, at the end of instruction, a fully developed business plan or, as the final project in an online course, the student may be required to submit a substantially researched term paper.

With project-based assessment, the dangers of having the student simply purchasing a pre-packaged term paper are diminished the more individually the project is tailored to the resources used in the course, the student's individual interests, and the use of intermittent "checkpoints" -- such as weekly, brief, e-mailed "progress reports" that are individual and specific enough to reduce the likelihood of students' thinking they can submit someone else's work and avoid being found out (Hudspeth, p. 354).

Others suggest using Internet-based videoconferencing or online synchronous class discussions or similar performance-on-demand type class activities as part of authentic or performance assessment of student achievement. In addition to encouraging participatory learning, enhancing student communication and/or technology skills, and interaction between isolated learners or between learners and the distant instructor, these "real-time" performance activities also tend to ensure, incidentally, that the actual student be present and accountable for course content.

Durability of Final Assessments

"Final" evaluation for certification or course credit is unlikely to be eliminated anytime in the near future. However, the advent of the technology that has provided the means to offer computer-based or online courses of study has also caused the re-evaluation of assessment issues, such as what should be assessed in a virtual, for-credit course. Many issues are currently being debated, including how to best create learning environments and evaluation procedures that encourage the application of knowledge rather than rote memorization; how to design instruction to help learners to think for themselves; and how does computer based learning works in conjunction with other resources in the planning, implementing, evaluating and improving loop? (Harvey, 1998)

In discussing learner assessment, the role of the instructional designer is growing. Because the instructional designer is intimately involved in establishing the instructional objectives for instruction as well as the assessment instruments by which the student's learning will be judged, the instructional designer's role is critical to insuring that CBI/WBI instruction works as expected. Since the instructional delivery is often remote, and results are sometimes difficult to evaluate in terms of instructional effectiveness, the unique position of the instructional designer is more critical to the development and evaluation of technology-based instruction than ever.

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Creating a Web of Evidence: Multimedia Examples of Student Performance

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Abstract: Students thrive on deep engagement with people who care about their learning, especially when they are trying their hands in new territory. Through experimentation and dialog, mentors, teachers, and students support one another online as they flesh out ideas, sharpen skills, and display new work. Supported by funds and technical assistance from the WEB Project (http://www.webproject.org), a US Dept. of Education Innovation Challenge, this Vermont network has built some simple assessment tools to foster improvement by focusing on discussions that lead to high quality work and sustained professional growth.

Overview

Students thrive on deep engagement with people who care about their learning, especially when they are trying their hands in new territory. Through experimentation and dialog as part of the WEB Project, mentors, teachers, and students support one another online as they flesh out ideas, sharpen skills, and display new work. As a result, everyone learns more about the big ideas and essential questions that fuel inquiry and progress in the disciplines. Technology plays a subsidiary role to stimulate new ways of working, new media avenues for expression, and to foster communication at a distance.

Supported by funds and technical assistance a US Dept. of Education Innovation Challenge, the WEB Project (http://www.webproject.org) has built several dynamic online networks that foster professional growth and measure improvement in student learning. The classrooms and networks of teachers and community professionals involved include work in Music, Visual Arts, History and Literature.

By design, The WEB Project serves "all students." Each classroom or network incorporates vital learning results like communication, problem solving, critical thinking, civic responsibility, and personal development into its use of technology. Community and statewide organizations aid in the educational process and help to set standards for quality.

The project has thus developed successful advanced technology strategies in three broad areas of work: 1. Developing and Using Online Assessment Systems, 2. Achieving High Quality Work, and 3. Sustaining Professional Growth.

1. Developing and Using Online Assessment Systems

Assumed in the notion of "excellence for all" is an agreement about what constitutes excellence. The WEB Project develops agreement by bringing teachers and content experts together to identify what it means to meet a standard. This is a thoughtful process that takes about 3 years to accomplish if a school is at a beginning level of aligning standards with curriculum and assessment practices. The development of assessment systems goes through an iterative process. This means that designs begin with a "best guess" that is checked and revised. Multimedia technology, interactive television, and the Internet are critical to the professional development system that allows for this network, separated by distance, to reach agreement. With the aid of these advanced technologies the WEB Project followed the performance assessment steps listed below. Teachers in the WEB Project involved their students in this process as well as professionals in the field.

1. Select standards from the Framework.
2. Base assessment systems on evidence from the standards.
3. Double check assessment systems against real student work through reference to a wide variety of media evidence of student performance.
4. Revise the assessment systems through continued use in classrooms and professional dialog using web-based communications with experts in the field.
5. Exchange a variety of media products via telecommunications and in person.
6. Assess and report student work online, in-person, and with the use of interactive television.

2. Achieving High Quality Work

Standards and benchmarks of student work samples set by WEB Project members represent both the product and process aspects of learning. Student interviews in 1995 revealed that they wanted two different types of input about their work. According to the interviews, students want to know where they stand (yardstick measures) and they want to know how to make what they are doing be better (reflection and critique of work-in-progress).

Based on the student remarks, a network formed to develop evidence of student performance with a web-based system of support for reflection and critique. Simple, yet enabling standards from the Vermont Framework such as "Students use a process of reflection and critique to improve their products" and "Students can generate and select from multiple solutions to a problem" allow students to receive feedback and select what makes sense. As a result, students report that they feel that their online mentors (experts, other teachers, and others students) take their work seriously. This is a key to increased motivation, time spent in creating and elaborating ideas through work products, developing new skills, and using feedback to improve work.

Focusing on production and elaboration of ideas

In order to assess learning and reach goals of excellence, we find it key to focus on the production of new elaborated work. The original focus of The WEB Project was exclusively geared toward building assessment systems as described above. Teachers benchmarked rubrics for visual arts, historical research, and reflection and critique. This alone did not improve performance or engage students. However, when we shifted the focus to production (multimedia, music composition, etc.) it increased student motivation and provided activities that built dynamic environments, incorporating assessment as a natural part of the learning process instead of standing out as a single event.

Using a variety of evidence

Using multiple forms of evidence of learning allows students to show what they know in many ways. To quote one parent from Brattleboro whose son worked on a multimedia team that investigated community memories of World War II:

> "I was thinking that if you knew Matt by whether he wrote his essays or not, you wouldn't know Matt. And you would think of him as a totally different kind of student than you get from watching him do a technology project. I also think that what he takes, in terms of raising a young man who is going to go out in the world and be accountable to others and responsible to himself, the separate facts of history are not as important as gaining an overview. For me it was a chance to see that this young man is really engaging in positive ways in the world which I don't see in terms of responses to homework and things like that. He came home and talked about this a lot. He related it to contemporary events. It wasn't just that he learned about World War II. He talked about the issues of race and gender that were going on at the time. He was saying that the socio-cultural climate was really different in the 30s and 40s than it is now."

Outside audit confirms our internal sense of progress from school-based measures and individual anecdotes. The latest RMC (1999) evaluation shows that student motivation has increased and student learning is improving.

3. Sustaining Professional Growth

As important as the signs of improving student achievement, teachers also show evidence of change. Teachers in the project begin to routinely use the core ideas and questions of their disciplines to evoke elaborated student communication and performances. The WEB Project is a model of a technology-based professional development system that uses the collaborative efforts of students, teachers, and scholars to establish exemplars of student performance stemming from dynamic learning environments. As a result of efforts on the assessment systems, the core knowledge of teachers and the creation of an environment of high quality work, the WEB Project can show four categories of the implementation of standards in teaching and learning assisted by advanced technologies. The following examples illustrate each category.

Adaptation of existing models to align with standards, using electronic examples of performance

> Example: National History Day is a program for sixth through twelfth graders. Each year a common theme is presented for students to explore. They select a topic, relevant to the theme, from any time period or place in history. Using primary resources and extensive research, students then demonstrate what they have learned through a research paper, a project, a media presentation, or a theater performance. The WEB Project sponsored teachers and historians to developed an interface to the national scoring guide, which shows the relationship between History Day criteria and the Vermont Standards in the categories of project and media. The student work samples from the Vermont History Day competition have been included on this site to serve as references for students and teachers in future competitions.

Articulation of standards to include evidence of performance and student work samples

> Example: Multimedia Communication Rubric and annotated exemplars
> Schools across the United States agree that multimedia communication is important. In Vermont, Standard 5.15 represents this value, "Students design and create multimedia products that successfully communicate (what they intend)." A group of teachers gathered in the fall of 1998 to attach evidence to this standard so teachers across the WEB Project could look at multimedia communication through a similar lens. After trial and revision, this evidence became:

Evidence
K-4 Students explore media elements that may include sound, images, movement, text and interactivity to communicate. Students contribute in the creation of multimedia products.
5-8 Students communicate through the creation of multimedia products that effectively combine media elements that may include sound, images, movement, text and interactivity with emphasis on clarity and focus, use of media, and attention to detail.
9-12 Students integrate multimedia elements to communicate understanding, synthesize content material, and present new insight.

A 6-point rubric (0-5) was then constructed to show development. The rubric contains benchmarks for Levels 1-3 only because attainment at higher levels requires significant adjustments to school schedule and an interdisciplinary team of teachers (or outside expertise) from technology, the arts, and the content areas under investigation.

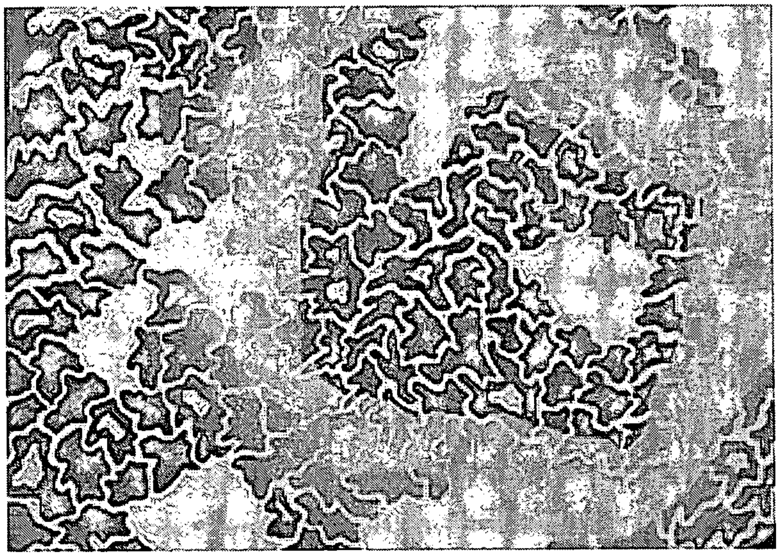
Multimedia Level 3 Exemplar (http://www.webproject.org/multimedia/iguana.html)

> Level 3 users successfully communicate by combining multimedia elements in an engaging, organized, easy to navigate format. Clarity and focus are clear and attention is given to detail.

Complex slide show that retells the story "Why Mosquitos Buzzz." Colorful artwork is used along with clever transitions and instrumental/voice audio to keep the viewer engaged in the story. The presentation exemplifies the use of ingenuity rather than reliance on special effects to solve artistic problems. Many solutions combine artistic principles such as perspective with the subtle use of transitions.

Demonstration of student achievement via web based portfolios

Example: Cabot Student Art Portfolio excerpt exemplifying: 1B: Students can create works of art that show how their ideas relate to medium, techniques, and processes. 2B: Students can evaluate the effectiveness of artwork in terms of design elements and principles. (http://www.webproject.org/cabot/melissaart.html)



"This piece has the visual elements focus, contraction, expansion, complexity, and chaos. The focal points are the large negative spaces. The shapes contract and expand as the spaces in between get larger or smaller. I think that this piece is pleasant to look at but it is also chaotic. I believe that this piece is well balanced with all the negative space. It is spread out evenly through the piece. I think that this was one of my favorite pieces of artwork that I did this year." Student quote

General Guidance for improvement while work is in-progress

Example: Rubric for Reflection and Critique
Reflection and critique of work in progress form the basis of the WEB Project's strategy for improving student performance. Students, teachers, and mentors collaborate online to discuss student work as it progresses. A three point scale is used to assess the level of response given to students by adults and by other students.

Reflection and Critique Level 3 Exemplar (http://www.webproject.org/exchange [select Projects to view public example])

From: Lee
Organization: VT Elementary School
My name is Lee; I am a sixth grade student. I need help on my pencil drawing; I have no clue what I should do next. Do you think you could give me some help? I like this drawing a lot.
Requested feedback: What can I do to the background? What should I do with the bird's chest? How can I make the values show more than they do?

Comment Excerpt from: Joan Curtis, Artist
The strength of your picture so far, I believe, is the interesting composition. The way you have arranged the close-up eagle within the picture's edges is quite powerful..... I would like to see a little more description of the feathers you are seeing.... Is it possible to be more specific with your pencil?....

Comment Excerpt from: Ken Leslie, Johnson State College Visual Arts Center
.... You asked about "background." This is the place where you can add information that will tell a bit of a story. Imagine how different this same drawing would be if there were tree branches and leaves in the background, or hunters

with guns, or zoo cage bars. Not one line of the eagle has changed, yet the meaning of the drawing is completely different for each of those backgrounds....

From: Lee
Thank you so much for all of your remarks. What I ended up doing is I put bars in the back so it looks like it is in a cage in the zoo.

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Design and Development of Interactive Multimedia for Library Research Instruction

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Abstract: This paper describes the design and development of a multimedia program that provides instruction in locating, evaluating and citing information in a university library. The paper also discusses the use of interactive multimedia for instruction. The program was developed by a collaborative team of instructional designers, content experts, and media consultants using Authorware. The program uses multimedia elements, interactivity, Web-based media, and games to enhance the learner's experience of the instruction. Preliminary evaluations indicate the program is an effective means of providing undergraduate library research instruction.

Introduction

Instructors of university freshmen and sophomores often find that their students lack basic library skills. Because the ability to acquire and evaluate information is vital to success in our information society, it is crucial that students learn the tools and skills required to effectively access and use information resources. Colleges and university libraries have adopted many strategies for teaching library research skills, including instructional handouts, library tours, classes, and online instruction. Hallis (1996) notes that electronic library resources provide access to library expertise at the user's convenience and that elementary and secondary students are gaining facility with electronic resources and an increasing expectation that such resources will be available at the university. This paper describes the design and development of a multimedia project that provides instruction in locating information in a university library, evaluating the information for relevance and value, and citing the information using accepted citation formats.

Interactive Multimedia and Instruction

The term *multimedia* has a number of connotations. Essentially, multimedia is the integration of some or all of the following components: text, audio sound, static graphic images, animations, and full-motion video (Perry, 1994). *Interactive* multimedia empowers the user to control the software environment (Phillips, 1997).

The team chose to create a multimedia tutorial for this project because of the advantages that integration of multimedia would bring to the instruction. While some researchers believe that media is merely a vehicle to deliver instruction, and that media itself does not affect student achievement (Clark, 1994; Soloway, 1994), recent research does indicate advantages to the integration of multimedia in education. Yaverbaum and Nadarajan (1995) gathered several studies pertaining to multimedia and learning. One of the studies they review describes the following benefits of multimedia (Shim, 1992, as cited in Yaverbaum & Nadarajan, 1995):

- Increased learning and a reduction of learning transfer time
- The presentation of nonlinear access to information
- The ability to link information
- The promotion of a collaborative work environment
- The ability to present information in multiple media

Another important advantage is the control that learners have in multimedia instruction. Barker (1990) notes that in multimedia instruction learners select what they learn, and they control the pace, direction, and style of the learning experience. In addition, visualization of instructional materials through the incorporation of graphics, audio, and video help students better comprehend the instruction (Kozma, 1991). Kozma also states that multimedia instruction allows learners to quickly retrieve previously learned information, facilitating review of instruction.

Numerous studies have compared multimedia instruction to more conventional methods of instruction. Most of these studies indicate that multimedia instruction is more effective. For example, Oz and White (1993) conducted a meta-analysis of 47 studies comparing multimedia instruction with conventional instruction in the military, industry, and higher education. Analysis of "knowledge," "performance," and "retention of trainees" variables revealed that multimedia was more effective and less costly than conventional instruction.

In a study of middle school students, Small and Ferreira (1994) found that when given an information-gathering task, students using a multimedia resource spent more time exploring the information and performed better research than students using printed resources. Interestingly, the authors suggest that middle school students perceive information delivered through video and sound as more credible than information delivered in printed form, and so they have a greater trust of multimedia information and are more engaged when conducting research with multimedia.

Developing Multimedia Using Authorware

The team used Authorware Professional by Macromedia as its development tool. Authorware provides a feature-rich environment for the development of interactive multimedia instruction. Authorware presentations can be distributed via a network, on CD-ROM, or a combination of the two. It supports a wide variety of file formats and media elements, including graphics, sound, and digital video files. Our project makes full use of the interactive capabilities of Authorware and includes sound and animation, quizzes with popup feedback, the ability to access library resources on the World Wide Web, and games intended to provide practice and feedback on comprehension. Indeed, Authorware is particularly noted for its ability to provide multiple choice quizzes and similar learning interactions (Phillips, 1997). User control is enhanced by Authorware's ability to accept many kinds of input, including keypresses, mouse clicks, text responses, conditional responses, and limits on response times (Jenkins & Cartledge, 1995). Authorware can also be used to test for correct or incorrect user responses and to provide learner feedback (Niemeyer, 1997). Authorware uses a flow line interface in which various interaction icons can be dragged and dropped, reordered, copied, and deleted as required (Jenkins & Cartledge, 1995). Authorware has been used to develop multimedia instruction for a number of diverse content areas, including biotechnology (Jenkins & Cartledge, 1995), forestry (Seiler, Peterson, Taylor, & Feret, 1997), library skills (Niemeyer, 1997), and airline flight staff training (Snydar, 1998).

About the Project

The project, "Library Research: Learning the Basics," was designed by a team of graduate students in an instructional technology course. The two-semester sequence, entitled "Collaborative Design of Multimedia" and "Collaborative Development of Multimedia," was intended to teach the skills needed for developing educational multimedia using collaborative teams (McNeil & Varagoor, 1999). Using the Seels and Glasgow (1997) model of instructional design, the team worked with a professor of history to identify instructional needs, formulate objectives, write content, and create storyboards for the project. The initial target population for the project was freshman and sophomore students in an American history survey course taught at the University of Houston. During the second semester, three of the original team members used Authorware to develop the project. The team worked with artists to design the interface and graphical elements of the piece, and with technical experts to record spoken word portions of the instruction.

The design team team identified four primary objectives for the instruction:

- identify and refine a research topic
- find information related to the research topic
- evaluate the information using the evaluation criteria presented in the piece

- cite the information using appropriate styles (MLA, APA, etc.)

Each of these primary objectives was further divided into smaller objectives. Several lessons and interactions were created to address each objective. The program's opening menu provides access to each topic area and to further information about the project (Figure 1).

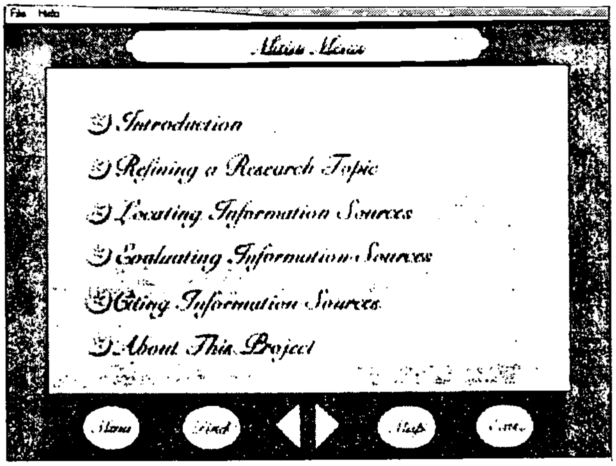

Figure 1: Opening menu.

Program Interface

Our goal in designing the program's interface was an uncluttered appearance and ease of use. Because the program was intended for use by undergraduate students of United States history students, our graphic design consultants used embossed buttons and historical images to create a "feel" of American history in the program.

The **Menu** button provides instant access to the main menu at any time. The **Find** button displays a popup window that allows the learner to enter a desired search term; the window then displays a listing of screens in which the term appears from which the learner can select. The **Map** button displays a listing of all of the program's learning objectives and sub-objectives. The **Exit** button allows the learner to close the program (this option is also available from the **File** menu in the upper left corner of the window). The left and right arrow buttons allow linear navigation backward and forward through the instruction. The **Help** menu in the upper left corner of the window displays descriptions of navigational elements and other icons in the program.

Using Multimedia to Enhance Learning

Small and Ferreira (1994) write that the goal of the library media specialist is to develop information problem solving skills that apply both to printed resources and to newer information technologies. Our goal in developing a multimedia project for library instruction was to teach library research skills in a stimulating way. We did not want learners to passively receive instruction but rather to become engaged by it. To accomplish this, we took advantage of multimedia elements such as sound, motion, and feedback to capture the learner's interest and enhance learning (Lee & Boling, 1999). For example, upon opening the program, the learner is asked to type his or her name. This entry is stored as a variable so that the program can displayed the learner's name in selected interactions throughout the instruction, thus personalizing the experience for the learner.

Sound and Visual Elements

Dual coding theory suggests that a combination of multimedia elements, such as sound and visual cues, can enhance learning (Mayer & Sims, 1994). Several screens in the project present the learner with the opportunity to hear spoken commentary and to read a transcript of the commentary if desired. By clicking on the bell icon, the

learner can hear recorded narration on information literacy. Clicking on the scroll icon causes a transcript of the narration to appear (Figure 2).

Interactivity

Various icons in the program provide access to tips and examples of topics covered in the instruction. As shown in the following figure, by clicking on the key icon, the learner can learn expanded information on the instructional text. In many screens, interested learners can find more information on a topic by clicking on star-shaped icons for examples and directions to sources of further information. In other interactions, the learner can position the mouse pointer over an item to display explanatory text (Figure 3).

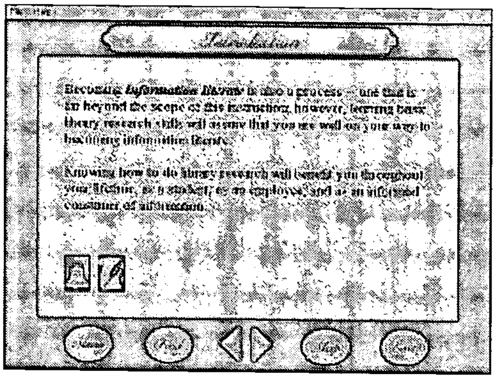

Figure 2: Sound and transcript.

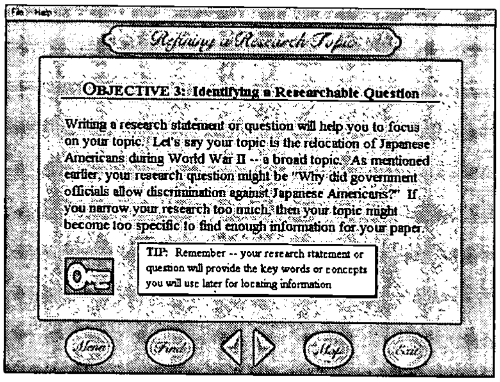

Figure 3: Using the key icon to get a tip.

Feedback

Meaningful feedback on student performance is an important component of all instruction, including interactive multimedia (Laurillard, 1993). While it is difficult to simulate the personal interaction between teacher and learner in a software program, our program provides quizzes and other practice activities containing feedback tailored for each question and response. Incorrect feedback provides assistance with identifying correct response, while correct feedback provides positive reinforcement, as shown in Figure 4.

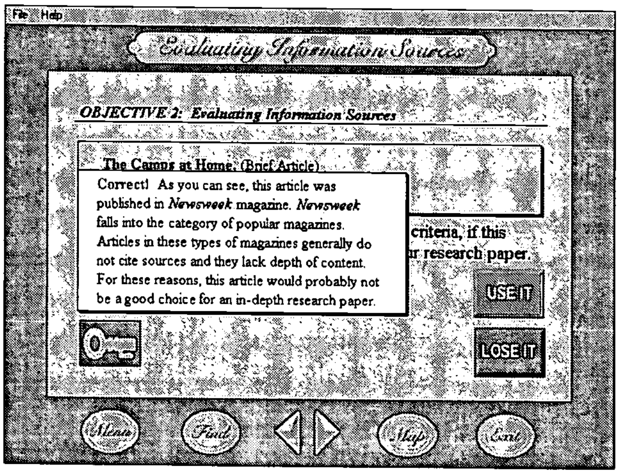

Figure 4: Feedback for correct response.

Games and Simulations

Games and simulations of real-world activities can provide learner motivation and reinforce concepts learned in instructional multimedia (Rieber, 1996). We incorporated three such interactions into our program: a drag and drop exercise to reinforce information evaluation criteria, a book shelving game to practice the Library of Congress classification system, and an adaptation of Rieber's (1997) board game design to provide practice of all the concepts learned in the instruction.

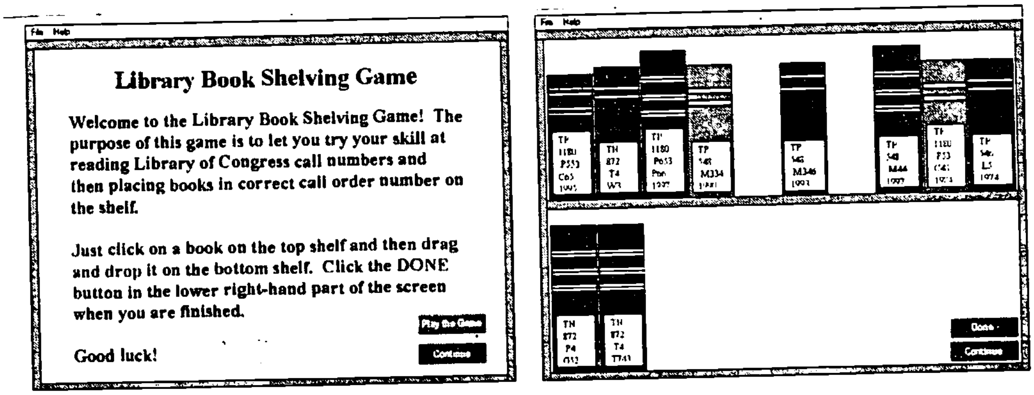

Figure 5: Library book shelving game.

Web-Based Media

The Windows version of Authorware allows the inclusion of URLs (unfortunately, this feature uses an ActiveX control, which is not available on Macintosh platforms). We used this feature to allow learners to access and use the university's online catalog within the program. Exercises ask learners to answer questions about the library's holdings and to evaluate Web-based sources of information.

Discussion

This paper has described the collaborative design and development of an interactive multimedia project to teach library research skills. Instructional designers, content experts, graphic artists, and technical specialists worked together to create an engaging instructional product. Initial formative evaluations, including evaluations by the dean of libraries and other librarians at the university, suggest that the piece is an effective tool for providing self-paced instruction in basic library research skills. While instructional examples focus on using the library for historical research, we believe the program could readily be used to provide library instruction for undergraduate students at any level and in any course.

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Issues in the Design and Development of DVD-Materials for Teacher Training in Counseling

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ABSTRACT: To cope with dramatically increasing problematic behaviors among primary and secondary school students in Japan, training for counseling skills is considered one of the most important areas in current teacher education. We have developed on a DVD a prototype of counseling materials to both assist in the training of college students and in-service teachers learning counseling skills. Multi-angle scenes depicting client, counselor, and complete classroom views were made of three counseling cases. The teachers, by using these DVD materials in training, can observe and analyze counseling sessions from a multilateral perspective by using the multi-video function to select and observe three-angle sequence, the multi-audio function to select and hear comments by expert supervisors, and the subtitle function to show aims and technique of each counselor during each counseling session. Evaluation results showed that this was an effective approach for learning counseling skills with the use of DVD-video.

Current Issues in School Counseling and Teacher Education of Japan

During the past ten years in Japan there has been a dramatic increase in the number of cases of problematic behaviors among primary and secondary students. These include school refusal, bullying, violence inside and outside of school, committing suicide, drug usage, sexual activity, and so on. Of them, school refusal, bullying, and violence (e.g., attacking teachers, peers and residents in general and damaging equipment) are most serious at lower secondary school. The Ministry of Education, Science, Sports and Culture (MONBUSHO; 1999b) reported that the number of lower secondary schools with bullying (n = 4,684 - 44.6% of the total) and with violence inside of school (n = 3,551- 33.8%) and outside of school (n = 2,000 - 19.1%) were at all time highs. Additionally, the number of reported cases of school refusal (more than 30 days absent) were 101,680, which showed an increase of 20% over the previous year and the highest count since MONBUSHO started keeping records.

To cope with such problems, MONBUSHO has implemented some new policies for the improvement of counseling systems in schools. They have developed a parallel approach to accomplish it. One approach is to introduce counseling specialists and clinical psychologists as school counselors into schools. This project started in 1995 with 154 schools. It is the first time in the history of Education in Japan to systematically introduce professional counselors into schools all over the country. Until then, in many cases, teachers have taken roles of counselor (Oono, 1997). Otherwise, students with problems have visited some educational institutions outside of schools and taken counseling by so-called professional counselors, who have different counselor certificates since there is no established counseling certification process in Japan. As a result, there are more than 15 kinds of certification of psychology in Japan (Sato, 1999). However, most counselors participating in this project are certified as clinical psychologists from a major nonprofit corporation supported by Association of Japanese Clinical Psychology. This certification process is being authorized widely in spite of heated arguments among professional associations of psychologists. Early results from program evaluation research on the impact of school counselors show positive effects on behavior (MONBUSHO, 1999a). As a result of these findings this project has been extended from year to year with 1,661 schools involved in 1998.

The second approach to enhancing counseling skills of teachers focuses on improving the professional skills of the teachers. Though some teachers have traditionally taken roles of counselor in schools due to lack of professional counselors, all teachers are now required to gain more counseling skills so that they can apply them to educational guidance, as well as management of the classroom, learning method, and cooperation and collaboration with parents and counselors. In Japan, training in counseling skills has not been considered as improving interpersonal and teaching skills, despite the recent research evidence (e.g., Peck, 1977; Hargie, 1984) which suggests the importance of training in these skills for teacher preparation. Now it is expected that teachers understand students deeply by utilizing counseling skills in daily communication with their classes. This view reflects the importance of teachers developing knowledge of preventive and developmental counseling skills in their professional training program.

Thus training for counseling skills is considered one of the most important areas in current teacher education. This has brought some changes to teacher education programs. There is an increasing number of training programs offering counseling for in-service teachers, while practicing teachers (license law was revised in 1998) and those in teacher training courses at universities and colleges, all need to get more credits for professional counseling. Given the high demand for counseling classes both by the pre- and inservice teachers it is important to identify the resources to meet these needs. But many faculties at the teachers colleges were not specifically trained to provide graduate courses in counseling and clinical psychology. Furthermore, there were few learning resources for teachers of college students on this topic. Given these conditions it is clear that the need for instructional materials on counseling training was very high. Kawashima and Miyamoto (1996) conducted needs assessment for instructional video materials at all national teachers colleges in Japan and the results showed the need for video materials on counseling was ranked third after technology & home economics and science.

Purposes of Development of DVD-material on Counseling

The primary purpose for the design and development of the instructional materials was to prepare a prototype of counseling materials to help professional students in the learning of counseling skills. We focused our materials on observation learning of counseling, which is a traditional and useful method in training for counselors. The three design objectives are as follows:

(1) To provide concrete procedures and strategies of counseling through video since there are few chances for teacher training students to practice and observe counseling sessions.

(2) To provide several points of view for observation and analysis of counseling since there are differences in counseling strategies among schools of counseling and clinical psychology. It is important for teachers to learn counseling skills in terms of eclecticism so that they could treat a great variety of students in school.

(3) To provide flexible and interactive observation settings by using DVD-Video. It has a storage capacity of 4.7GB, more than 7 times that of CD, which is possible to record about 133 minutes Laser Disk quality or a broadcast-quality video (MPEG2), and various functions such as interactive menu (enabling random selection of contents from the menu screen), multi-video (enabling selection and switching of up to 9 types of video), multi-audio (enabling selection and switching of up to 8 types of audio), and multi-subtitles (enabling selection and switching/presentation of up to 32 types of subtitles).

We have developed materials for teacher training using DVD-Video (Yamada, 1997; Yamada et al. 1998). In our earlier efforts, we applied multi-video functions to four kinds of video recorded from a class taken at four angles simultaneously. Results from the field shows that it provided more positive effects in observational learning compared with the conventional tape-based video. Recently multimedia technology is being introduced into counselor training. For example, Engen et al. (1994) developed their materials using videodisc technology to provide realistic situations to which students can react as they deal with the microcounseling skills in the hierarchy of skills for helping professionals. However, this study is the first trial to develop DVD-materials on counseling.

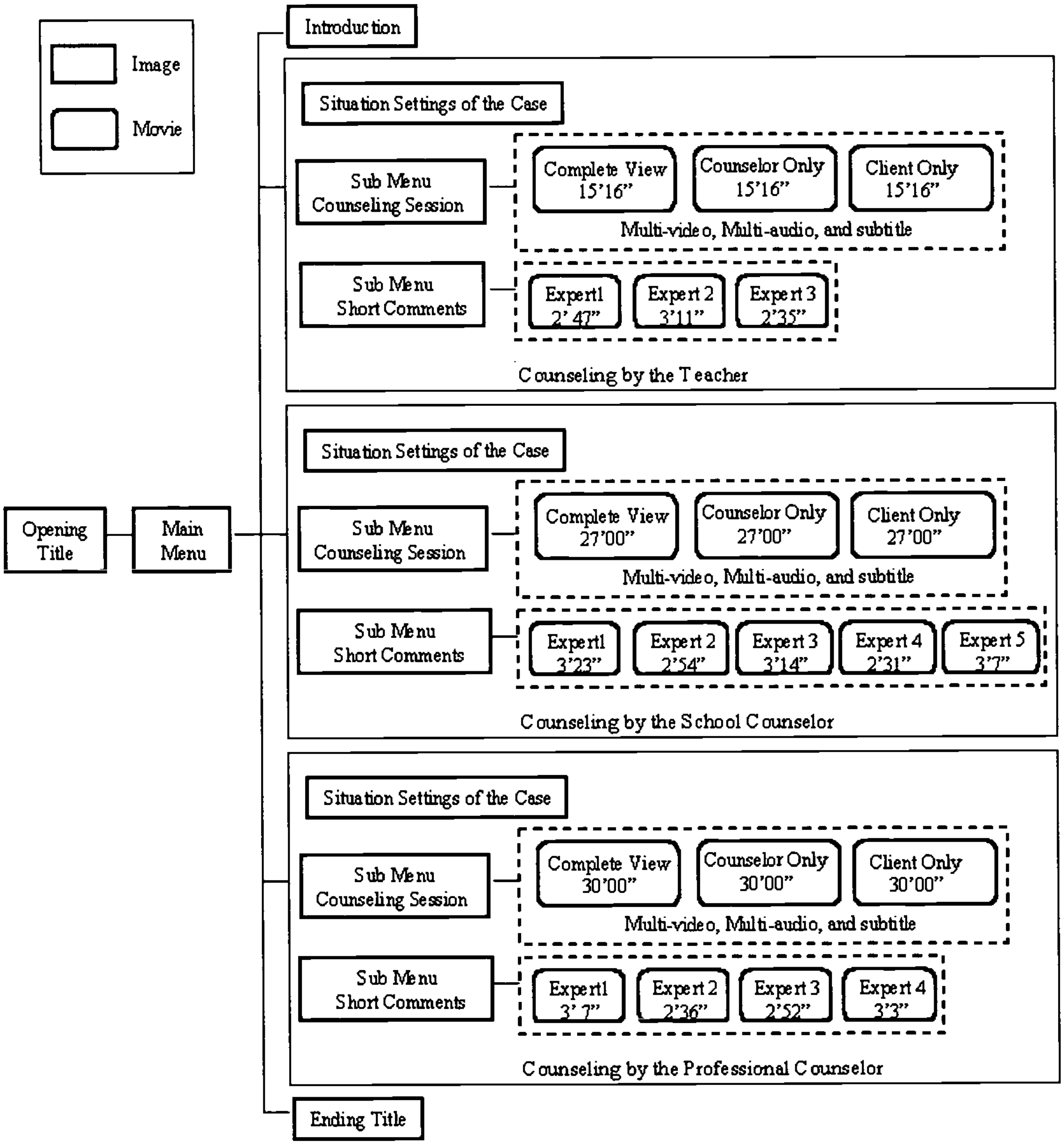

Figure 1: Structure of the DVD material

Features of Developed DVD-materials

First of all, we designed three types of counseling cases in terms of counselor; counseling by the classroom teacher who takes the role of counselor in the school (topic: bullying), by the school counselor to be introduced by MONBUSHO (topic: career counseling), and by the professional counselor in the school counseling center (topic: school refusal). Each counseling session was constructed using role-playing, which was based on a situation that each counselor had dealt with before. The clients were junior high school students with professional young actor/actress playing the role of the client. We constructed DVD-materials using these three counseling cases as major components (Figure 1). Each case consisted of situation settings of the case (presented in text), counseling session, and general short comments by experts (see below). We also used dual layer / single sided disk, which has a storage capacity of 8.5GB. This material contains total 256 minutes MPEG2-video. The developed materials have three key features to illustrate the following contents and functions.

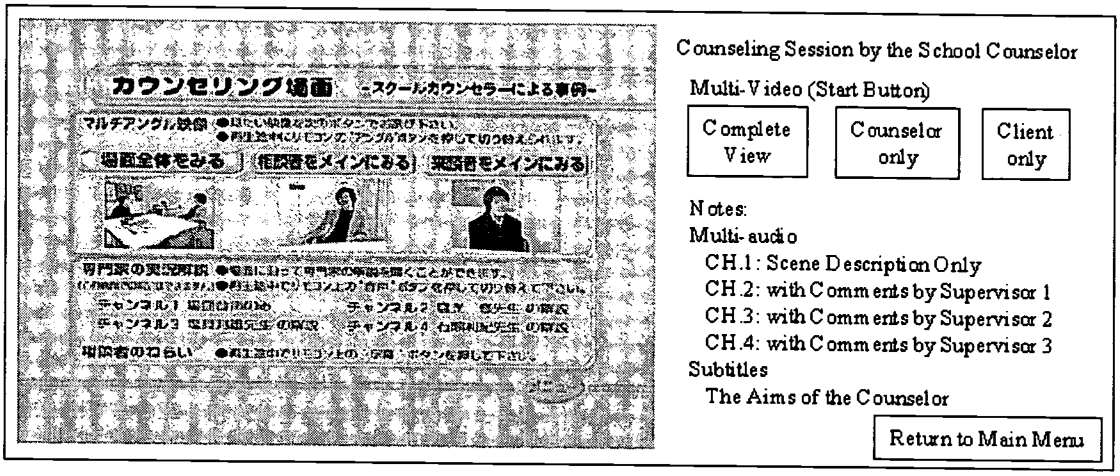

Figure 2: Example of Sub Menu (Counseling Session)

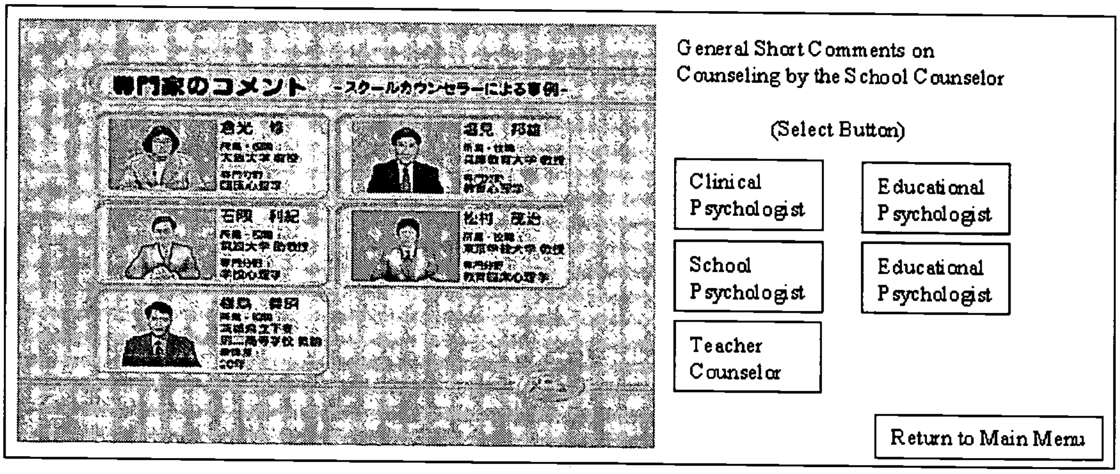

Figure 3: Example of Sub Menu (Short Comments)

The first key feature is the multi-angle recording of three types of counseling cases. Each counseling session was also recorded from three angles simultaneously; with camera focused on counselor only, client

only, and complete view. By applying multi-video function to them, it is possible to select and switch one of three sequences randomly when a video session is being played (Figure 2).

The second key feature allows comments by expert supervisors on the counseling cases. Three supervisors with different opinions on counseling were recorded to go with each counseling session sequence. Applying multi-audio function to them, it is possible to select and switch each supervisor's comments randomly during playing of each session (Figure 2). In addition to supervisors' comments, general short comments on each counseling sessions by another expert were recorded which is possible to select from the interactive menu (Figure 3).

The third key feature allows for the printing of the subtitles for the aims and technique of each counselor. Some aims and technique of each counselor during counseling were made in forms of subtitles. Applying subtitle function to them, it is possible to select randomly whether to show the subtitles or not during playing of each session. Utilizing the functionality of the system we were able to create 24 patterns of observation for each counseling session. We established Web-site (in Japanese) (http://www.nime.ac.jp/mim/cs/index.html) to provide literal protocols of counseling sessions, supervisors' comments, and general short comments.

Evaluation of Developed DVD-materials

In the process of developing the DVD materials, we organized a focus group that consisted of six clinical psychologists, six educational psychologists, six expert teacher-counselors, and three professional counselors to conduct formative evaluation. They reviewed the quality of counseling sessions, supervisors' comments, general short comments, and subtitles of three counselors' aims and technique and usefulness of multi-functions used in these materials through several focus group sessions.

In addition, 14 teachers participated in a training program using pilot version of DVD-materials which included only teacher's case (see Figure 1) without subtitles. The instructors presented the counseling process and its analysis using all video components (three angles of video, three supervisors' comments, three general short comments) and functions (multi-video and multi-audio). After their lecture, they rated usefulness of each content and function using a 4-point scale (very useful, useful, more or less useless, and completely useless). The results showed that more than 10 teachers answered 'useful' to every content and function probe, with the multi-video function and supervisors' comments rated as 'very useful' by more than 10 of the 14 teachers.

Based on these formative evaluations the materials were revised and completed in March,1999. We distributed these materials and questionnaires to all national teachers colleges and teacher training centers of all prefectures and asked them to evaluate it after using it for one academic year (April, 1999 to March, 2000). As the first step of evaluation, we especially focused on practical usefulness in terms of instructors who taught classes on counseling at teachers college or training program for in-service teachers. In the second step, we are planning to objectively evaluate by measuring learning effects an addition to the results from this subjective evaluation. Considering the costs of time for developing multimedia products like this material, however, a formative evaluation by experts using the focus group approach seemed to be the most practical method.

Conclusion

The collaborative effort of multimedia developers working with professional teaching/counseling experts is reflected in this project. The result is that the authors along with the professional researchers from the counseling community created a multilateral learning environment for students to observe and analyze the counseling process. Such learning resources have the potential to provide a rich context for considering multiple strategies as well as providing a chance to hear from experts their opinions regarding the counseling process based on a field based context.

The potential of DVD materials for instructional skill development is illustrated with the multilateral and multi-functionality that reflects the diversity of classrooms and the multiplicity of views for the training in the counseling process. A review of the competencies needed for the counseling certificate are needed to be matched with the counseling training skills in the design of future DVDs to maximize the support from the teacher training centers for the use of these materials. In addition, computer-based DVD technology, such as

DVD-ROM and DVD-RAM, more established and popularized would be great potential as a medium combined with Internet (Yamada, 1998).

These materials and questionnaire have been distributed to all national teachers colleges and teacher training centers of all prefectures in Japan. The questionnaire was designed for subjects not only to rate some scales, but also to write how they used this material in practice. This material was designed to allow users multiple ways to serve their educational clients. This flexibility of use is one of the natural attributes of multimedia products. Therefore, it is important for users to be presented several examples of how to use the educational materials, though examples might converge on particular patterns of use finally, rather than to be provided a single model.

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Acknowledgments

The DVD-teacher training materials are distributed freely by simply making a request via the email. Please submit your requests by emailing to the following address: mim-office@nime.ac.jp.

Role of Audience In Multimedia Production

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Abstract: Multimedia projects are opportunities to negotiate meaning through a variety of portrayals. However, too often multimedia projects are created with inadequate thought for how it will be perceived by others. Multimedia products at times are not user- friendly or meaningful because the creator has designed it from an egocentric perspective. This paper will describe an ongoing research project that uses a set of formative evaluation activities involving peer and target population evaluation. These activities are designed to help students involved in multimedia production to develop a greater sense of audience.

Introduction

The Faculty of Education at the University of Lethbridge (Canada) has been offering a course called Multimedia and Learning as a senior undergraduate offering for the past three years. This course is a study into the tools and educational value of multimedia. The course surveys multimedia applications, discusses the value of multimedia for learning, presents principles of design and layout, and engages the user in a team approach to development. The intent of this course is to provide educators with skills and knowledge to effectively integrate and discuss the role of multimedia in learning. It also prepares education students with experiences producing multimedia materials so that they are in a better position to use it with their own students. An important element of this course is group work. Students in this course are grouped into research and production teams. Members of the team are delegated topics to research and application tools to become familiar with, a form of reciprocal learning (Brown, Campione, Webber, and McGilly, 1992). This project culminates in the creation of a major multimedia product.

Students need to be critical developers as they select tools and representations that externalize their thoughts. This takes an understanding of the media but more importantly it requires a sense of audience. Without a sense of audience, multimedia may fail negotiating meaning. Students will create a more communicative product if they consider how others interact and view their material. To foster this sense of audience, the student teams first shares their project with another group through peer evaluations and adjustments are made to the product accordingly. The product is then field tested on a small number of individuals from the target population. The target populations are individuals who the project was designed for outside the multimedia class. Based on that experience further refinements are made. Students are then asked to list and are accountable for the suggested changes or

criticisms of their projects. One of the difficult aspects of teaching a multimedia production course is timely and effective feedback at the formative stages of multimedia construction. The techniques of peer evaluation and target population testing are powerful incentives to make formative changes and refinements.

Background:

Peer evaluation is the process of students sharing their work with other students who have been assigned to assess it. In this particular situation it is for the purposes of formative evaluation, to improve the multimedia project that students have created. The idea is that others look and interact with a student's work and provide a commentary on the things that were good as well as things that could be improved. In reviewing the literature on peer evaluation there are two main categories. One area is the use of peer review for the purpose of teacher evaluation; the other is peer evaluation in the writing process. Teacher evaluation will not be considered here because this project is more interested in how peer evaluation influences learning. There are a fair number of references to peer evaluation into the writing process because it is a part of proof reading, having someone else to read written work. The value of this activity is rather obvious since the writers of the text knows what they want to say they often assume the reader will be able to follow their writing logic. Having someone else review writing often will reveal shortcoming in writing process and provide suggestions to improve the final product (Benesch, 1985; Bishop, 1986). The same is principle is true for multimedia. Students tend to be too close to the work and an external perspective gives the developers a sense of audience. Reviewed texts on educational assessment had few explicit references to peer evaluation and cases in which there were references to peer evaluation, they were imbedded in other approaches or glossed over. This may not be the case for all textbooks but clearly this is not a strategy that is a common component of educational assessment. It was surprising the difficulty in finding research or publications on peer assessment per se. Stiggins (1997) suggests using student as evaluators of skills and products. That author further points out that if students are to be used they need to be trained. This is also suggested as an important aspect of peer assessment in the writing process (Stern, 1992). In fact it is suggested that students come up with the evaluation criteria they will use in performance assessment. This is a strategy that is used in a variety of domains. At the University of Massachusetts for instance there has been fair amount of investigation into paired-problem solving which is a form of peer assessment (Whimbley and Lochhead, 1986). It is used in the context of Math as a way of sharing and justifying an individual's problems solving strategies with another. The partner acts as a sounding board and will use probing of challenging questions to stimulate further thought or nudge thinking in a different direction. This approach seemed to have value in the development of effective problem solving.

To understand the value of peer and target population evaluations this paper draws not only on the educational perspective but the multimedia industry as well. Although the course is not intended to train people for the multimedia industry, there are some processes used by the industry that can be adopted by educators. In the real world when companies create quality multimedia products, much planning and testing goes into the process.

Effective planning is definitely a necessity, but there is a need for testing as well and this is understood by the industry. Most companies have alpha and beta versions of their software that is distributed to potential clients to test. In contrast, education instructors' on the whole have done little with external evaluation in multimedia projects. The reason for this is multifaceted. First, multimedia projects are relatively new to education, most instructors, haven't considered multimedia forms of communication to have the same status as linguistic forms. Instructors will often address the issue of verbal and textual forms of communication in their classes and have a set of criteria for evaluating these forms of representation in assignments but don't do the same for multimedia. In addition, instructors may not think that multimedia deserves the same degree of attention because it is seen as fun rather than a serious form of communication. Another reason may be that the instructors have had few opportunities to communicate through multimedia themselves so are not sure what makes a good project and what does not. This will probably change as we have seen with the sophistication of web pages on the Internet. For instance, as people have become more discerning they have been drawn by those web pages that are more engaging and logically organized. This in turn becomes an expectation for web pages. For instance, there are numerous web sites that deal with what a good web site should be like or help designers identify common short coming in their design. Another reason is that if the multimedia industry fails to produce a quality product the consequences can be rather harsh; the audience will ignore their product and use something else, which results in a financial down turn for the company. Essentially for multimedia companies, audience is everything and companies that ignore that don't last long in the competitive market place. In education those harsh realities are removed so there is less pressure to consider the quality of a multimedia project. Case in point, provincial or state examinations for most part do not provide options for multimedia forms of communication. All these are real barriers to using multimedia and in particular using peer evaluation as a formative evaluation technique.

The Study

The research question is, if students are encouraged to make an accounting of the suggestions of others, will that be an impetus for changing their multimedia products? To address this question a number of different sources of data will be collected and tabulated. During the course on multimedia and learning, students report on their peer evaluations and the results of their target population field tests through the use of email messages. These email messages will be analyzed and categorized. This information will be put into a table, which should facilitate drawing inferences and making conclusions. Students' multimedia projects will be collected at the various stages of development. Using their projects as references one can tell a story of how their projects changed over time. The researcher plans to use students' multimedia projects as exemplars of change. Each group submits a copy of their projects before peer and target population evaluations and then again after each form of evaluation.

This study presents the notion of peer evaluation and target population feedback as tools for scaffolding students' reconstruction of multimedia projects. This is a work in progress. It is hoped that researchers and instructors will be able to use the principles coming out of this research and apply those to their own multimedia productions or related courses.

The results of this research address the value of audience in changing student multimedia constructions and suggest implications for other courses.

Data and analysis:

Ongoing data collection will begin in January 2000. This will continue for two or three years or until sufficient data has been collected to draw valid conclusions. There are two kinds of data that the study will use, data collected through email assignments from offerings of the course and projects collected. Students' email messages will be categorized and tabulated (as seen Figure 1). The contents of student email submissions will be classified into one of the following categories to determine the kind of suggestions made:

- Graphic Design issues: This category will cover issues like style, color, placement of images, text, font size, and the over look and feel of the project.

- Usability/navigation: This category covers issues of interactivity, the degree to which it is user friendly. This will be reflected in comments relating to how the user navigates through the project or how the project is structured. For instance, is it clear how to get from one part to the next, can users get to parts of the project they want to, is there a need for further links, etc.

- Functionality: Functionality will deal with more fundamental questions. Does it accomplish its purpose? Is it worthwhile?

It should be noted that the evaluators are not given any explicit criteria or categories to evaluate products, although these categories are covered in class in regards to developing good multimedia. Evaluators are asked to identify those aspects of the project that were good and those things that might be improved upon.

Once a comment has been categorized it will be determined if it is a positive comment or a suggestion for change. As part of an assignment for the course, students will be held accountable for each of the suggested changes made by peers or the target population. They will either be expected to reflect that change in their work or justify why they did not. A further category will be the justifiable nonchanges. These would be changes that are identified by the project group as being worthy to pursue but for one reason or another (time, resources, expertise) are not able to implement. This does not suggest students will be compelled to make changes. Students do not need to make changes to get credit for assignments. However, they are expected to address the suggestions either by indicating the suggestions are not necessary, the change is a justifiable nonchange, or they see the value of the change and make the change accordingly. Tabulating this information will provide data on the usefulness of peer evaluation for changing the multimedia projects. As an after thought there may be an alternative to email, that is online databases. This too might facilitate summarizing the data.

In addition this study will track changes to students multimedia projects so copies of students' projects at various stages of development will be retained. These juxtaposed will the tabulated data will help tell the story of how change takes place. The study will use these projects as exemplars in presentations or as screen displays in reports. Table 1 illustrates a tentative form that will be used to collect and tabulate the data that will be collected and categorized.

Role of audience in changes to usability

Multimedia Course				Usability			
	Groups	Positive Comments	Peer Suggestions	Target Suggestions	Justified Nonchanges	Self-evaluation Changes	Cha Sugg
Peer Evaluations							
	Group1	2	4	3	1	1	(
	Group 2	3	4	2	1	0	.

Table 1: This is a sample data collection form which will be used to tabulate results from student peer and target population evaluations on the category of usability. Each category would a have similar table associated with it.

There are two ways students may develop a greater sense of audience. One is that they see the value of having others review their work. This might be measured to the degree they think valuable information will come form peer and target population involvement in the production process. Another measure of a sense of audience is, the extent student creators are able to take the perspective of others in the production process. This is a difficult factor to collect information on. One way address this issue is to determine to what extent peer and target population comments are useful in future project development? Does the experience actually raise an awareness of a sense of audience for participating students? This will be difficult to document or track over the long term. The nature of these suggestions may be endemic to a particular project, so to have students demonstrate what they have learned through the development of a different project may not be valid. However, perhaps one can infer this kind of transfer if students are able to identify the principles that they have learned from their peer evaluations. So an additional question will be posed to students for them to identify the principles they have learned from the peer and target population evaluations. It is hoped that through the course content student will have the language to articulate these principles. Another question will be asked at the end of the session to see to what extent they feel target and peer evaluation is a part of the evaluation process.

Findings

The information from Table 1 will be used to identify patterns in the data. For instance, the measure of student sense for audience comes from either a low number of changes being suggested or a high percentage of the suggested changes being acted on. The number of changes over suggestions should be high, if students have a good sense of audience with justified nonchanges taken into account. In other words, groups that have been told there are problems with their projects should make changes to accommodate those suggestions. However, there will be expected disagreements from time to time in terms of suggestions made and the degree to which the creators of the project sense it is an issue. There are two possible explanations, either the creator group ignores the perspective of the audience or the evaluator group are making unreasonable suggestions. Other patterns may

emerge from this table as well. For instance the number of positive comments might be viewed as an overall evaluation of the project. Looking at the differences in the number and type of suggestions between the peer evaluation and the target population would also be interesting information to collect. Identifying further changes through self-evaluation might further provide evidence of a heightening sense of audience. There is no need for a control group because each project is a control in the sense that before the target population and peer evaluation, the project is meant to be in a finished state. So the control is the state of the project before peer and target evaluation have been accomplished. The numbers that will be collected are not sufficient to do any kind of inferential statistics so this becomes a qualitative study

There are no definitive results since this a study in progress. However, data from previous years were put into the table to test the categorization scheme. The pilot study data was obtained from a manually maintained email archive. Although the data was sketchy and was not categorized as finely as this proposal suggests, patterns began to emerge. One pattern was that through peer evaluation and target evaluation, numerous suggestions for change were made in all categories but functionality. Another result was that the production group acted on most suggestions. One might argue that these changes were stimulated not by peer evaluation but by the nature of the assignment. Controlling for that would be difficult but the course assignments could be setup so that they don't get any credit for addressing the suggested changes. However this in turn might skew the degree to which the students look seriously at suggested changes. Giving students credit for making changes is thought to stimulate them to be more sensitive to the issue of audience. Suggestions not acted on may have fallen into different categories. First the development group may not have shared the value of these suggestions. Alternatively, the suggestions may have fallen into the justified nonchange which would suggest that the development group realized the value of the comment but did not have resources or time to act on it. It was interesting to note that were only one or two suggestions in terms of functionality. However, through understanding the context this result becomes explainable. Suggestions regarding functionality address the very intent of the project. Functionality addresses the project's purpose, was it successful achieving its purpose or was the purpose useful? The peer or target evaluators, knowing that by this time the production team had gone to great lengths to create the product to date may have suppressed these issues. Instructional interventions are now being considered to accommodate for this. For instance, if students went through a peer review early in the process before production commenced as a sort of proof of concept, it would be interesting to see the number of comments that emerge regarding the functionality of the project. Another explanation is that the audience viewed the projects as being functional. A more systematic data collection process should provide a better indication of how student projects change and why. At this point it may be premature but the pilot study suggests that through greater audience appreciation (peer and target evaluation) many useful changing can be made to multimedia projects.

Conclusions

Designing and developing multimedia projects may involve different skills and engage different learning styles than that used in the writing process. However, because both processes involve creating a

product that will negotiate meaning and facilitate communication with others, both approaches can benefit from a sense of audience. In this case the role of audience comes through student assignments that involve having multimedia projects reviewed by peers as well as individuals from the target population. This study reported an ongoing project that documents the role of audience on changes to students' multimedia projects. It is speculated that feedback from an audience is a powerful influence on implementing changes to multimedia projects. On a broader note it is thought that the audience's perspective differs from the creators perspective and this information can help make multimedia projects more useful. With the current emphasis in the curriculum on students creating alternative ways of presenting and portraying ideas, students need a better sense that meaning is a negotiated issue. Using techniques like peer and target evaluations to improve multimedia projects will highlight the importance of this.

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VisionQuest©:
Helping Our Future Teachers Envision and Achieve Technology Integration

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Abstract: The purpose of the VisionQuest© project is to help current and future educators envision and achieve technology integration by providing access to electronic models of technology-using teachers. By helping teachers envision and achieve exemplary technology use, we promote widespread, fundamental changes in teaching and learning methods that foster the development of both exemplary teachers and learners. We describe both the development and organization of the VisionQuest© CD-ROM. Potential future uses are also examined.

Introduction and Background

The Office of Technology Assessment (OTA 1995) recently stated that "the challenge of integrating technology into schools is much more human than technological. It is about helping people, primarily teachers, integrate these technologies into their teaching as tools of a profession that is being redefined through the process" (p. 28). Although most of our students who are preparing to teach recognize the importance of using technology in their classrooms, they tend to enter our education courses with limited visions of how technology can be used to achieve new instructional goals or implement new teaching practices. Despite the fact that the prevailing wisdom about how teachers should use technologies in schools has evolved—from teaching programming, to encouraging individualized drill and practice, to participating in electronic communities (OTA 1995), most of our students have never witnessed or experienced integrated technology use. We concur with the President's Panel on Educational Technology (PPET 1997) that integrated technology use will be achieved when technology is used to "facilitate fundamental, qualitative changes in the nature of teaching and learning" (p. 33). As such, technology will be used to support new interaction patterns and activities (e.g., changes in teacher/student roles, classroom organization, curricular emphases, assessment practices) that "simultaneously alter both the means and ends of classroom thought and action" (Fisher, Wilmore, & Howell 1994, p. 122).

Examples of integrated technology use are not readily available in our local schools. Even if they were, arranging for a large group of students to visit, and interact with, teachers in these classrooms would be logistically impossible. In previous semesters we have relied on instructional videos to illustrate exemplary technology use, yet most of these examples are situated in technology-rich schools and provide little information regarding the beliefs that support effective use or the steps that teachers have taken to achieve current levels of integration. Students often respond to these examples with varying degrees of frustration. How will they achieve this level of use if their schools cannot support this amount, or this type,

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of equipment? Students need more than video examples of how to use technology in the classroom. They need opportunities to examine and reflect on the beliefs that support and shape integrated classroom practice.

Rationale (Why this CD-ROM?)

The purpose of the VisionQuest© project, and the primary purpose of this CD-ROM, is to help current and future educators envision and achieve technology integration by providing access to electronic models of technology-using teachers. Based on PPET's recommendation (1997) that "education students should be given the opportunity to observe uses of educational technology" (p. 55) yet, recognizing that many classroom teachers have not yet effectively integrated technology into their curricula, we are developing CD-ROM cases of technology-rich classroom practice. By examining both the pedagogical beliefs and classroom practices of exemplary technology-using peers, pre- and in-service teachers may gain a better understanding of *how* technology can be used (the practical considerations), as well as *why* it should be used (the supporting pedagogy) to enhance and transform current classroom practice.

We believe that technology integration is not achieved by merely providing teachers with access to technology. Research has shown that availability and access are not the sole determinants of technology integration (Hadley & Sheingold 1993). The use of technology may be associated more with teachers' beliefs about teaching, the purpose for which technology is used, and the value teachers assign to particular uses of technology. Teachers need opportunities to examine and reflect on the beliefs and practices of other teachers who are currently integrating technology. This CD-ROM provides pre- and in-service teachers with models of technology integration. The CD-ROM can transport these teachers into others' classrooms so that they can examine the instructional practices, classroom organization, and curricular emphases of exemplary users of technology. They can see for themselves the roles played by the student, the teacher, and technology in a classroom where technology is integrated.

Methodology

Application Process

Six CD-ROM case studies are currently being developed that illustrate the beliefs and practices of exemplary technology-using teachers from across the state of Indiana. The selection process began by soliciting self- and peer nominations from k-12 school colleagues located within an hour's driving distance of the university. Letters were sent to the principals of 358 public and private schools, asking them to recommend any teachers known to be exemplary users of technology. Nominated teachers completed application forms in which they briefly described their beliefs and practices regarding classroom technology use as well as their visions for technology use in the future.

Selection Process

Upon receipt, applications were reviewed using research-based criteria that placed learning at the core of the integration process. Informal conversations with "promising" teachers (via phone or e-mail) helped narrow the list. Classroom observations and interviews were conducted with the most favorable candidates to obtain additional information about teachers' classroom organization; curricular emphases; their use of technology in the classroom; the roles played by the teacher, students, and technology; and the assessment practices of the teachers.

Development Process

Videotaping

Six teachers were selected from among their peers to be featured on the CD-ROM. During the 1998-99 school year, videotape was recorded in four teachers' classrooms, with an additional two classrooms slated for taping during the 1999-2000 school year.

The video team consisted of a small camera crew (one-two people), the principal researcher, and two graduate assistants. Using a qualitative approach to research and development, we began with a general outline of what we planned to videotape, but remained open to new ideas during taping.

Before videotaping, we held planning sessions with each teacher about the lessons to be videotaped. While we did not want to stage the classroom sessions, we were intent on capturing a representative sample of the teachers' classroom practice, including specific instances of technology integration. Using the same guiding questions that were included on teachers' project application forms, we looked for shots that illustrated the guiding visions of the teachers, their approaches to classroom organization, the roles of the teacher, student, and technology, and teachers' assessment practices.

Digitizing

The videotapes were logged and transcribed by two graduate students involved in the project from its inception. Segments were identified that fit into the different categories identified on the application form. For example, teachers in one school gave an oral quiz in their Biology class. We marked that segment as evidence of "Assessment." In another example, the students came into the classroom and took their class notebooks from the shelf and started working. We marked that segment as possibly relating to either "Classroom Organization" or "Role of the Student."

Storyboarding

Our storyboard was revised and refined after we had logged the videotapes from our first video shoot. This differs from common practice, in which videotaping tends to follow a finalized script. Although we knew which components each story should include, those components took shape only after we had begun the videotaping process.

After videotaping, we examined each tape to identify appropriate segments for each part of the story we wanted to tell. After we had lined up the visual evidence for the story, we determined how to narrate the story and how to supplement it with additional visuals, such as digital pictures. Our storyboards went through several drafts, starting with handwritten outlines and progressing to detailed notes, in which we decided exactly which visuals--graphics, video clips--went with which audio clips.

Authoring

We then started the process of creating the interface and synchronizing the video and audio clips. We began by using Flash as our authoring tool, but ran into memory problems. We then switched to GoLive CyberStudio, an HTML authoring tool. Once the first case "prototype" was on the way, the graduate students on the team began the development process for the next two cases.

Lessons Learned

A Qualitative Approach to Development

Due to the research nature of this project, we adapted an iterative approach to development, modifying various components of the outline to reflect new themes that emerged in our classroom video shoots, and thus, in our storyboards. In this sense the development did not follow a conventional production path; we began videotaping prior to having a finalized script and storyboard. This was a learning experience for all team members—those who were used to a more systematic approach developed an appreciation for the qualitative "work in progress;" those with a qualitative approach developed an

appreciation for the up-front technical aspects of development. Yet, throughout the project, the team worked together to make the project a success.

Thus this project allowed both the research and the technical teams to share and adjust their ideas and practices related to the development of a product. On the one hand, the technical team adopted a more flexible approach to development. On the other hand, the research team came to appreciate the benefits of having a more definitive style of working, similar to that which is prevalent in professional multimedia production settings.

Organization and Use of the CD-ROM

The CD-ROM is organized around the metaphor of a journey. Users explore the paths that six teachers have taken to achieve their current levels of technology use. They can examine how teachers' pedagogical visions of classroom practice have shaped their journeys. In addition, users can examine how teachers' journeys began, the roadblocks and challenges they faced, as well as the incentives that have propelled them forward. On yet another level, users can examine the relationships among teachers' beliefs (about the role of the teacher/student/technology, classroom organization, curricular emphases, and assessment practices) and current classroom practices related to technology.

Cases currently are being constructed such that users can explore teachers' classrooms either one at a time (case by case) or collectively (i.e., comparing features or themes across cases). Each case contains a variety of elements that combine to illustrate how teachers' visions for technology use are translated into practice. Classroom video examples comprise the center of each case and are integrated with teachers' interview comments, reflections on the lesson's effectiveness, descriptions of how each lesson evolved, as well as a discussion of the supporting pedagogy. Users also have access to information about classroom layout, available hardware and software, and resulting student projects.

As an instructional tool, the CD-ROM is designed to provide opportunities for users to explore a variety of examples of how effective technology use can be achieved. Although, optimally, initial uses of the CD-ROM would be completed in a whole class setting, this is not essential to effective use. Users have the option of working individually, or in small groups, to examine and compare the six cases. Users will explore and compare case components within a "reveal-reflect-refine" framework (Lesh & Kelly, in press). That is, teachers' beliefs and practice will be revealed within multiple contexts that prompt users to reflect on critical similarities and differences across cases. Recognizing that even "exemplary" technology integration is ever-changing, users are challenged to articulate testable suggestions that refine observed practices. During concurrent and/or subsequent field experiences, students' ideas can be piloted, then further refined in a continually "evolving expert" process.

Future Uses and Plans

Still in a prototype format, formative evaluation data are currently being gathered from intended users (pre-service teachers) of the CD. Based on the evaluation feedback obtained, the CD-ROM will be revised and finalized during the current (Fall 1999) semester. During the Spring, 2000 semester, materials will be piloted in two sections of *Classroom Applications of Educational Technology*, a one-credit course that serves as a companion to our 2-credit *Introduction to Educational Technology* course. During the spring semester we will begin gathering data to assess the effectiveness of the materials in fostering the growth of students' visions for classroom technology use.

The CD-ROM materials will be used to improve our k-12 teacher preparation program. In the future, use will also be extended to support local in-service teachers' efforts to envision and achieve technology integration. By providing electronic access to the beliefs and practices of technology-using peers, this project implements a cost-effective solution to a persistent problem. Using realistic pedagogical models, these materials can help current and future teachers envision and use available technology resources to create learning environments that simultaneously support and benefit from the use of instructional technology. By including teachers and students from both the University and local public schools we establish a close connection between technology, teacher education, and k-12 education. By

helping teachers envision and achieve exemplary technology use, we promote widespread, fundamental changes in teaching methods that foster the development of both exemplary teachers and learners.

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Database Advisor : a New Tool for K-12 Research Projects

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Abstract: The Database Advisor (DBA) is a tool designed to guide users to the most appropriate Web-based databases for their research. When teachers, students or library staff begin a research project it is not always obvious which database would be the best resource to locate information on a topic. As K-12 schools rely more and more on databases via the Internet, a search tool such as Database Advisor will be essential. Presented herein, is a description of how the Database Advisor works, the equipment and resources necessary to implement, where to get the source code, and why K-12 schools should seriously consider this product. To see the Database Advisor in action, visit UCSD's public version for the Sciences at: http://scilib.ucsd.edu/Proj/dba/dba_public.html.

What is *Database Advisor*

Database Advisor software was developed in 1997 by the Science Libraries at the University of California, San Diego (UCSD). Database Advisor (DBA) is a web-based front-end to bibliographic and full text databases to which UCSD has remote access via the Web, Z39.50 and telnet. Database Advisor allows the user to specify terms, then automatically performs a keyword search of all profiled databases. DBA spawns a search process for each database, quickly sorts and returns the results from each database. The user can see which database contains the most information on the topic. A hyperlink to each database is included so the user can immediately get to the results or the specific database to launch a search in that interface.

Why K-12 schools need *Database Advisor*

When students and staff in public schools are engaged in research projects, time and cost are very big factors. Databases are often purchased by consortiums, special licensing arrangements, or through specialized grants such as EDL (Electronic Doorway Library) grants. The vast numbers of possible places to find information often confuse patrons in public schools. The Database Advisor (DBA) can assist K-12 students and staff by suggesting starting points in specific databases that match the information need of the user.

Database Advisor is a tool that will simultaneously search all profiled databases, and it can increase usage of some expensive and underutilized databases. Customization of the various databases would also advise the user if there is an extra fee or provide an alternate avenue to obtain the data. Database Advisor has the ability to reduce the amount of time spent researching a topic using databases. Use of this tool will focus the user's attention on the specific databases that are likely to provide useful information. As K-12 schools rely more and more on databases via the Internet, a search tool such as Database Advisor will be essential.

K-12 school libraries are increasing using web pages as starting points for research. If Database Advisor was an add-on feature to some of the instructional web pages, patrons would immediately know which databases they could gain access to free of charge. Although many people believe that the Internet is free, this is not true. This is especially true for valid, authentic sites, including databases. Someone has to pay for the development, data entry, programming and site maintenance. In order to gain access to high quality, valid reference sites, schools have to make difficult decisions on which databases they can offer. This decision is often fiscally driven. K-12 schools simply can not afford the same databases as large academic institutions. They often have to pool resources together to be able to purchase even a single database.

Time is always an issue. K-12 students often are locked into specific times that usually range from thirty to ninety minute class periods. Schools continue to follow an agrarian calendar and school day. When Database Advisor is added to a web site, this time barrier is broken. Students can access and do a great deal

of research from home or the public library. They can also maximize their in-school research time by e-mailing information they find to their own e-mail address for later reference work.

Database Advisor has already been created and the source code is free of charge to K-12 schools. DBA is designed to be "portable" for application in any organizational environment, including schools. Schools need to pay a person to adapt the source code to meet their specific needs. This tailors the features of Database Advisor to their unique instructional needs. As K-12 libraries increasingly use web based content subscription services they need tools to assist their patrons. Database Advisor can maximize their time and improve their results.

How *Database Advisor* works

DBA works somewhat like a DIALOGWEB's DIALINDEX® search -- on a much smaller scale, and with results customized to your unique local database mix. Database Advisor's appearance (input boxes, point-and-click, radio boxes, etc.) will be familiar to Web users. Graphic load is kept to a minimum, with a familiar, easy-to-use Web interface. For example, in the Web environment hitting the "enter" key sends a search query; DBA observes this convention. On the Welcome Screen it is obvious where the user enters search terms (Fig. 1).

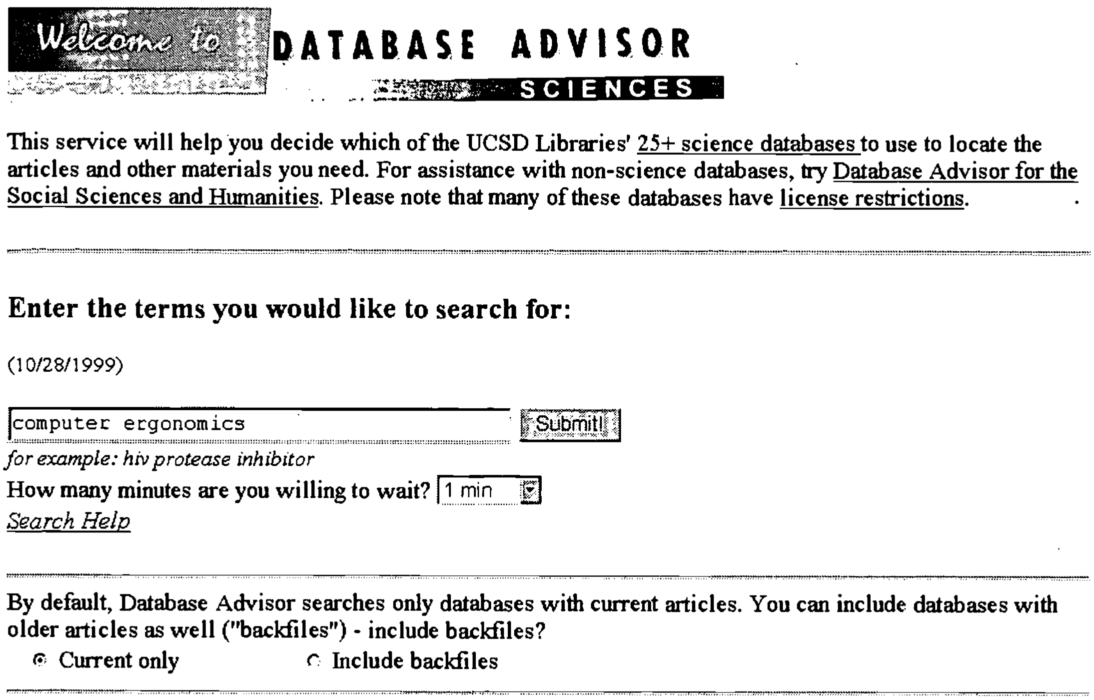

Figure 1. Welcome Screen -- enter search terms

The user is given options to change default settings. Searching current files is the default, but the user can choose to include backfiles. Most users want to quickly search ALL databases but the user can select subject categories thereby limiting the databases searched (Fig. 2). Most search results are listed within one minute, but if more time is needed the user can increase the search time -- this is a useful feature when databases timeout before returning results. The Help section provides guidance in structuring DBA searches (Fig. 3).

SUBJECT CATEGORIES (optional)

▲ Return to Top

- To limit your search by subject category, click in the box next to that category. You can select more than one.
- If you select nothing from the sections below, all subject categories will be assumed.
- There are 10 broad subject categories included in Database Advisor, each of which includes a number of different databases.
- A list of the databases included in each subject category is available.

☑ All Subject Categories

☐ Biology
☐ Chemistry
☐ Computer Science
☐ Engineering
☐ Mathematics
☐ Medicine
☐ Oceanography
☐ Physics
☐ Science Business
☐ Science Education

Figure 2: User selects subject category(s)

SEARCH HELP

▲ Return to Top

Database Advisor (DBA) will take the terms you specify and automatically perform a **keyword search** in over 25 different databases. Your results indicate the number of **hits** that would be found in each one, ranked from the most to least hits. You can then link directly to the database of your choice to perform your search. Here are some tips to help you use **Database Advisor** most effectively:

Tip	DO	DON'T
Keep it simple • limit to one or two main concepts • don't use multiple synonyms; use only one word for each concept.	bridge corrosion	bridge corrosion rust acid rain precipitation
Boolean searches • Do not use AND, OR, or NOT. • AND is implied between each word.	aspirin headache	(aspirin OR ASA) AND (headache OR migraine)

The following are **not** available in Database Advisor, but may be available in one or more individual databases when searched directly:

- author searching
- phrase searching / word adjacency
- single letters and special characters - e.g., π, Σ, é
- wild card characters / truncation symbols - e.g., * ? #
- case sensitivity - e.g., MIT vs mit

Figure 3. Search Help

When the user hits the "enter" key, Database Advisor automatically performs a keyword search of more than 25 science databases. DBA spawns a search process for each of our nine database vendors and returns the hits on the query (Fig. 4). Results are ranked, so the user can see where each database stands relative to the others. Each database has a link that can be followed to access the database and continue the search process. The concept of "instant gratification" has been implemented; the user goes directly to the results of a search when they choose a database. This function presents some technical challenges and is not available for all UCSD databases. A legend (Fig. 5) explains the Results page.

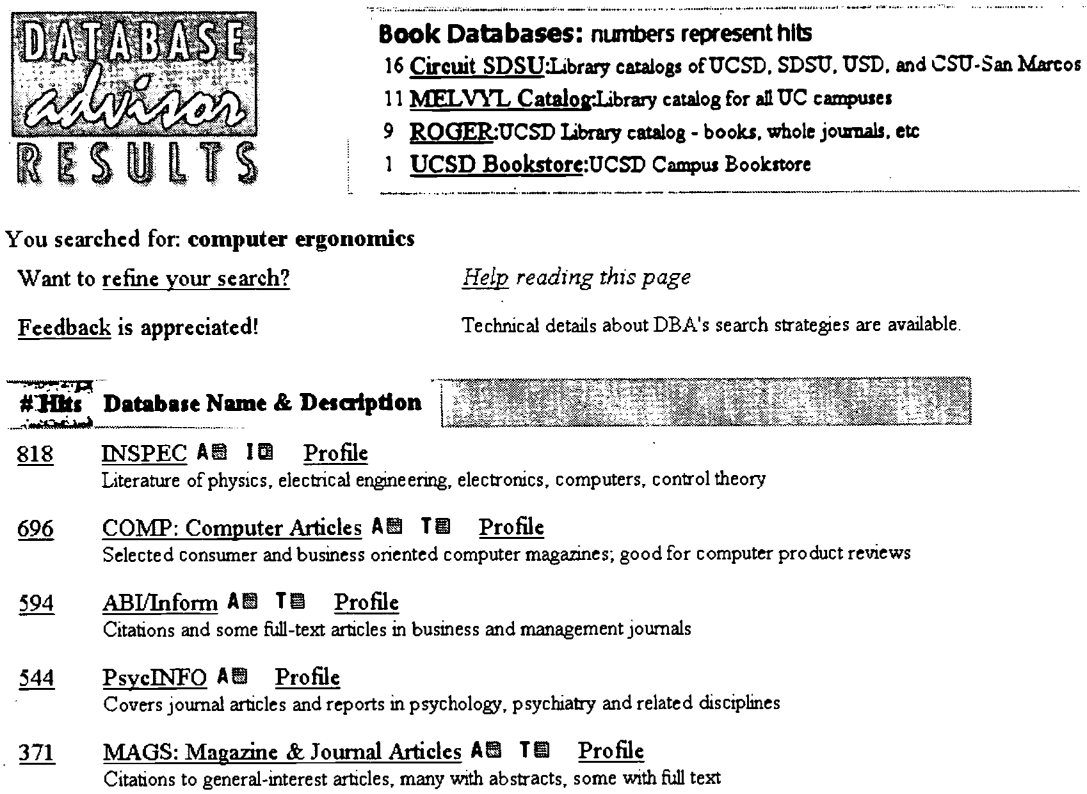

Figure 4: Top of the Results screen

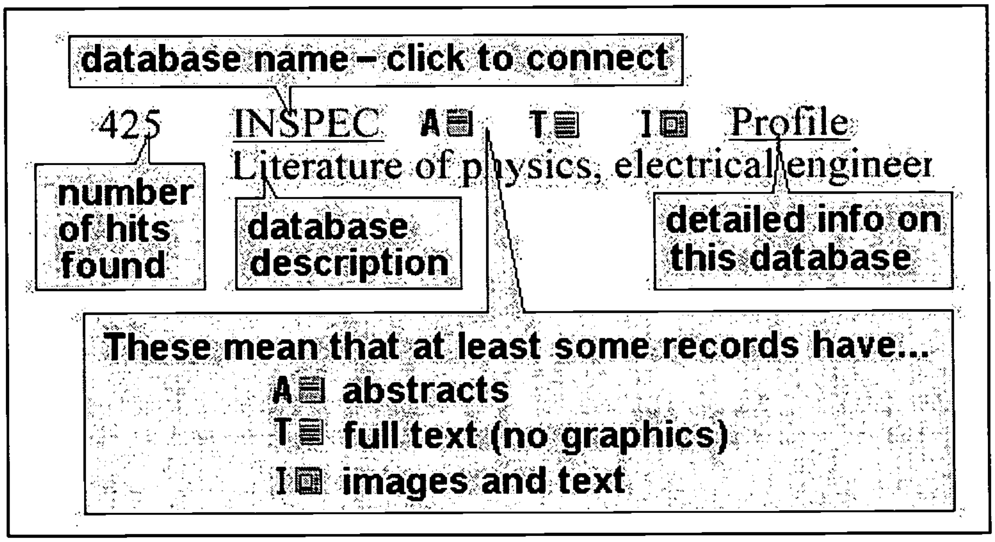

Figure 5. The "Legend" explains the Results screen

At this point the user can examine the database profiles (Fig. 6), refine all aspects of a search (Fig. 7), or click on a database name on the Results screen (Fig. 4) to run a search in that database.

COMP: Computer Articles Profile

Database Name	COMP: Computer Articles
Search URL	http://www.melvyl.ucop.edu/?CSdb=comp
Starting date	1988
Ending date	present
Abstracts	Y
Full text	Y
Full image	N
Subjects	Computer Science, Science Business
Update frequency	weekly
One line description	Selected consumer and business oriented computer magazines; good for computer product reviews
One paragraph description	Use the MELVYL Computer Articles database (COMP) to retrieve records for articles in about 200 consumer and business oriented computer magazines. The articles are indexed by Information Access Company and include subjects and abstracts, plus the complete text for many articles. This is a particularly good place to obtain product reviews for computer components and peripherals.

Figure 6. Sample database profile

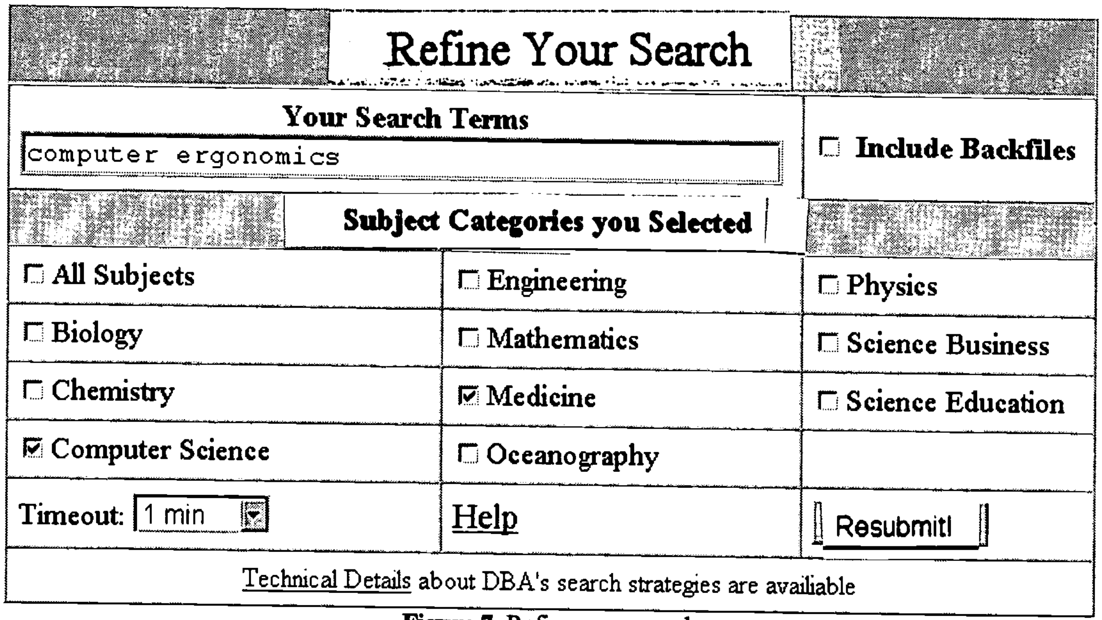

Figure 7. Refine your search

A Database Advisor search differs from searching in a specific database. Searches are limited to the databases profiled by the librarians and databases in the user-specified subject categories. While users supply the keywords, the librarians have already supplied the search strategies to standardize the search across the various databases. Precise technical search strategies and fields are used to search each database. "Our goal in designing search strategies was to achieve an equivalent search of title words, abstract words, and subject terms in each database. This was not always possible because of the differences in the fields available and the way in which each database searches these fields. To achieve uniformity across databases, DBA's search strategies are by necessity rather generic" (Hightower, et al., 1997). Database Advisor guides users in choosing a database, it does not perform the most precise search possible in each database. Using the unique features and search capabilities of a database, more precise searches can be performed and users can refine their search as appropriate for each database used.

DBA searches three types of **bibliographic** databases: web, Z39.50 and telnet. Precise technical search strategies and fields searched in each database in Database Advisor are available at: http://scilib.ucsd.edu/Proj/dba/search_strat.html. Database Advisor does not search Yahoo or the rest of the Web. DBA was designed to search bibliographic indexes and abstracts, like Inspec and Compendex, because we lacked a good tool that searched across databases supplied from so many different vendors. Several meta-search engines (like *Inference Find* and *Metacrawler*) exist that traverse the publicly accessible webspace. Perhaps in the future it will be possible to offer a link to one or more of these meta-search engines from DBA...as long as the results remained useful rather than overwhelming or confusing to the user.

Implementation...how to get source code

To implement at your site someone (a technically-savvy librarian or administrator, for example) will need to work with an on-site programmer to select databases, assign appropriate subject categories, develop profiles and determine the search strategies that will work. A single programmer currently on staff in the UCSD library now maintains the code, adding and adjusting database scripts and profiles as necessary.

A fully functional version of DBA is available to users of UCSD Internet accounts (i.e., those using a UCSD Academic Computing account, or those in an on-campus building). Obviously, non-UCSD usage of databases has licensing implications. A public version is available so you can see a "live demonstration" of how Database Advisor works. Note: Some databases are removed from the public version of DBA due to license restrictions. Anyone with Web access, regardless of UCSD affiliation, can use the demo version of Database Advisor. However, many of the databases that show up on the Results page are restricted to University of California (UC) or UCSD users, and may not allow access from outside IP addresses. To see the Database Advisor in action, visit the Public Version of DBA Sciences at: http://scilib.ucsd.edu/Proj/dba/dba_public.html

The source code for Database Advisor, Sciences version, is available under the terms of the GNU General Public License at: http://scilib.ucsd.edu/Proj/dba/code/dba-source.html . The DBA program is free software. You can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation (either version 2 of the License, or any later version). The program source code is distributed in the hope that it will be useful, but without any warranty. For more details about the GNU General Public License see: http://www.gnu.ai.mit.edu/copyleft/gpl.html. To run DBA at your site you need a UNIX computer with Internet connectivity and the equivalent of an Apache Web server (common in academic settings). You need the following software to install Database Advisor:

Z 39.50 API Client software for Z39.50 connections: You obtain the code from http://lindy.stanford.edu/~harold/z3950/www_gateway.html

GNU C compiler: To compile the zclient code for your machine. For more information on the GNU project and a list of FTP sites for GNU software go to http://www.delorie.com/gnu/

perl (version 5.004_01 or later): You can get the latest version of perl from: http://www.perl.com

Summary

Database Advisor has the ability to reduce the amount of time spent researching a topic using databases. Use of this tool will focus the user's attention on the specific databases that are likely to provide useful information. As K-12 schools rely more and more on databases via the Internet, a search tool such as Database Advisor will be essential. Many K-12 school systems now have both the technology and programming ability to implement a tool like DBA, and, at this time, Database Advisor is the only tool we have seen that meets this information need.

References

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Digital Cameras in the K-12 Classroom

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Abstract: Today's digital cameras, electronic devices that merge computer capabilities with traditional photography, have come a long way in affordability and ease of use. Digital cameras can enhance and energize many curricular activities. They allow for instant results, user flexibility, and ownership in the development of the images. Users take pictures in the standard way, store them on a digital disk, and use these images on their computers. Although film based technologies can provide the same opportunities, the use of the digital camera provides a hassle-free way to capture, manipulate, and present images relative to instruction.

As our society relies increasingly on transferring knowledge quickly and easily through visual means, the digital camera provides a powerful tool for customizing the materials we will use to transfer this information. Many of the educational reform movements of today emphasize the importance of designing the learning experience to be relevant to the child's world. A good way to bring the world into the classroom is with visual representations of the content being discussed. For example, a Kindergarten and First Grade classroom activity is the shape walk, in which teachers take their class into the neighborhood where students find instances of simple two dimensional shapes as used in society or represented in nature. Using a digital camera, the student takes pictures of the shapes instead of merely pointing out these instances. As middle grades classes discuss the form and functions of geometric shapes, digital cameras allow the students to take pictures illustrating where form enhances function. Examples of such pictures include the rectangular solids used on container ships as an efficient way to load and unload cargo or spherical gas storage tanks as representation of shapes that provide strength to resist internal pressures. A high school Geometry experience designed to develop an appreciation for geometric theorems, might include visual images. The digital camera could be used to: 1) take pictures of a building and insert the pictures into a draw program, 2) superimpose a grid over the inserted image, and 3) use the image to calculate an equation for an architectural feature such as an archway.

Additional geometric applications might be to illustrate the Golden Rectangle, a rectangle with an approximate proportion of 2 to 3, a feature of classic Greek architecture that is considered to be the most esthetically pleasing proportion to the human eye (Jurgensen, Brown, & Jurgensen, 1988). Another activity could include taking pictures of three dimensional structures at a corner and inserting the pictures into a draw program so that lines can be drawn to show perspective and vanishing points.

Today's definition of literacy moves the focus of literacy beyond facility with the printed word and toward acquiring a knowledge base. The definition of a literate person is evolving to include the ability

to gather and impart information in a visual format. The delivery and acquisition of this information includes visual images. The instructional process should include providing today's students with proficiency in the skills necessary for handling visual information (Crockett, p.5). The digital Camera provides a tool to develop this form of literacy in the same way that word processing does for the printed word.

Integration of the Digital Camera into the Instructional Process

Within the P-12 curriculum, use of the digital camera is only limited by one's imagination. Some instances of integration of visual images into the instruction process of common content areas are:

- Reading and Writing - This application combines reading with the visual arts and writing skills. Descriptive language can be developed by taking a picture and asking the student to describe the content of the picture, either orally or in a written format. Conversely, the teacher could describe an object or situation either verbally or in written form and ask the students to create a picture of the description. As the students develop these skills, their communication abilities are advanced through creation of a picture book or story, a storyboard for a play, or a record of an experience that imparts information both visually and verbally.

- Science, Social Studies and Mathematics - Images can be used to prepare for, document, and follow up on, field trips in the content areas. A teacher's visit to the field trip site prior to the trip to record images that the students will observe creates a visual record to serve as an advanced organizer. As part of the actual trip, students take pictures. Follow up activities include reports or further study of aspects of the trip. For example, a field trip to a historic town could include the architectural aspects of the town. On a pre-trip visit, the teacher takes pictures of various types of architectural designs to share with the students before the trip. While on the trip, the students record their observations, both similar to and different from the architecture features the teacher observed. Reports developed as a result of the trip might include researching the defining features of an architectural style, and analyzing whether the designer/builder of a particular building incorporated more than one architectural style. Identifying the mathematical considerations that are apparent in the design of a structure, and how the design of the structure relates to it's function are also questions to be considered.

- Projects - As students create projects in the classroom they take pictures to record the process and results of the project. A class working on folk art could take photographs of the quilts in their families. The students could then create a database for use in discussing: 1) the differences and similarities of the quilts, 2) the materials used to create a quilt, 3) the lives of the people who created them, 4) how the designs reflect the life of a quilter, and 5) the geometric patterns and tessellations required to make a quilt.

- Scientific Experiments - Students use the digital camera to record their observations in a science experiment that involves change over time. The growth of a plant or animal, the change in a specific site over seasons or years, or the effects of a chemical reaction are all possible situations which can be recorded by a series of images.

- Desktop Publishing - Student reporters for class or school newsletters take pictures of special events, students, and faculty to illustrate articles.

- Visual Arts - The aesthetic aspects and critical analysis of an image are explored by discussing the organization of visual space to convey a feeling, action, or documentation. The display of the images, criteria for selecting images, and how an image can convey a message in place of words are all considerations. Additionally, using an image to complement text, the manipulation of images to create a new image, and the isolation of certain aspects of an image to focus on a specific idea, are important aspects of visual imaging and communication.

- Data Analysis - Students using the digital camera can create a visual field in the database. A class that is studying the birds observed in the schoolyard could create a database of each bird viewed. The time sited, color of plumage, whether the bird is a juvenile or adult, if the bird is migratory or residential, its feeding and nesting habits, as well as an actual picture of the bird could be included. If multiple entries for each bird occur, students can analyze the data to determine if the siting were of unique birds or if a repeat siting of a single bird occurred. A teacher could also build a database over several school years providing the opportunity to track birds over time. Another application involves creating of a database of American Sign Language (ASL) to provide learners with images of each letter and of common phrases. The ASL could also be useful for special need learners.

- Computer Literacy - Most state and local school districts are beginning to require a computer literacy component in their graduation requirements. The digital camera is a vital part of this process and provides images that are integrated into web pages and presentation programs.

- Classroom atmosphere - Many teachers use pictures and images to highlight each student's special characteristics in order to build self-esteem and a sense of place. A picture emphasizing a child's special characteristics and their contributions to the classroom becomes the vehicle for building classroom pride. Use of a digital camera helps facilitate this idea by showing the strengths and actions of each student and helps them see themselves as part of the classroom community. Students with special needs who are encouraged to use the camera to record projects and information are given a powerful tool to help them participate in classroom learning activities and improve their self concept.

- Assessment - In assessing learning, digital images can be used in construction of traditional tests and in production of alternative assessment documents. Tests created that include images of items or processes from classroom experiences give the teacher an opportunity to develop test items that relate to the student's experiences. Authentic assessment is achieved with the inclusion of images that students have taken of their work in portfolios documenting a greater variety of work than might otherwise be included.

Advantages and Disadvantages of using the Digital Camera in the Instructional Process

When using visual images in the classroom, making the decision to include the digital camera to produce the images over traditional methods requires analysis of the camera, the learning situation and the capabilities of the learner. Several advantages and disadvantages present themselves for consideration when selecting an imaging option using a digital camera. First, and probably most important, are the advantages.

Advantages

Photographing with a digital camera is almost instantaneous. Images can be viewed and/ or downloaded immediately and used at the "teachable" moment. Additionally, images can be analyzed and retaken immediately on site, if desired. The capability to delete unwanted images immediately is also a plus, allowing the user to manage storage space. Film cannot be inadvertently exposed using a digital camera thus preventing the loss of an image that is common when a traditional camera is used.

Cost, following the initial outlay of funds for a digital camera and storage device (flash card or floppy disk) is minimal. Therefore, one time funding provides equipment and materials for use over several years. Eliminating continuous cost frees teachers and student to use the camera frequently.

Several features are evident in all digital cameras. They include a Liquid Crystal Display (LCD) screen and storage format. Many cameras use the LCD as the viewfinder allowing the user to see exactly how the picture is composed prior to taking the picture. Most digital cameras also allow the user to adjust the resolution of the image before the photograph is taken.

Digital cameras save pictures in standard JPEG format that is compatible with a wide variety of computer programs. When JPEG images are used they can be easily inserted and integrated into word

processing, database, desktop publishing and presentation programs. Use of the digital camera eliminates a step in the process of including images in a computer presentation. If traditional photographs are used, they must be scanned into the computer adding an additional step in the imaging process. The extra step increases the cost of the imaging by requiring the purchase of another piece of equipment. Additionally, the learning curve is increased due to the fact that the user must master the use of the scanner and its associated software. The quality of the digital camera images is as good as or better than a scanned photograph when used in computer applications.

Finally, a number of digital cameras also have video-out ports, this feature permits the projection of the digital image on a television screen or monitor and is especially helpful if a computer is unavailable in a classroom.

Disadvantages

There are, however, some obvious disadvantages in using a digital camera in the educational environment. The initial cost of one digital camera exceeds a number of regular "throw away" traditional cameras. However, the one time cost of a digital camera is offset when the continuing cost of film and developing is considered.

A second issue is printing. Printing of images that have been taken with a digital camera on either an inkjet or laser printer may diminish the quality of the printed photograph due to the printing process and the paper that is used.

Lastly, when shooting in an outdoor environment with a digital camera, bright sunlight may prevent the user from viewing the LCD. Thus, the ability to compose, focus and review an image is greatly reduced unless the user makes some provision for shading the LCD.

Considerations when purchasing Digital Cameras for the K- 12 Classroom

When considering the purchase of a digital camera several questions must be answered. Who is going to be the primary user, a student (and of what age) or a teacher? A camera designed for an adult might prove too difficult for a young child to use. Another question to ask is: How and for what purpose will the camera be used? Therefore, when purchasing a digital camera, one needs to pay attention to the various features offered. These features include:

Viewfinders. Does the camera have an optical viewfinder or a LCD screen? LCD's let you view the pictures you've just taken allowing the user to decide to retake the pictures or delete them from the cameras that only have LCD's (no optical viewfinder) tend to suffer from two problems: they use up batteries quickly and can be hard to see in bright daylight. The best bet is to look for a camera that has both a LCD and optical viewfinder.

Storage. Today's cameras store images on a number of different types of media. The most common is the Flash Card and associated compact Flash Card. These cards come in various sizes from 8mb up to cards that hold over 256mb of information. If a computer is equipped with a PCMCIA slot, one can transfer the images on these cards directly into the computer more quickly than by cable. The Sony Mavica camera uses standard 3.5" HD floppy disks. The picture files can then be used in any computer with a standard floppy drive. This inexpensive media would allow every student to have their own storage disk and edit the pictures on any computer, at home or school.

Resolution. Cameras with higher resolutions produce sharper images. The least expensive digital cameras have the lowest resolutions, 640 x 480 is the minimum needed for a decent image. Higher resolutions are especially advantageous for print, as opposed to Web pages and/or presentation programs. The one problem with the higher resolution cameras is that they tend to cost more and the pictures take more storage space. Therefore, one should look for a camera that allows one to change the resolution of the picture before taking it.

Lenses. Most low-end digital cameras offer fixed-focus lenses, like those on the less-expensive film cameras. Fixed focus lenses are all right in many situations, and are lighter and easier to use than zoom lenses, although it may be more difficult to get the picture desired in difficult situations, for example when taking a picture of a distant object or person. Cameras with zoom lenses allow the user to eliminate distracting backgrounds when shooting, and add to the camera's versatility. However, zoom lenses add to the cost and weight of the camera. At the high end of the price scale are cameras that allow you to use different lenses for different situations. Minolta's digital cameras will work with most of the lenses they make for their 35mm film cameras. Look for a camera that has the type of lens needed for the intended purpose of the camera.

Software. Digital cameras come with a variety of bundled software that will allow the manipulation of the images once they are downloaded into a computer. This software ranges from minimal viewing programs to complete image editors. The two most popular software programs that are currently being bundled are *Adobe Photoshop LE* and *Adobe Photo Deluxe.*

Virtual Reality. - A series of pictures can be taken of a scene that covers a panorama of the site. These images can then be "stitched" together to form a 360 degree panorama allowing the viewer to control the point of view of the scene. The panoramas are initially created by using a tripod with a digital camera to create a series of individual still images. Then the images are imported into a QTVR software package and the panorama is formed. The viewer can then actually experience and control the observation of the site. Several shareware and commercial programs are available to create panoramas. The commercial software programs include Apple's *QuickTime VR* for both Macintosh and PC computers and *VR Worx*, or one of several powerful programs which are easy to use and that can be purchased for under $100 and allow the teacher or the students to develop panoramas.

Computer. Almost all of the digital cameras will work with both the Macintosh OS and Windows computers, but it is important to be sure that the camera comes with the cables and software for the computer which will be used.

Digital Cameras are great learning tools to simulate and motivate students and teachers alike. As teachers use and experiment with digital cameras they will find applications that are unique to their classrooms. The digital camera coupled with other computer applications provides a sound basis for teachers and students to meet the National Educational Technology Standards.

Web Sites

For more information on the digital camera, from how they work to how they can be integrated into the instructional process, explore the following Web sites.

Digital Imaging Resources for Educators
http://www.edb.utexas.edu/regcol/digimg/index.html
Digital Cameras In Education
http://www.ozemail.com.au/~cumulus/digcam.htm
Digital Cameras In Education
http://www.kodak.com/US/en/digital/edu/lessonPlans/lessonPlans.shtml
KODAK: K-12 Solutions - Lesson Plans
http://www.kodak.com/US/en/digital/edu/k12Solutions/index.shtml
Enhancing Learning Through Imaging
http://www.kodak.com/US/en/digital/edu/education.shtml
The Casio Classroom – Technology, Mathematics, and Science Education
http://pegasus.cc.ucf.edu/~ucfcasio/casio.htm

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NEW DEVELOPMENTS IN AUDIO AND VIDEO TECHNOLOGIES

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ABSTRACT

Pohlmann (1999) describes what he calls the "X-tronic generation" as, "Younger than Gen-Xers" and having "pure, liquid technology coursing through their veins" (p. 38). Their out of school lives are saturated with high tech tools, and they have become experts in manipulating this technology. How well equipped are our educational institutions in dealing with X-tronic kids? Change theorists claim that there are levels of concerns that educators progress through as new innovations are introduced into their professional lives (Hall & Hoard, 1987). The first level is that of *Awareness*: Knowing that an innovation exists and understanding its uses. This article is aimed at the awareness level. It describes several emerging audio and video technologies including DVD, digital television, high definition television, and new audio formats. It focuses on technologies that have high adoption rates and appear to have some potential in educational settings, including distance delivered instruction.

THE X-TRONIC GENERATION

A few weeks ago my ten year old son purchased a device from a local department store that attached to his Nintendo 64 player allowing him to program his game cartridges with custom options not normally available to the user. Within minutes, he had programmed his James Bond game to make his character invisible, and he had an assortment of weapons at his disposal that would make the politically correct shudder with horror. A quick surf on the Internet provided him with even more programming codes that allowed him to do things that only ten year olds would understand. Later that evening, he worked on a multimedia book report on Jack London's *White Fang* using the ubiquitous Hyperstudio. This activity was interrupted with Internet hookups to several major airport control towers, including Chicago's O'Hare and Dallas-Fort Worth, so that he could listen in on what was happening in the friendly skies. His final activity of the evening was a screening of *Austin Powers* on DVD displayed in all of its garish glory on a pristine large screen TV with six channel surround sound. The next day I dropped him off for school with his *printed* book report in hand, where he spent six hours interacting with analog technologies such as textbooks, pencils and paper, and storytelling.

Pohlmann (1999) describes such kids as the "X-tronic generation" (p. 38). He states, "Younger than Gen-Xers, they have pure, liquid technology coursing through their veins" (p. 38) Pohlmann goes on to state that critics of X-tronic kids should "try looking at tomorrow through younger eyes, eyes that see sophisticated technology as a necessity instead of a luxury. Maybe then they will understand how the X-tronics instinctively use technology to broaden their horizons and reach farther than ever before" (p. 38).

How well equipped are our educational institutions in dealing with X-tronic kids whose out of school lives are immersed in technology? Can teachers capitalize on the skills that our children are learning outside of the classroom in order to enhance the teaching of reading, writing, science, math, music, history, and art? Furthermore, what are colleges of education doing to prepare the current crop of preservice teachers and library media specialists to deal with the X-tronic generation?

Change theorists claim that there are levels of concerns that educators progress through as new innovations are introduced into their professional lives (Hall & Hoard, 1987). The first level is that of *Awareness*: Knowing that an innovation exists and understanding its uses. As professional educators who live in the world of instructional technology, it is our obligation to understand how the change process works so that innovations can be used to enhance learning and reach X-tronic kids who are increasingly questioning the

relevance of the K-12 educational experience. This article is aimed at the first level of concern: Awareness. It describes several emerging audio and video technologies including DVD, digital television, high definition television, and audio formats such as Dolby Digital and MP3. This article is not all-inclusive, but rather focuses on technologies that have high adoption rates and appear to have some potential in educational settings, including distance delivered instruction.

DIGITAL VERSATILE DISC (DVD)

Since the Digital Versatile Disc (DVD) was introduced three years ago, its adoption rate has been faster than that of VHS videotape. The CD-ROM sized disc has many features that make it attractive to users. A single disc can hold up to four hours of full motion video and high quality audio information on each side of the disc. The picture is free from artifacts such as tape noise and hiss associated with traditional videotape. Furthermore, users have instant access to any of the information on the disc without having to rewind or fast forward through the information.

Many discs include soundtracks that are in different languages, typically Spanish and French. This makes it an ideal medium for foreign language classes or for students whose first language is not English. Most discs include subtitles in several languages making the information useful for deaf and hard of hearing students. Most of the titles currently available are full length feature movies, both current releases and classic motion pictures. Useful extras are often included such as commentaries from directors and producers, background information about the film, actor biographies, featurettes, and even links to websites.

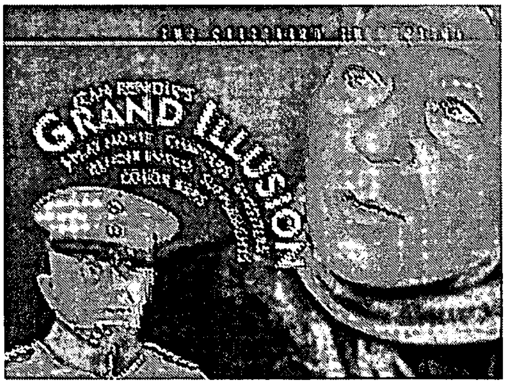

Figure 1: DVD menu from Jean Renoir's *The Grand Illusion*.

Many DVD's feature high quality Dolby Digital audio along with more traditional stereo or mono soundtracks. The digital soundtracks can contain up to six channels of discreet sound information, enveloping the viewer in the action. The six channels are center (dialogue), front left and right effects, rear right and left surround, and low frequency (subwoofer) information. In order to reproduce the six channel soundtrack, a six channel decoder is necessary along with five speakers plus a subwoofer. Decoders are included on most hi fi receivers produced in the last two years.

Another audio option offered on many DVD's is Dolby Pro Logic surround, which is a format that has been around for about ten years. This is not a discreet six channel arrangement, like Dolby Digital; however, with a Pro Logic receiver and five speakers, the surround effect can be very effective. Dolby Pro Logic extracts the mono surround information from the stereo soundtrack and steers it to the appropriate speaker using matrix technology. The channel separation is not as well defined as Dolby Digital.

In addition to high quality audio and video information, many DVD's offer a choice of aspect ratios, including traditional television (4 units wide by 3 units high) and widescreen (typically 16 units wide by 9 units high) allowing the viewer to see the film in its original theatrical format.

Educational titles are beginning to appear. They offer all of the advantages mentioned previously plus user friendly operation. Only a DVD player and a TV are required for viewing. Teachers can access parts of the disc instantly with the touch of a button, much like the laserdiscs that were used in education in the early 90s.

Discs are reasonably priced—most less than $30—and are not prone to mechanical problems associated with VHS tapes. The only downside to DVD for school use is that the discs require careful handling. If discs become scratched or smudged, they will malfunction. Most teachers and media specialists are accustomed to handling CD-ROMs and audio CDs, so the durability question is less of a factor.

Implications for teachers and library media specialists are many. First, library media specialists should consider purchasing DVD players instead of VHS video players as they replace machines. Also, they should consider ordering educational materials on DVD rather than videotape. Teachers should be trained on handling and operating discs and players, and integration techniques. Many of the same integration principles that apply to CD-ROM, computer software, film, and videotape apply to the use of DVD in the classroom.

Overall, DVD is a rapidly growing technology that has excellent potential in the classroom. Teachers, media specialists, and teacher educators should be familiar with its advantages and uses in the classroom.

DIGITAL TELEVISION AND HIGH DEFINITION TELEVISION

The Federal Communications Commission has mandated that digital television (DTV) will become the new standard for TV broadcasts in the United States replacing the current NTSC standard which has been around since the 1950s (Griffin, 1999). Digital television is a high quality format, free from much of the interference (ghosting, unstable picture quality, lines and "snow") common to NTSC.

High definition television (HDTV) is a subset of the digital TV, containing the highest quality picture included in the DTV spectrum. So far, HDTV's introduction has been slow, and there are many competing formats (Arlen, 1999). Only a few programs in major cities are currently broadcast in HDTV, and users need several things in order to decode the information. First, a high definition television set is required, and although the prices are dropping, they are still out of reach for most consumers and schools. Second, a high definition tuner/decoder—again, fairly expensive—is also required. As mentioned previously, there are several competing formats which impacts the tuner/decoders that are available on the market today. Finally, a rooftop antenna is currently required, since HDTV broadcasts have yet to hit the cable and satellite markets.

There is no question about the quality of HDTV. It is magnificent (Griffin, 1999). But cable TV companies have yet to embrace the technology, and the nation's largest cable companies are not planning on offering any digital broadcasts until mid 2000—and then only to a few customers (Arlen, 1999).

One of the strengths of the HDTV format is its theater-like aspect ratio of 16 units wide by 9 units high. When DTV becomes the main delivery medium, current NTSC sets will require set top boxes to translate the digital signal into an NTSC form. For HDTV broadcasts, this will mean black bars on the top and bottom of a traditional 4 by 3 television.

The implications for teachers and media specialists are many, but not urgent. Eventually, decoders will be required to convert DTV signals for NTSC TVs in schools and media centers. For the time being, digital TVs are so expensive and the introduction has been so slow, that it makes no economic sense for schools and universities to purchase digital equipment. Format changes are likely, and the current crop of DTVs could be obsolete by the time that DTV becomes mainstream. It is on the horizon, however, and teachers and media specialists should keep abreast of DTV's dvelopment as it slowly replaces NTSC.

MP3 WEB AUDIO FORMAT

There are many developments related to the worldwide web that could be covered in this article including streaming video and audio used to enhance distance delivered instruction. I have chosen MP3 (MPEG-1, Level 3) audio because it offers high quality portable audio information in a relatively small file size. As courses are developed for web delivery, audio information in the forms of lectures, music, and poetry have traditionally suffered from compression artifacts making them difficult to understand and tedious to listen to. MP3 allows the web developer to compress files at different bit rates that significantly reduce the file size, yet still offer near CD quality sound. These files can be downloaded and played using an MP3 player (available free—www.mp3.com) either on the computer or by using a portable MP3 play, much like a Walkman that can be taken anywhere. This allows the learner freedom from the computer for some of the web delivered course material.

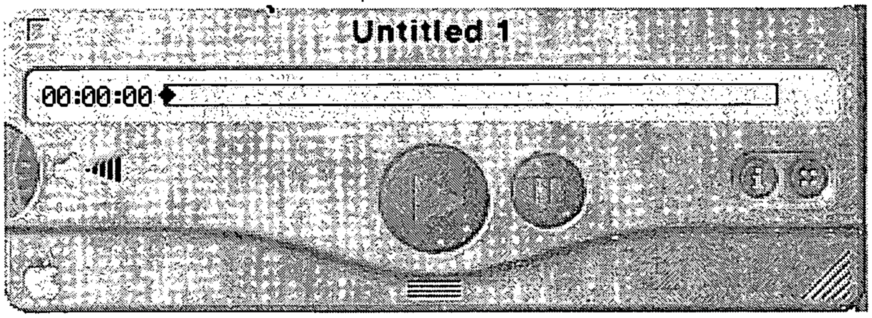

Figure 2: Quicktime 4 Player. Plays MP3 files. Available for Macintosh or Windows.

A thirty-minute lecture recorded at CD quality would take approximately 300 megabytes of hard disk space. This lecture could be broken up into three 100 megabyte files, and reduced to MP3 resulting in three 5 megabyte files with reasonable quality. Samples of MP3 files can be found on my website at www.edtech.unco.edu.

MP3 files are fairly easy to process. You begin by recording audio information directly to your computer using an audio capture program and the microphone included on most PCs. The file can be saved as an *.aiff* file which will work well with MP3 processors. You can download an MP3 "ripper" from the web, and the *.aiff* file to MP3 (Lake, 1999). Most rippers include several choices of compression rates. You can experiment to see which compression rate works best for your audio material. Your MP3 files can be posted to a website, and users can download and play the files using an MP3 player (see Figure 2).

FINAL THOUGHTS

As professional educators it is our responsibility to keep up with emerging technologies that show potential in enhancing the teaching and learning process for our students. More and more, students are becoming technologically savvy. They cannot imagine a world without computers and other high tech tools that allow them to express their creativity and to grow as individuals. Teachers, media specialists, and teacher educators should consider how they are going to reach the X-tronic generation, so that the classroom experience is not so far removed from their daily lives outside of school. The process begins with awareness. In this article, several video and audio technologies have been discussed in an effort to enhance awareness for professional educators.

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Linking Video Conferencing to the Desktop

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Abstract: Video conferencing for use in education has included the development of expensive yet sophisticated technology capable of delivering quality instruction to multiple sites. Limitations arise from using a closed network and a factor such as cost to establish and operate the network with video compression or satellite technology can potentially impact programming. An alternative to expensive and site-restricted technologies is desktop video conferencing. This paper reviews the process that involved selecting desktop video conferencing as the "next generation" distance learning technology. In addition, the paper discusses the creation of a multi-site desktop video conferencing network designed to serve central Louisiana and provide an array of program possibilities including courses for credit, teacher certification, and training to participating sites.

Introduction

The evolution of video conferencing for applications in education has accelerated significantly. Moreover, desktop video conferencing systems are becoming viable options to more expensive video compression systems for delivering classes (Kies, Williges and Rosson, 1997). Prevailing distance-learning technologies such as interactive satellite, video compression, audio graphics, and web-based Internet classes have a history of providing a mechanism to facilitate classes for credit or training to specific sites. What has resulted from the use of these technologies is an awareness of and sensitivity to the cost of delivering programming at a distance. With other considerations such as student attitude toward the technologies, interaction with the teacher and students, availability of access to the technology and support resources and adaptability of the technology to specific learning styles of the participants, a new desktop distance learning system emerged as a possible contender in the arena of diverse and costly distance learning technologies.

Desktop Video Conferencing as an Emerging Distance Learning Technology

The literature suggests that technologies such as desktop video conferencing have positively impacted the quality of teaching and availability of electronic resources for students (Googin, Finkenberg and Morrow, 1997). Desktop video conferencing is a relatively new yet emerging technology that provides cost-effective instruction under the umbrella of distance learning. Specifically, the cost of delivering instruction via distance learning using computer software and teleconferencing strategies--the profile of desktop video conferencing--creates savings in terms of money, time and resources without a substantial loss of effectiveness of instruction (Castellan, 1993). Desktop video conferencing has created more practical, less network specific distance learning opportunities than systems like video compression that cost $250,000 to $300,000 (Ward and Lee, 1995). It is a technology that allows students, teachers and colleagues to interact with each other from their desks or classrooms via the Internet creating the essence of a phone conversation but with video and graphics (Googin, Finkenberg and Morrow, 1997).

Technologies such as desktop video conferencing are often evaluated by specific benefits they generate that support instruction particularly for distance learning applications. Since most distance learning technologies improve access to learning, especially for students who are time and place bound, other issues such as creating positive learning environments for users are equally important. Laney (1996) noted that desktop video conferencing may foster collaborative teaching and learning environments between universities and public school districts or between rural and urban schools. Other benefits of using desktop video conferencing include sharing courses and expertise in the field with other institutions with limited resources and providing opportunities for students to participate in "electronic fieldtrips" where they meet with experts in their respective fields (Googin, Finkenberg and Morrow, 1997). Regarding the benefits of using desktop video conferencing over other distance learning technologies such as satellite or compressed video technologies, the information by Evans (1997) summarizes a comparison between the three technologies when examined by attributes such as coverage, interactivity, quality of video, cost of technology, cost-effectiveness, production and preparation, access to the technology and infrastructure.

	Desktop Video Conferencing	*Satellite*	*Compressed Video*
Coverage	limited number of sites	large number of sites	limited number of sites
Interactivity	face-to-face and maximized	limited interaction	face-to-face
Video Quality	lower resolution, less than full motion video	broadcast quality full motion video	lower resolution, less than full motion video
Costs	monthly lines costs for ISDN (competitively priced)	leased T-1 lines (usually expensive)	brokered satellite time (usually expensive)
Cost-effectiveness	most cost-effective of three technologies	cost-effective for large audiences	more cost-effective than satellite
Production	in an informal atmosphere or office at the desktop	usually in a studio	usually in a classroom
Access	connection made via a computer	uplinking by an video engineer	connection made via a technician
Infrastructure	ISDN phone lines	uplink transmitter	T-1 lines in designated markets

Table 1: Summary by Evans (1997) of comparison between three distance learning technologies, desktop video conferencing, satellite and video compression

There are some disadvantages however, to delivering courses at a distance using desktop video conferencing. Video and audio quality will not be as good as broadcast television or video compression. Video and audio use a great deal of space called brandwidth, which is typically not available with desktop video conferencing technologies (Googin, Finkenberg and Morrow, 1997). Comments such as "This would be great if...the video were better...the audio were better...it could mutli-point...the screen was bigger" (Johnson, 1999, p.1) are typical comments from users of first generation desktop video conferencing technologies. Additionally, users may have difficulty adjusting to live audio and video while trying to

manipulate the technology like microphones and cameras to obtain optimal operating quality (Ward and Lee, 1995). Training of users may become the element that eventually neutralizes any disadvantages of using desktop video conferencing for distance learning applications.

Kinds of Desktop Video Conferencing Technologies

The first and most recognizable type of desktop video conferencing system is CU-SeeMe, developed at Cornell University (Fudell, Hardy and Terrell, 1997). CU-SeeMe allows students to send and receive video and audio on a computer to other participants (Todd, 1996). Companies like Vtel and PictureTel have developed desktop video conferencing systems using ProShare operating software (Johnson, 1999). Recent entries into operating software include Ilinc Corporation's Learnlinc Version 3.1 which is the system running the desktop video conferencing network at Northwestern State University, the subject of this paper.

Evaluation of Desktop Video Conferencing Technologies

A sizeable body of research exists that evaluates distance-learning systems (Goldstein, 1993). Yet the majority of research has focused on evaluating high-quality video systems operating on broad bandwidth. Limited research is available on low-bandwidth systems such as desktop video conferencing. This is due in part to how new the technology is and its limited application, thus far, in education. A study by Biner, et al (1995) examined student performance and satisfaction with low-bandwidth modalities. It revealed that technology-related factors such as quality of video and audio and the impact of conferencing tools like the electronic whiteboard are important components to the success of student performance and satisfaction with the technology. Kies, Williges and Rosson (1997) examined specific factors that affect quality of presentation such as frame rates and resolution of image. They noted that a minimum acceptable range of tolerance for users was 5-6 frames per second although a full 30 frames per second is desirable. Systems like CU-SeeMe operate with fewer frames rates to run at lower bandwidths on ISDN lines. The results of performance on slower frame rates had no effect on quiz scores. Also, transmitting video images over lower bandwidth did not affect a learner's ability to absorb educational material. The authors of the study said, "Equally important is the implication that expensive hardware and software is not needed for the transmission of video to ensure learning" (Kies, Williges and Rosson, 1997, p. 84). The study noted eight recommendations for using desktop video conferencing systems in distance learning: (1) avoid frame rates less than 6 fps; (2) avoid lines of resolution less than 320 X 240; (3) if considerable motion is required, use a faster frame rate; (4) if considerable detail is needed, use higher resolution: (5) use a whiteboard for lecture notes; (6) ensure high-quality audio; (7) be sensitive to student dissatisfaction with the technology; and (8) support interactivity by creating a comfortable setting (Kies, Williges and Rosson, 1997).

Desktop Video Conferencing as the Next Generation Distance Learning System

Northwestern State University of Louisiana has pioneered the use of distance learning in Louisiana. Even though the history of this endeavor is predated to the late 50's when the university produced the first ITV (Instructional Television) project in the state, the university has developed and used several distance learning delivery systems including audio graphics, interactive satellite, web-based Internet and video compression technologies. While distance learning technologies possess unique qualities that make them desirable for special applications, most have weaknesses that limit their use. Moreover, the technologies that provide elements most desired by students are usually too expensive and restrictive. Consequently, the university as a result of a U.S. Department of Agriculture Rural Utilities Service grant decided to pursue a new direction in distance learning which is flexible, accommodates for most learning styles, and is synchronous but can have asynchronous applications. It also has multiple applications that replicate traditional face-to-face instruction, can access educational resources such as the World Wide Web, presentation software, video and CD technologies yet has a "price tag" that is affordable.

The challenge for the university was to select a technology that could be used in several instructional applications yet provide participating sites an opportunity to have a technology that also doubles as a powerful PC lab for training disadvantaged citizens in 10 rural parishes of central Louisiana. In effect, the network had to make available traditional courses for college credit and teacher certification, provide training for projects like "Welfare to Work" and others where people receive training on how to use computers in the workplace, and be connected to the global Internet/World Wide Web. This was a tall order for one technology, and especially a technology that anchors a multi-purpose distance-learning network. Desktop video conferencing was selected because it met all the criteria established in the grant and of course by the users who needed a cadre of services.

This desktop video conferencing network was the answer to several problems that faced the university. First, it introduced a new technology that addresses several distance learning challenges such as the need to see faces of teachers and students. Second, it provided a network where partnerships were established not out of need but necessity. Third, it allows courses for credit to be taught from any discipline without restrictions or limitations imposed by the technology. Fourth, it provides at least one site per parish where students, teachers and citizens can come together and take classes or participate in training sessions. Fifth, it affords teachers who have skills unique to a discipline, to teach classes to other students in the parish and across the state using their expertise. Sixth, it serves as a PC lab at the site and can be used for regular computer activities; not so with dedicated video compression classrooms and satellite studios. And seventh, it provides a low-cost alternative to video compression technology particularly since video compression sites were not located at public schools.

Even though Northwestern State University has in operation four distance learning systems, interactive satellite (limited because of cost), web-based courses on the Internet, video compression and desktop video conferencing it has made a commitment to this new technology and according to the desktop video software provider is the first university in the south to proffer a network like this. Collaboration within the university has expanded opportunities with desktop video conferencing. Another grant has been secured to establish a training facility for the College of Education to allow teachers to develop courseware using this technology and originate classes in graduate and undergraduate education from this site. This new lab will virtually double the teaching capabilities not only in kinds of courses but number of sections as well. The teaching stations have increased from four to fifteen. While the bandwidth needed to operate the system will limit the number of classes taught simultaneously, there will be adequate preparation stations available for teachers to prepare their classes in advance. Therefore, scheduling of classes, workshops or training sessions should be simple without sacrificing time for faculty to prepare; a problem that plagues many distance learning providers. Educational Technology in the College of Education will use desktop video conferencing to develop "hands-on" technology training, which until now has been limited, by most distance learning technologies. In effect, the faculty believes that most of the future movement in distance learning will be toward low-cost, web-based instruction on the desktop.

Funding for Desktop Video Conferencing

The initial funding for the desktop video conferencing system at Northwestern State University was supplied from a grant written to the United States Department of Agriculture Rural Utilities Service in August 1997. A second grant was submitted a year later to broaden the scope of the project to include five additional parishes in central Louisiana. The College of Education was awarded a grant in 1998 to parallel the RUS project, which would essentially double the teaching and production capabilities by establishing a second desktop video conferencing laboratory on campus, but in the Teacher Education Center.

The RUS project established a distance learning facility in ten parishes to address economic and educational challenges for the people of this predominantly rural area. These include: (1) K-12 education--standard, remedial and advanced placement; (2) higher education--undergraduate, graduate, and teacher certification; (3) adult and continuing education--GED, workforce development, and life-long learning; and (4) job searching. College-level courses were planned for the network and made available to those who are time and place bound with specific restrictions that limit their ability to take classes or attend workforce training sessions. Job training and information will also be available for those making transition from welfare to work. Public school administrators will use the system to collaborate on other initiatives by face-to-face

conferencing. The match for the project was 60 percent from the partnering institutions and 40 percent from the Department of Agriculture Rural Utilities Service.

The impetus for the grant was to address problems that faced the available user population from demographic data that include a rural population with a high drop-out rate of 50% to the ninth grade, 91% do not have college degrees, a large percentage of the population are classified as disadvantaged, and of those who attend college over 50% need remediation.

A second grant from the Board of Regents Support Fund, State of Louisiana, specifically addressed the need to prepare teachers for the emerging technologies such as desktop video conferencing. The College of Education at Northwestern State University is a leader and advocate of distance learning. The grant provided the tools for training per-service and in-service teachers and administrators to use these new tools. Area superintendents expressed a concern about the infusion of technology without proper training for teachers on how to use and integrate technology into teaching and learning. They were worried the problem may compound an already desperate situation regarding the attitude of teachers and parents about technology in the classroom. What resulted from these grants was the establishment of a network that accommodates a multitude of educational and work related issues while helping to better prepare teachers for using technology in the classroom.

The Desktop Video Conferencing System at Northwestern State University

The desktop video conferencing system at Northwestern State University joins other distance learning technologies on campus as the "next generation" of distance learning technologies. The projects valued at almost $700,000 impact residents of ten parishes in central Louisiana and teachers and school systems from throughout the state. It currently provides several undergraduate and graduate classes to rural parishes with several of those participants enrolled in classes for certification. Plans are underway to provide training to area teachers on technology use through courses and workshops. The system is user-friendly and accommodates the diverse schedules of students located across the area. And, when not in use as a distance-learning network it serves as a state-of-the-art computer lab for word processing, web searching, making power point presentations as well as other computer-related activities. These are ancillary services, of course, that most distance learning technologies cannot provide. Moreover, distance-learning technologies use fixed networks with dedicated classrooms and are usually not available as a technology support area.

A profile of the network is as follows. First, on campus there are two teaching areas on opposite ends of campus. One serves as a teacher and preparation site with four desktops while the other is a teaching/preparation and computer laboratory with 15 desktops that can also be used as a receive site. The sites are connected via T-1 lines to a server on campus then to the ten sites in the parishes. Second, each school site has ten computers configured in the lab with desktop software, camera and audio/microphone headset. The capacity of the system is three classes simultaneously. This means that at one site up to three classes could be received in one time block. Classes are currently offered starting at 4 PM and again at 7 PM if necessary. During the evening hours it is possible to provide six different classes per night or at least 24 from Monday to Thursday.

Ilinc Corporation provides the operating software for the network. The Learnlinc Version 3.1 software has a teacher or client area with conferencing window, class list, agenda list, and text chat area. Participants have a similar student area but without features that control the system. Learnlinc includes complete administration tools to register and keep records on students. It has a question and answer application, whiteboard, synchronized web browser and can use virtually any authoring tool. The Q & A application can be prepared prior to class and is a powerful device to check to see if students are grasping concepts being discussed in class. It is good for quizzes as well but has limitations as to how many questions can be asked. The Q & A application will report the results numerically or with a graph to the professor and students as desired. The system can promote interaction through "hand-raising." For example, if the professor asks a general yes or no question and seeks a yes response. Students click their "hand" icon. The teacher sees the hand appear next to the student's name on the roster. It is also a device to use when a student has a question. Control of the conferencing window can be passed to another student where his/her image in the conferencing window is transmitted to the entire class. Students may not pass control of the conferencing window but can do most other applications. The software works very well on T-1 lines but can work at lesser bandwidths.

While it is possible for all sites (100 students) to be enrolled in the same class, distance-learning protocol suggests that a class be no larger than a normal face-to-face class, which is about 30 students.

Desktop video conferencing, the RUS system at Northwestern State University, will compete with some successful distance learning technologies and initiatives already in operation on campus. Even though the network is in its first full year of operation it has already shown signs that it can provide high-quality cost-effective instruction that is meaningful, accommodating and user-friendly. As the group of users of distance learning technologies continues to diversify desktop video conferencing will continue to meet the demand.

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Teaching Teachers to Use Multimedia Tools: One University's Approach

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Abstract: This paper describes a course in multimedia for teachers taught as a one-week intensive course during the summer for a variety of types of students. The background and rationale for course design is discussed along with content and style of instruction are discussed. Throughout the paper, the authors describe experiences during the past offerings of the course. The paper closes with comments on the assessment of students (the grading policy) and assessment of the course itself (feedback from students and student performance in successive courses).

The Multimedia course is part of a graduate program designed to provide a masters degree for elementary and secondary school teachers, since New York State requires such a degree for permanent teaching certification. The degree is a joint one, with responsibility split between the School of Education and the School of Computer Science.

The students in this class fall into three groups. One group is the expected recent graduate going on for the masters degree. A second is teachers who already have a masters but wish to take the 15 credit block of technology-based courses that are part of this degree and constitute a "Computers in Education" certificate. The last group includes teachers who come for only one course, and often have a free voucher because of their involvement with student teachers from the University.

Given the different groups, a need exists for courses that are given in a format suitable for teachers. While this one-week-long course on multimedia is what the teachers want, the content and structure must meet what we see as the needs of the group: a course that will give them both the technology background and the knowledge to integrate that technology into their teaching.

As we structured the course, we posed the following questions:

- What should the course cover?
- How should it be structured?
- Who should teach it?
-

The course syllabus distributed on the first day contains the following definition of multimedia:
Multimedia refers to the orchestration of a variety of media, including text, images, animation and sound. One component of the orchestration is the feature of **interaction** with a user with the most common example being *navigation* through the material via clicking with the mouse. Material supporting this is called *hypertext* or *hypermedia*. There has always been multimedia but its latest manifestation can be called *desktop multimedia*. There are tools for the individual media types, tools for putting it all together and tools that support both creation and orchestration.

Course content

This definition for multimedia leads to our choices for activities during the week. From the technical perspective, the orchestration is done using HTML, a presentation tool (PowerPoint) or a stand-alone multimedia-authoring tool (Hyperstudio). We emphasize that 'content' in the form of images, animation and sound, can be used and re-used in different types of projects. For example, an image taken with the digital camera can be incorporated into either a PowerPoint presentation or a Web page. This is a difficult concept for some students, who tend to confuse the tool and the products of the tool.

From the perspective of integrating technology in teaching, the course is structured so students will use technology in planning curriculum that enables them to guide their own classes in multimedia preparation. We've built in practice in that area. The schedule given out is the following:

Day	Hardware & Software	Assignment(s)
Monday	digital camera PowerPoint	PowerPoint: A presentation introducing yourself to the class Discussion: history, examples, choice of tools
Tuesday	Paint Shop Pro scanner Netscape Communicator	Original drawing, modification of acquired drawings (scanner, digital camera, download, screen capture) with explanation for how students producing this *content* will contribute to learning Discussion: classroom/school logistics; grouping
Wednesday	Sound Recorder NotePad & Netscape Composer	Web/HTML project incorporating images & sound & hyperlinks, including template for students to use Discussion: models for students
Thursday	Paint Shop Pro & Animation Shop Photo Editor	Web project(s) with animation & image map including discussion of relevance to subject matter Discussion: teacher workshops
Friday	Hyperstudio	Hyperstudio prototype project Discussion: making assessments

In the above schedule, notice that we ask students to draw and make sound files, although many of them are uncomfortable doing so. Since the children they teach are expected to do these things, we encourage the teachers to experience this as well. The drawing and sound tools allow opportunity for creativity and fun and need to be practiced. Students take their own photographs, make original drawings, modify acquired drawings, plan and produce animations and also make their own sound recordings. The students learn that it is possible to make relatively simple drawings that still have educational content, e. g., a sketch of active transport by a biology teacher. They also learn that the production of a drawing, animation or sound file takes planning, attention to detail, and leads to a learning of the content material they are working with. They develop a "can-do" mentality.

Course structure

As the course content indicates, we've focused on assisting the students in integrating this technology into their own classroom curriculum. Some few students anticipate a more technically oriented course because the course carries a "computer science" designation. Since the Information System Department offers such a course, and because this is part of a teaching degree, we feel that an educational approach is most appropriate for this course.

We spend time at the beginning of the course on developing an educational philosophy appropriate for teaching with technology, and carry that throughout the course. We discuss teaching materials as the students need them, rather than lecturing at the beginning of the lesson. We emphasize the need to permit students to make mistakes and learn to correct them, rather than the teacher being the fount of all

knowledge. We model and also discuss how much more satisfying it is to work collaboratively to solve in-depth problems.

We are fortunate in being able to teach the class in a computer classroom in which every student has his or her own computer. Headsets are available for sound recording and playback. The room has a feature, with the brand name "Robotel", in which the display of any computer, the teacher's station or any student's station can be shown on all computers very easily and quickly. Everyone can demonstrate his or her projects to the whole group. We can have different students teach or demonstrate special techniques to everyone from their own computers. This feature facilitates the type of teaching and learning that we want to model for our student/teachers: a focus on students collaborating and sharing.

Style of Instruction

The course includes several different software packages and a fast pace of delivery. It was important to us to do more than just demonstrate keystrokes. Furthermore, we wanted to make sure the participants each make actual use of each package. Since we are teaching teachers, we have the explicit challenge to demonstrate how they would teach the use of tool as opposed to just demonstrating its use.

In some cases (for example, PowerPoint and Hyperstudio), we demonstrate a small number of actions and then let the students experiment themselves. We offer individual help and, while doing so, make a list of additional operations to be demonstrated by students to the whole class. The room projection system makes it feasible to go in and out of this 'sharing' mode quickly. At the end of the day, we have each student present his or her work. Their presentation includes explanation of their plans for classroom use.

In other cases, such as teaching HTML, we prepare examples beforehand. We prepare a type of template that has some explanation of HTML features, but also includes content or subject matter examples and direction. This is a way for a classroom teacher to indicate directly what the assignment task is.

Our approach in HTML is to ask students to know, or be able to look up or copy examples of tags, and to generate the HTML using NotePad. Our experience has been that if students use tools such as Front Page, the results tend to include less real content and more distracting clip art. In certain cases (probably not this compressed one-week class), after students become familiar with making tags, we demonstrate Netscape Composer and indicate where it is advantageous (for example, constructing tables) and where it can be problematic (for example, creating a simple link to another page). For the HTML, we also use the tactics of recruiting students to demonstrate and explain features. Similarly, we include a more or less formal presentation from everyone at the end of the allotted time period.

For drawing in Paint Shop Pro and animation in Animation Shop, we do express humility about our own skills. Our tactic is to say, "if we can do it, anyone can" while producing a goofy version of a smiley face. Similarly, we produced an animation of a cookie being eaten by successively erasing irregular parts of the initial drawing. More significantly, when we go around the room seeing who can demonstrate features of the tool, we have always been able to feature examples of relatively simple drawings that still demonstrated important aspects of subject matter.

Typical Issues

In this multimedia course, we strive to have students acquire images in all the ways discussed: taking their own digital photographs, scanning pictures from photos and text, downloading images from the Web, making their own drawings, and modifying and combining images. We try to be sure that every student attempts every method.

Many students confuse the product of a tool with the tool itself. In particular, they need to be shown repeatedly that an image they created in one specific way can be used in more than one package, be it a PowerPoint presentation, a Word document, or included on a Web page or in a Hyperstudio folder. They

also need to learn that an image can be modified by another tool to produce a new image. We actually require that they do re-use (re-purpose) images and sound files to reinforce this concept.

A more basic source of problems is in naming and saving files. Students frequently cannot find the files they have created or modified. The Windows operating system is a source of some of the problem since in many cases, the dialog box will not show the extension or the target folder. We suggest to our students that they define naming conventions for their own students when they get to their classrooms.

Course faculty

This course is the responsibility of the School of Computer Science. The first few times the course was offered, it was team-taught by two faculty members, one from Computer Science and one from the School of Education. The joint planning and teaching set the direction for the course content. It also made it evident that the course is much easier to teach when there are two instructors in the room. This past summer, the faculty member from computer science taught the course alone, while still maintaining the same focus on pedagogy. A very knowledgeable University student was recruited to assist two of the days, making it possible to continue to deliver a great deal of one-on-one instruction.

If other people are to teach the course, we will recommend that there be some assistance available for the first few days of the course. In addition, we would also recommend that, at least initially, there be some team teaching required for the faculty. The learning that took place on the part of each of the faculty members involved has been necessary to make the course a success.

Assessment of students and course

The grading policy of the course has been fairly benevolent, since it is a one-week course. Given the time, any reasonable effort on each project resulted in an A. However, practically all students appear to be working diligently all day, often through lunch, and we do have to kick them out at the end of the day. We do discuss grading of multimedia projects and encourage the specification of well-defined rubrics that focus on the underlying subject area.

There is a possibility that the course will be more than one week in future offerings. In a less compressed version, we would require more extensive project-based work and more formal written explanations of the theoretical rationale. The ideal format would probably be one in which the one intensive week was followed by one short session a week later. This would give the students time to refine their projects and to give more thought to how they could use the tools more effectively in their teaching.

The informal and formal feedback from the students, for the most part, has been strongly positive. The students claim that they work hard and "learned much more than they expected in the week." There is evidence that the students retain much of what they have learned as they continue in other courses. For instance, the students who are in the masters program or the certificate program eventually take a capstone course requiring extensive technology in teaching. Their projects in the capstone course show the knowledge gained in this multimedia class and the fact that there has been extensive retention of that knowledge. They continue to use multimedia, and continue to use it to promote teaching and learning.

Ten Years on: Assessing Multimedia Distance-Learning

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Abstract: This paper is a presentation of a 10-year experiment in multimedia distance learning in English for specific purposes within the general frame of a 3-year management diploma in the French higher education system. It defines analyses and rationalises key elements in the technical evolution against a background of epistemological and present didactic academic standards gleaned from literature scanning. An overview of the milestones of the experiment is given pinpointing some successes to adopt and pitfalls to avoid.

Introduction

This paper is a presentation of a 10-year experiment in multimedia distance learning in English for specific purposes within the general frame of a 3-year management diploma: Diplôme Universitaire de Technologie en Gestion des Entreprises et Administrations.The Instituts Universitaires de Technologie – IUTs- where it takes place, are institutions of higher education within the French university system that lead to a professional degree. Over 100 IUTs account for about 10% of the student population in France. Each IUT has several departments corresponding to different technological specialities in the secondary and tertiary sectors of the economy. This multimedia project was first launched by the French Ministry of higher education in 1989 in 4 experimental IUTs as an alternative to the traditional studies. The range of available multimedia tools was very narrow at that time which led us to focus primarily on the pedagogical shifts induced by the introduction of both distance and emerging multimedia tools. Since its launching in 1989 the tools have evolved at a tremendous speed and what was considered in the first years as a long-term objective turned into actual effective, ready-to use instruments within a very short span of time. We had to navigate between pedagogical conceptual constructions, highly sophisticated, not really user-friendly tools and real life students. While technology was evolving we have always maintained a flexible system in which the students may avail themselves of analog or digitalised materials according to their needs and capacities. In this paper we will attempt to define, analyse and rationalise key elements in the technical evolution against a background of epistemological and present didactic academic standards gleaned from literature scanning. The general term of «multimedia» refers to tools as well as contents and practices. We will review what it represents in the context of our courses in connection with the various underlying models of learning and their associated strategies as well as the field of second-language acquisition. Our ultimate aim is to provide the teachers engaged in or envisaging off line and on line distance multimedia teaching with an overview concerning: the technological evolution of IT tools, their didactic and pedagogical added value and the problem of the assessment of students' work.

The General Frame of The Experiment

The nation-wide project presented here was first launched in 1989 by the French Ministry. It consisted, in fact in, a mere injunction from the hierarchy to field practitioners to try and set up an innovative distance training using « multimedia » tools in Business Administration. Similar projects were also run in speciality departments in the secondary sector.

It was opened to both initial and adult students. The official national curriculum was re-shaped into a set of 9 credits corresponding to the main fields of study, each one split into 3 modules, one for each year (cf. http://www.geapx.iut-tlse3.fr/programme.htm). The studies were organised into alternate distance learning periods of 2 weeks and one in-site regroupment day every other week. In the case of our IUT, -which is presented here- Resource Centres were set up in 3 cities situated in a radius of 80km from Toulouse. 3 years ago a fouth was added and we now have another one within the university itself. These resource centres are accommodated in different types of institutions such as Chambers of Commerce, vocational centres, university distant-branches, etc. They provide the students with communication and pedagogical hardware and software material. This experimental program has dealt so far with a limited number of Students. Over 1,000 students have since graduated from the various IUTs involved in the project (approx. 100 from Toulouse)
This paper deals more specifically with the teaching of English.

Who are our students?

The student population is very heterogeneous in age, social and educational background and life environment. Some are high-school leavers; others have already been in the work-market for years. Accordingly their initial training in English, can still be very vivid but frequently very "bookish" or reduced to a blurred souvenir. Worse they very regularly suffer from a common nation-wide so-called « French inability to master foreign languages ». The picture is not always as black as it may seem here but it is true to say that there is a wide discrepancy in the students' minds between the mitigated image they have of English and the nearly inescapable obligation to master it in the global exchange and communication environment they live and work in. This psychological aspect is also present in traditional language classes but quite often buried under routine teaching strategies. Because of large numbers of students and the relatively small amount of time devoted to language learning, it is widely assumed that the class must globally adjust to a theoretical average student's pace. It consequently tends to lose the attention of the quicker and slower ones who, put together, may amount to the majority, if not sometimes the whole class.

Since distance implies remoteness, for the same number of students as in a traditional classroom , a distance learning scheme results naturally in individualisation. The dark side of it can be isolation but it can also permit individualised counselling and hence a real learner-centred training. This was an opportunity we spotted from the very beginning of the project. The entire curriculum was designed with a view to holding together the official curriculum requests with - and not at the expense of - the genuine interests and needs of the learners. We contend with Philips (1987) that « the language to be learnt must correspond to actual pragmatic needs to the learner ».

Their role and ours in the light of theory

On a purely theoretical cognitive level we are in favour of a balance between the generative and the constructivist learning theories. We do believe that « the learning process is not so much the result of an accumulation of layers of knowledge brought in from outside as the progressive elaboration of a personal inner object of knowledge » (Fijalkow, 1996). Referring to Vygotski (1985) he claims that it is therefore a non-linear, discontinued process that we view as not merely fuelled from ready-made outside pedagogical sources but by the learner's output feedback.

Therefore to us, the teacher's role is to constantly adapt and re-inject materials tailored with or according to the learner's own production. This is in tune with Von Glasersfeld (1989) who stresses that learning is basically a process of discrimination. We fully support that: « [Thus] the preferred current strategy [...] is that once learners have absorbed some chunks of language and patterns of communication, they should be given access to the underlying model via a guided discovery approach that uses both learner-controlled exploration and teacher-controlled demonstration ». (Scrimshaw 1993, p147).

The real challenge/opportunity in multimedia distance learning is to take advantage of both distance and technology: distance as a means of responsibility and introspection on the learner's part on the one hand, Information Technology as a powerful means of communication and tutored progression, on the other hand. This implies that students are able to manage their learning progress in an autonomous way. Very early in the project, it became apparent that it was not the case for a large majority of students. A new methodological

module was set up which proved to be absolutely necessary and evolved over the years from a short ½ day quite informal meeting to a very structured one-week session.

Contents

This National curriculum covers the four language skills: oral and written comprehension and expression applied to social and professional situations. The scope is much too wide to be met within the 3 modules. We therefore selected some priority sub-objectives according to the students' needs as follows:

- Checking and up-grading grammatical competence
- Improving aural comprehension
- Training in oral expression and production
- Training in specific BA language
- Restoring or building a positive socio-linguistic approach to English

These language skill objectives are spread over the 3-year span of the studies. They are embedded so to speak in different tasks and different tools (cf. table 1). Levy (1997) reports that 2 studies by Robinson et al. (1985) and Verano (1987) conclude that « [These findings] highlight the importance of integrating individual CALL work with the total program of language instruction, including the classroom, rather than configuring it as an independent, supplementary activity ». It is all the more true in our case where the classroom is so called virtual », except for the regroupment sessions. It implies that the pedagogical contents of the tools available to the students cannot merely « illustrate » our academic knowledge delivery since there is none. They are both, in their contents, form and interactivity, « the » knowledge to be grasped and encoded by self-reliant students.

Tools

Since its launching in 1989 the available tools have evolved at a tremendous speed and what was considered in the first years as a long-term objective turned into actual effective, ready-to use instruments within a very short span of time. We had to navigate between pedagogical conceptual constructions, highly sophisticated, not really user-friendly tools and real life students. While technology was evolving we have always maintained a flexible system in which the students may avail themselves of analog or digitalised materials according to their needs and capacities.

Starting from a total lack of digital medium, we have been through the era of floppy disks to diskettes, non-recordable then recordable CD Roms, and eventually DVDs, from mere fax machines to present high speed communication tools on the Internet.

The tools we are currently using are non-modifiable commercial educational software (Web English, Mediaconcept-Citcom) other commercial applications not specifically designed for educational purposes (Finance for non-financing managers), authoring tools enabling the digitalisation of existing teaching materials such as audio and video recordings used over networks (Intra and Inter) or on standalone machines (Lavac)[1], synchronous and asynchronous communication tools via intranet and internet, university-designed Web site as well as free Internet site educational facilities such as conferencing, document posting, class schedule, class administration, etc. One can also mention the use of survey or polling software turned into exercise processors. Videoconference is also available although not very much used and MOOs are envisaged.

We basically remain teachers and we are qualified to design our own course. According to the theory we exposed earlier it is evident that we are in favour of tools which enable us to adjust the program to the needs of our learners and of ourselves. We differentiate the guided autonomous learning we are engaged in, from self-instruction, which excludes the presence of a teacher. In our case we are in constant exchange process (either synchronously or a-synchronously) with our students and it is essential that a large number of the tools we use be flexible enough to, in a way, comply with our requirements.

We have always tried to keep up with the technology evolution with one notable restriction. As a matter of fact is it absolutely essential that all the students have access to the same tools. This means that we sometimes cannot use new ones, which offer more interesting services just because they are not compatible with

[1] Lavac is a rare example of an authoring system primarily devised and designed by a language teacher.Toma (1996)

one or several resource centres' configurations. Some students may also have lower configurations at home whether in terms of machines or telecommunication connections. In short that means that very sophisticated equipment has to be left aside for practical everyday reasons. (Tab. 1)

Language & Professional Skills / Language Learning Tools	Grammar	Aural comprehension	English for management	Oral Production	Oral expression	Business simulation
Web site: Web English	✗✓△			✗✓△		
Course book	✗✓△	✗✓△	✗✓△			
Audio cassettes		✗✓△	✗✓△	✗✓△		
Video cassettes		✗✓△	✗✓△			
Web site: electronic course book	✗✓△	✗✓△	✗✓△			
Purpose designed interactive CAL packages	✗✓△	✗✓△	✗✓△			
Videodisk						△
Audio recording on tapes				✓△	△	
Video recording on tapes					✓	
Purpose designed interactive CAL CD ROM		✗✓△	✗✓△	✗✓△		

Table 1 : Correspondance between language learning tools and language and professional skills
✗ year 1 ✓year 2 △ year 3

The assessment problem

Another difficulty is the processing of the bulk of data we receive from the various tools concerning our students' progression. Some charts are totally useless. Others are too detailed and it requires both methodology and organisation to spot the accurate information. Not to mention the flow of questions, reactions or mere information mailed by the students themselves. Still, it is essential to keep in mind that every student expects his or her « personal » teacher to be available and caring. This is a big change from our previous experience in the traditional French education system which has always been mainly teacher-centred. Even though active pedagogical theories have been put into practice over the last decades thanks to precursors like Montessori, Piaget, La Garanderie or Trocmé-Fabre it is true to say that learners throughout the system have remained somewhat passive and the introduction of distance combined with I.T usage has definitively given them a better command of their learning process and therefore more efficiency.

We have not yet solved the problem of Examination Paper Structure. The official system of evaluation requires everybody to take the same subject and to be evaluated against the same criteria. We encourage students to take a positive look at their language training regardless of their previous experiences, and to work at their own pace. We cannot therefore expect every one of them to attain a theoretical common level of proficiency by the end of year 2. The examination is rather an opportunity to demonstrate what they have learnt during their study of the course, whatever « what » is. We can see how much a student has worked and it is fairly easy to assess the quantity and quality, but the mark given doesn't necessarily reflect the level of language proficiency. The electronic submission of assignments still poses problems. The traditional system has not yet evolved to fit new methods of teaching and learning.

Conclusion

Possibilities appear everyday and we believe that as teachers, it is our role to keep up with technological evolution in order to ascertain that students benefit from these tremendous capabilities without losing academic content value. It is also our contention that if it is the teacher's role to choose the appropriate tools and media according to his or her teaching goals as well as the students' needs, this is all the more true as

regards the design of his or her own multimedia courseware. It is also absolutely essential to say that strong support services are critical to success and that new rules must be set up to organise the collaboration between professionals who have never before worked together on such terms.

Teachers are often said to be afraid of being replaced by machines. That might well happen if technology remained in the hands of commercial businesses. But our experience, among others, proves quite the contrary when they are used as support for strong pedagogical theories.

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Interactive Multimedia as Research Portrayal

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Abstract: This paper reports on an ongoing project to implement an interactive on-line multimedia web site for communicating research and development results. The value of multimedia for activating rich knowledge structures is documented in the literature. However, using multimedia as a communication device for publishing research has been largely unexplored. A research and development project into online distributive education will be used as an exemplar of how this can be implemented.

Introduction

The Faculty of Education at the University of Lethbridge (Canada) has been doing an ongoing investigation into the effectiveness and feasibility of online distributive education. A number of online courses have been developed as well as courses that are blends of online and face to face contact. As part of the development of these courses a number of custom tools were developed or generic tools were adapted. In addition, over the past years there have been a series of Science Institutes put on for practicing teachers in the field. These have been extremely popular and teachers have been enthusiastic about going back to their own classes with pragmatic ideas gained from these professional development sessions. However, one of the challenges of doing research into the effectiveness of these kind of initiatives is the degree to which text alone can adequately retell the participants' experiences or describe the tools. These initiatives can be set to words but words seem to fall short in describing an attitude reflected in the intonation of a voice or an interactive is easier to demonstrate than describe. In an effort to address these problems, a multimedia web site is under construction with the intent of communicating the results of that research to interested stakeholders. In this case the stakeholders are corporate sponsors, university administration, government granting agencies, colleagues doing similar research, and perspective participants. All of these stakeholders have an interest in the context of the course offering, its effectiveness, what the tools look and act like, and what participants thought of their experience. The web site is designed to showcase the results of the research and development efforts through various types of media. The media includes, pdf files, images, video clips, demonstration of interactive tools (shocked files), linked resources, etc. It is hoped that a multimedia approach can provide a richer experience than what text alone can provide.

Background

The literature on multimedia and its effectiveness is still quite sketchy but there is an overall sense that multimedia can have a positive impact on learning. There has been even less investigation into how multimedia can be used to enhance the communication of research results. Understanding how multimedia influences student learning, however, may transfer to interactive multimedia as a research portrayal. To that end this next section will provide a brief review of the literature into multimedia for learning and make connections to how it applies to multimedia research portrayals.

The definition of multimedia has changed over time. It started out as the idea of multiple media

devices being used in combination. Because of technological advances, there is a blending of these mediums into one device, the computer (Kozma, 1991). It is the juxtapositioning of multiple representations that is the affordances of this tool; it is the combining of sound, still image, video, animation, text, music, and virtual reality to provide the user a multisensory experience. Interactive multimedia narrows the focus. Interactive suggests that users have a degree of control over the presentation of multimedia rather than being passively presented with the linear delivery of information. There are those that suggest interactivity cause students to spend more time on the material. Kennedy (1994) reports that using interactive multimedia allowed students to progress at their own rate and to quickly search information. It seems reasonable to suggest that researchers have strategies for reading textual reports that is anything but linear. A typical approach is to read the abstract, jump to the introduction and conclusion and then to a quickly skim of the rest, if something looks more important or relevant that it is read more intently. What if the structure of the document reflected this form of perusal? Interactive multimedia is easily setup to facilitate this kind of nonlinear exploration of the information (Campbell, 1997). For instance, if the reader wants more background they can drill down through the structure of the multimedia project. The other related issue is that the developers of the multimedia project can build in a great amount of data or content in bite-size pieces but the user retains the option of looking at it or not. Interactivity can be an important component of multimedia enabled publications.

Multimedia provides an environment where the users can explore the content from multiple perspectives. "Knowledge that will be used in many different ways has to be represented in many different ways, with the potential to form various combinations" (Spiro & Jehng 1990, p. 203). Studies indicate that problem solving is enhanced with the use of multiple representations (Steed, 1994; Crosby and Stelovsky, 1995). When text and images are presented concurrently this tends to result in better learning than if either are presented separately (Mayer and Sims, 1994). It is thought that if we are stimulated with more than one sense the experience is more meaningful and memorable. Pavio's research (Dual-coding theory) (1986) suggests that some kinds of knowledge can be reconstructed easier if images are used. It was also found that concrete words have a similar effect (words that paint a picture). Other research has shown that a combination of verbal and visual information are better than either presented separately (Mayer & Anderson, 91). Books use primarily text to activate knowledge structures but it has been found that if meaningful images are included it is useful and can particularly help novices (Kozma 91, Mayer, 91). The out shot of this is that there should be a correspondence between the nature of the research results and the way in which it is portrayed. When the research involves rich and thick descriptions then the form of representation should reflect that. For instance, video is an excellent medium for viewing a complex scenario where individuals are interacting with each other or their environment. Imagine that same kind of scenario described with words. A video is much easier to process because of the way the visual and auditory system parallel processes incoming information.

On the affective side, students express that they enjoy learning from multimedia (Atkins, 1993), but liking it may not correlate with learning. However, if the material can be made more interesting or engaging then surely that speaks to its effectiveness for communicating ideas. The audience will be more likely to pursue the information further and it will be more memorable because the multimedia experience potentially creates a richer set of connections, which are available when reactivating knowledge.

It was found that for students who needed conceptual organization of the content, creating hypermedia helped (Spoeher, 92). Multimedia often can graphically represent the structure of the content so it is visually accessible. Hypermedia students seemed to have richer knowledge structure than students who didn't engage in that activity and seemed better at organizing information (Spoeher, 93). Through the use of multimedia as a research portrayal tool perhaps there would be alternative ways of representing the logical structure of information. For instance, what if there was a conceptual map of the content, and each node on the map was a hot link that goes to a different level of organization, how might that type of portrayal change the way the audience represent ideas in their minds?

The notion of virtually being there, seeing the people and experiencing the tools that were used might move stakeholders to a better understanding. Stakeholders can more closely approximate the real world

experience by entering virtual worlds which provide the advantages of situated learning (Brown, 95). That emphasizes the importance of context and multimedia may be viewed as a much more immersive environment in the sense that you can potentially get a better sense for context, by seeing or hearing it. This potential benefit comes through the depiction of real-life situations with the use of digital photos, video, and sounds (Wissick, 1996).

There is a clear sense from the literature that cognitive style has an influence on the effectiveness of multimedia (Crosby and Stelovsky, 1995). Those with visual spatial tendencies tend to do better in multimedia environments whereas those with low spatial ability are thought to require more cognitive energy to build connections between representations (Mayer and Sims, (1994). This supports Howard Gardner's concept of multiple intelligences (1983) that suggests each individual has different ways of knowing: mathematical, linguistic, musical, spatial, bodily kinesthetic, interpersonal and interpersonal, etc. Traditional research publications for the most part are represented in linguistic forms, by enabling multimedia forms, alternative learning styles might be activated that would engage the stakeholder in the content to a greater extent.

Interactive multimedia has potential pitfalls. For instance, interactivity can back fire; allowing users freedom of control may result in information that is skipped over or never viewed at all. It is suggested by some that students have poor self-regulation behaviors for making informed decisions about their learning path through multimedia materials. Clark, R. E. (1993) challenges the value of interactive multimedia and suggests we need more research. Educators on the whole seem less likely to accept visual portrayal as opposed to verbal or written arguments. Think about the kind of tools that are provided students during an exam, technology is rarely considered a necessary tool. Despite this, multimedia has such potential for providing metaphors or leverages to create mental imagery (Reiber 1995) and to help us communicate (Dede, 91).

The use of multimedia as a form of portrayal for communicating research results is something, which needs further discussion. It potentially provides a multisensory experiences which works to reinforce and highlight dimensions of the data, the researcher can use multimedia to express ideas in new ways, and it extends the definition of what is considered data (Campbell, 1997). Campbell goes on to suggest that using multimedia as a portrayal tool facilitates triangulation of data because different media types can be cross linked and represent the same concept from different perspectives. This in turn addresses credibility in qualitative research. Multimedia also lends itself to transferability through rich and thick descriptions available through video and audio elements. Understanding that alternative forms of representation have value for negotiating meaning should help us move in this direction. Second, building structures that encourage such options should be considered because we don't all think and process information in the same way and multimedia provides us with multiple representations.

There is a growing trend to use multimedia as tool to present and document educational research. The nature of emerging tools lends itself to new ways of gathering, analyzing, and sharing those results (Goldman-Segall, 1995). The benefits to learning listed above in the literature review are justification for using multimedia but there is another reason that seems to have an equal, if not a greater influence, that is the Internet. The advent of the Internet has inadvertently injected multimedia capabilities into electronic publications. As research publications move to the World Wide Web to facilitate dissemination, they naturally set themselves up for other forms of portrayal besides static images and text. Despite the potential the technical barriers for doing this are not insignificant. For instance, this document is published in PDF format and it was noticed that the sample RTF file implicitly suggests sticking with standard text and still image type of forms. What if the publication were to have a section on how to include other types of multimedia elements like, video clips, animations, virtual reality (VR), and sound files. The Internet provides a partial solution in that a URL can be imbedded in a document and interested individuals can link to that and see other types of information but then it is not part of the published work per se. Limited bandwidth is another limitation Most people are still hamstrung with slow connection speeds but that is changing quickly with the implementation of cable modems and ADSL connections. CD and now DVD provide a viable alternative in situations where large multimedia elements are intensively utilized.

The Web Site

To illustrate the concept and value of alternative forms of communication, a web site is being created as an exemplar. This web site will portray research done into the usefulness of online distributive education over the Internet. The secondary goal of the project is to facilitate the communication of tools, ideas, and experiences through multisensory experiences. In order to accomplish this, the demonstration and description of the tools are juxtaposed with supporting textual, auditory, and visual elements. These multimedia elements provide a rich source of information while the interactive component provides the audience an individualized route through the content. There are four kinds of data that the project uses in the web page. This is data collected through video taping sessions of both instructors and students (formal interviews or otherwise), anecdotal comments made through email messages or submissions to online databases, verbal descriptions of the tools and how they were used, and animated demonstrations of online tools. The intent of this is to allow other participants of these online courses and interested educators, an opportunity to hear the voices of students who have used the online components, get a feel for the kinds of issues raised through email correspondence, and sense for the tools that were used.

Before placing the video clips in the public domain, participants sign a release form and are given the opportunity to preview them to ensure they agree with the intent and the context they will be used in. Student participation is optional, as stated in the consent form.

Below is information that appears on the web page. The textual description is there to ensure there a context to the information. However the multimedia portrayal table is the driving interface for accessing the multimedia components. A table was decided on because the structure of the information (tools versus portrayals) matched the structure of the tool. This table acts like an index and links the audience to a desired section.

Background:

This study is sponsored by the Information and Communication Technology Research and Development (ICTR&D) project in the Faculty of Education at the University of Lethbridge, Alberta, Canada. The objective of this project is to study the effectiveness of on-line distributive learning. This document will use a variety of portrayals to represent the online tools which have been used to enhance online learning. It is hoped that such descriptions and representations will facilitate decision making for other educators and to communicate the nature of the experience.

Purpose:

The term "distributive" suggests that learning is not just the delivery of information but that information becomes transformed to knowledge and understanding. This process involves more than passive involvement so part of the mandate of this project is to explore diverse instructional strategies that engage the learners with the course materials, with other participants, and the instructor. This report will not make summative judgments as to the effectiveness of the tools nor the instructional design, rather it will provide context and data to help draw your own conclusions.

The Multimedia Portrayal Table:

Below you will view a table of links that will assist in creating a representation of the online course experience. Clicking on the various cells will open a new window with more information. Once you have viewed that information and want to return to this page, close that window. The data has been

drawn from an education graduate course, Educ 5410, Program Evaluation, offered in the Spring of 1999. The course was totally online. There were two sections of the course offered but only one class was sampled for video interviews, one that was totally done online and one that had a number of components online. The student information below comes from the totally online course but the instructor perspective comes from both offerings. The students were selected based on the instructor's view of a broad perspective (students who struggled and those who excelled and some in between). The description will provide a textual account of the tools, the samplers are illustrative examples of the tools, student email comments are email correspondence from students related to that tool, student video interviews are video taped interviews with a sample of the class, and the instructor video interviews will provide the instructors' perspective.

NOTE: S1, S2, S3 represent links to video taped interviews of different students, I1 and I2 represent links to video taped interviews of different instructors, likewise comment 1, comment 2, represent different student comments from email submissions. In the web version all the items in the table will be hot links, unfortunately in this version the links don't work.

Multimedia Portrayal Table

Description of the Tool	Sampler of the Tool	Student email Comments	Student Video Interviews	Instructor Video Interviews
Online Course Outline	**Sample Online Course Outline**	**Comment 1** **Comment 2** **Comment 3**	**S1** **S2** **S3**	**I1** **I2**
Online Gradebook	Instructors View: Instructor Log-in Add Student Class Summary Students View: Student Log-in Student Summary Change Password	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Online Reflections	Online **Form** **Student Search Page** **Instructor Search Page** **Log In Instructional Movie** [Shockwave]	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Newsgroups	**Newsgroups** **Log In Instructional Movie** [Shockwave] **Threading Instructional Movie**[Shockwave]	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Listservs		Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Email		Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Course Search		Comment 1	S1	I1

		Comment 2 Comment 3	S2 S3	I2
Active Course Maps	**Sample course map** (PDF format)	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
PDF Files	Sample pdf	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Online Instructions/Help	Newsgroup: **Threading Instructional Movie**[Shockwave] Grade Book **Log In Instructional Movie** [Shockwave]	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Online Questionnaires and Forms	**Hardware/Software Platform Survey** **Computer Skills Survey** **On-Line Course Evaluation**	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2

Table 1: This is a multimedia portrayal table which illustrates links to multimedia elements.

Students and instructors were asked additional questions relating to their overall experience with online education and their responses are listed in the tables below:

Describe the advantages of online courses.

Student Video Interviews	Instructor Video Interviews
S1	*I1*
S2	I2

Table 2: This is a multimedia portrayal table which illustrates links to multimedia elements..

Describe the disadvantages of online courses.

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 3: This is a multimedia portrayal table which illustrates links to multimedia elements.

How was your experience or learning different with an online course?

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 4: This is a multimedia portrayal table which illustrates links to multimedia elements.

How would determine if an online course is worth taking? List the criteria you would use.

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 5: This is a multimedia portrayal table which illustrates links to multimedia elements.

Comment on anything else in regards to the online component of the course you would like to share.

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 6: This is a multimedia portrayal table which illustrates links to multimedia elements.

This web page is intended to provide stakeholders with a altered perspective about the effectiveness of this online course because of the multimedia elements that are present. The actual web page can be accessed through the following URL:

http://www.edu.uleth.ca/ICTRD/report/site2000.html

Conclusions

This project is a work in progress, but the long-range intent is to research the effectiveness of multimedia for communicating research. Researchers and educators alike will be able to use the principles coming out of this project and apply those to their own multimedia publications. It is also hoped that this will facilitate a move by journals, conference proceedings, and professional associations to encourage and facilitate the creation of multimedia enhanced publications.

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Development of two Multimedia Corpora for Adaptive Web-based Distance Learning

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ABSTRACT: The use of web-based applications for accessing structured educational material is one of the most interesting variations of Distance Learning due to its flexibility and its reduced cost. In this paper we present two cases on the usage of a web–based system designed to support on line educational procedures. The presented system, called DVT (Dynamic Virtual Trainer), consists of one or more server machines which store structured educational material in the form of autonomous units which may accessed, combined and presented to the user according to user-defined criteria or choices. In order to demonstrate the system, we developed two educational packages. The first package includes educational material on Telecommunication technologies. The second package includes educational material on Mount Athos.

Introduction

In the context of Distance Learning a critical factor for the success of a specific course is the possibility of the students for accessing interactive educational resources such as animated presentations, multimedia libraries, etc. Students tend to learn more in classes in which they receive computer-based instruction supported by interactive educational information packages (Kuperstein et al. 1999). The design, development and delivery of such educational resources usually require significant effort to be spent by the teacher or the producer of the electronic educational material. In addition, a teacher should have considerable experience in computers and web authoring in order to produce a multimedia course tailored to the specific needs of a class or the needs of a geographically dispersed group of students. The problem of time consuming development of electronic educational resources may be faced through the use of flexible tools for the composition of electronic educational material. Using these kind of tools a teacher could easily create, enrich and maintain a body of electronic educational resources without the need of extended skills on computers and web authoring. As a result, the usage of such flexible tools may promote the introduction of information technologies in the day-to-day teaching practice.

In this paper we present a flexible architecture called DVT which stands for Dynamic Virtual Trainer (Kopsacheilis et al. 1999). We also demonstrate its use in developing two educational packages (multimedia corpora) on different subjects. The proposed architecture allows the dynamic composition of online lessons based on the combination of educational units according to varying user needs. The educational units are short composite entities of a variety of types like modules in HTML (HyperText Markup Language), virtual reality representations in VRML (Virtual Reality Markup Language), text, audio and video clips, etc. (Minoli & Keinath 1994). The dynamic composition of the lessons may be guided either by user defined search criteria or by other types of parameters like the desired level of lesson details, the level of relevance to other topics, etc.

A Flexible Development Platform

DVT is based on one or more servers who store the educational entities. The users are connected to the server through a common Internet browser and they have access to the introductory web pages of the server. The most important feature of these pages is the possibility for tailoring the lesson to be presented through the selection of the focal points of the discussion, the analytical level of the lesson, the levels of accompanying information, etc. The user may select one or more predefined lessons out of a menu. A much

more dynamic possibility is the real time composition of a lesson according to criteria entered by the user. The user may also use a set of questionnaires that accompanying the lesson's elements in order to self evaluate the educational procedure. The questionnaires are highly configurable (simple true-false answers, multiple choices, etc.). In addition a questionnaire may be easily formed to support the user providing tips, summarized information, etc. DVT uses the Internet-Intranet communication technologies for the distribution of the lesson (Halsall 1995). The entire architecture is supported by a DataBase, which keeps the relations between the elements of the educational material. The educational material stored in the server has the form of simple and short packages of information describing a specific topic, which are called Information blocks (IBs). An IB may include HTML pages, VRML representations, text, audio or video clips or a combination of the above components. Each IB corresponds to a set of parameters called Connectivity Block (CB) which supports the dynamic composition of the lessons. These parameters are used by the DVT Data Base in order to combine each IB with other relevant IBs or in order to combine the IB with a questionnaire. Finally the CBs include a set of key words which are used to select the specific IB each time the user enters one of the specific key words. A group of IBs forms a Chapter. A Chapter is focused on a set of relevant topics. A group of Chapters forms a Book. A Book covers a wider group of topics. This structure is depicted in Figure 1.

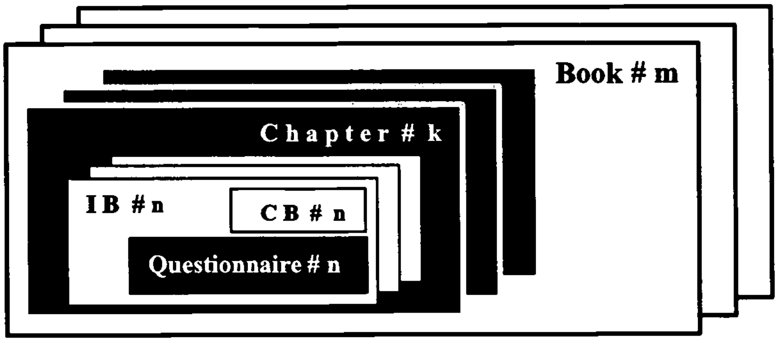

Figure 1. Information Structure in DVT

The overall quality of the produced lessons is a function of two factors: a) the multimedia content of each educational unit and b) the structure of the lesson which is reflected in the relations of the educational units. Courses for distance learning usually include a mix or a combination of various media. The key factors in the choice of media are the course objectives, the intended students and their geographical locations. The flexibility of the proposed system is based on the fact that any type of educational media may be incorporated in a course and presented by the system. The supported media include audio, video, text, images, Virtual Reality representations, etc. The increased flexibility of the system allows the designer of a lesson to customize and tailor the lesson according to specific student needs and, through this customization, to increase the educational effect of the lesson. The user-friendly environment for developing new educational courses is based on tools for easy composition of educational units and questionnaires. In addition the proposed system incorporates tools to setup relations and dependencies between the educational units. Finally, the educational material produced in the framework of a lesson is reusable in the sense that a number of autonomous units may be used for other courses. This is accomplished through the definition of a new relation of the educational unit in the framework of a new lesson. Based on this feature, a Virtual Reality representation of an ancient temple may be used in a course on architecture as well as in a course on ancient history, or even in a course on geometry. The proposed architecture supports the dynamic composition of related and mutually depended educational entities. The overall effect of the produced lessons depends on two major factors:

a) The structure and quality of each educational unit, and;
b) The overall course design, which is depicted in the relations between the educational units.

The proposed system allows the distribution of the dynamic educational material through low cost Internet based infrastructures. The DVT architecture is open and allows the integration of supporting

applications like real time video or voice conferencing packages. The educational resources provided to the students may be considered as a powerful complement of teleconferencing. DVT may be implemented on low cost hardware, software and communications platforms.

It is important to emphasize that the proposed system is not a specific implementation of an online course. It should be considered as a generic development platform, which allows the creation of interactive lessons on many different topics from different areas. More precisely, the proposed system allows the educator to create electronic educational libraries of short and autonomous entities, and to compose their contents to complete lessons or courses.

Using DVT for the Development of Educational Corpora

The above-described DVT architecture was used for the development of two educational packages on Telecommunications and Mount Athos respectively. We use the term Multimedia Corpora for the above educational packages in order to emphasize that they are complete educational entities made from multimedia educational material. Mount Athos is a peninsula in northern Greece. Twenty Monasteries are located on Athos since the medieval age (10th century) forming a unique monastic state. This package presents the history, the medieval artifacts, the natural environment and flora and fauna of Mount Athos.

The topic of telecommunications is presented mainly by means of text and animated graphics. The text modules include definitions and descriptions and the animated graphics are used mainly to accompany and support the descriptions. This package also includes a number of exercises and multiple choice questionnaires for self-evaluation of the users. The subject of Mount Athos is presented mainly by text, photographs, audio and video clips. Both corpora include educational information covering a variety of subjects. In Table 1 we summarize the presented topics.

Telecommunication Technologies	• Basic Definitions	• Transmission Technologies	• Examples of applications
	• Examples of complete systems	• Perspectives	• Future applications
	• Exercises		

Mount Athos	• History	• Architecture	• Geography of Mount Athos
	• Medieval Artifacts	• Byzantine Art (icons and music)	• Religious Art of 19th century
	• Natural Environment	• Flora and Fauna	

Table 1. Summary of Subjects Covered per Educational Package

The two corpora are presented to the users over Internet connections using the DVT dynamic page composition system. The composition is performed on the basis of user-defined choices. Examples of choices are the level of details, the focal point of the discussion (i.e. Geography vs. the History of a region), the level of difficulty, the level of correlation with relevant subjects, etc. Figure 2 depicts a screenshot of the educational package on Telecommunications. Figure 3 illustrates a screenshot from the package on Mount Athos.

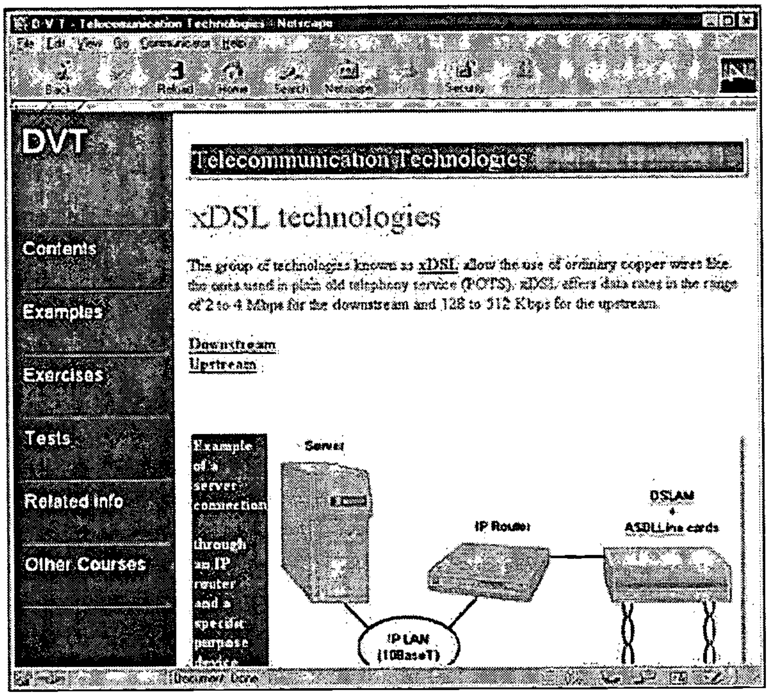

Figure 2. Screenshot of a dynamically composed page on Telecommunications Technologies

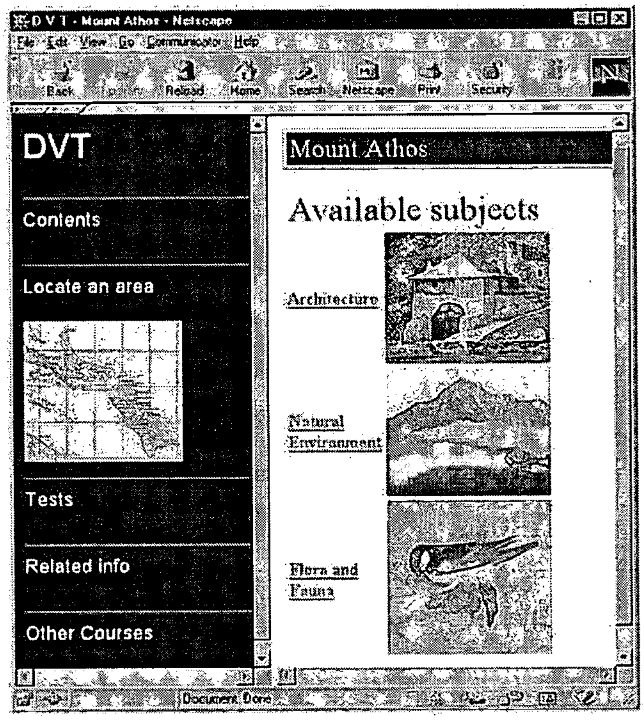

Figure 3. Screenshot of an introductory page on Mount Athos

Conclusions

The paper presents two educational packages developed using the DVT platform. Due to the flexibility of its architecture, DVT may support the development of electronic educational packages on a variety of subjects. The two packages cover Telecommunications and Mount Athos which represent two totally different topics. The DVT architecture has the advantages of flexibility, low cost and ease in developing new educational material and new courses. The advantage of low cost relies on the fact that only an Internet connection is required in order to access the educational material. Of course, the cost of the connection depends on the data transfer rate. In order to achieve satisfactory interactive access to multimedia educational information, a data rate in the range of 128 kilobits per second (or higher) is required. The feature of flexibility relies on the fact that the system demonstrates satisfactory and adaptive performance on different educational applications, over connections that vary in speed as well as for different computer platforms and operational systems. In addition the modules of educational information used to setup a lesson may have different styles and types. The modules are composite entities of a variety of types like HTML modules, VRML representations of virtual environments, audio and video clips, Java simulations, etc. The proposed architecture allows the designer of a course to select any component of any type. It also allows the designer to establish any relation between the components and finally to create a corpus of educational material which may fulfil a variety of pedagogical targets. The ease in developing new educational material relies on the fact that the educational information is stored in the server(s) in the form of short and autonomous modules, which are combined to setup a lesson. It is important to emphasize that the system acts as a powerful tool for the educators. The performance of the on-line lessons produced by the system, depends both on the relations between the information modules stored in the data base, as well as on the content and appearance of each information module. This implies that the system allows the tutor to incorporate his/hers experience into the educational resources to be developed.

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The Internet and Video: A Teaching Collaboration

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Course Website: http://web.bsu.edu/pmcallis (password controlled)

Abstract: The World Wide Web enables the linking of text, images, sound and video on Internet connected servers to be presented as enriching additives to the learning environment offered to students. Depending on instructional objectives, teachers utilize the Internet to engage their students in experiences that range from technical software-specific skill development to long-term cognitive learning. While the Internet can be viewed as supporting differing delivery models, such as technology-enhanced learning (TEL) and web-based training (WBT), among others, the Internet is extremely important for educators for its support of both synchronous and asynchronous modes of communication.

Students in an undergraduate music methods course routinely videotape themselves in various teaching roles. These experiences, as captured by videotape, are usually only viewed by the professor and the student. The creation and launching of selected teaching segments that can be part of the entire class experience, for all the others in the course to view and learn from, offers a tremendously enriched learning opportunity. The methodology used to best prepare students for this experience, capturing video-tape teaching sessions, how to digitize a selected 2-3 minute clip that illustrates a "best practice" teaching sequence, and how to upload onto a course website using available technologies and application software will be demonstrated.

Importantly, a varied and emerging set of learning experiences will be shared, from both the professor and student points-of-view. The Internet and video technology can significantly impact the teaching/learning process in teacher-training undergraduate programs.

Course Website (password controlled) http://web.bsu.edu/pmcallis

QuickTime http://www.apple.com/quicktime/

QuickTime and Video Editing http://www.apple.com/quicktime/authoring/video_editing.html

Adobe Premiere http://www.adobe.com/products/premiere/main.html

Microsoft FrontPage http://www.microsoft.com/frontpage

BlackBoard http://www.blackboard.com

Using Web Database Tools to Facilitate the Construction of Knowledge in Online Courses

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Abstract: This paper presents an overview of database tools that dynamically generate Web materials and focuses on the use of these tools used to support research activities as well as teaching and learning. Database applications have been used in classrooms to support learning activities for over a decade, but, although business and e-commerce have quickly embraced dynamic Web-based databases, their potential in educational environments is just now beginning to be explored. The paper builds a theoretical framework for using Web-based databases to support constructivist learning and describes several specific applications of dynamic databases used to facilitate the construction of knowledge and support collaborative activities in online teacher education courses.

Trends in Web-Based Instruction and Online Courses

The acceptance of the World Wide Web as a legitimate teaching medium is undeniably making educators rethink how they design and deliver courses. As access to the Internet approaches a "universal" level in higher education, the number of online courses and course-related materials continues to grow. Universities are facing an increased need to produce online training and other instructional materials, to provide opportunities for life-long learning, and to compete with a variety of virtual content providers. Consequently, dramatic changes are occurring in the way education is delivered and shared. IBM Chairman and CEO Louis V. Gerstner Jr. (1996) stated "if one billion people are going to access education, universities are going to have to change the way they teach." How they might change will be explored in this article.

Faculty Concerns about Developing Web-Based Courses

Faculty members at many universities have already begun to create and deliver online courses. These early adopters are testing and evaluating new models and methodologies, but, for the most part, no standardized paradigm for online course development has yet emerged. One of the reasons may be that faculty who create online courses are concerned about several issues related to this new way of teaching and are uncertain about how best to proceed. A major issue for many faculty is that creation of Web-based materials is time consuming and requires additional technology skills. Continuous updating of Web pages is necessary to keep content and links current as new material and resources become available.

Another issue is that faculty who want to create online resources themselves, will need access to adequate hardware and software as well as a robust, campus-wide electronic infrastructure. In other cases, faculty will need technical support services to assist them in the design and development process. Universities must find ways to provide multiple levels of support in order to maintain a dynamic university, one that can take advantage of the many technological changes that will continue to appear.

In addition to the need for technical support, faculty are also concerned about pedagogical issues that arise with online delivery. Designing a course to be delivered in a Web-based format requires a very different set of

instructional strategies and philosophical orientations. Some faculty members see the Web as an opportunity for implementing instructional innovations (Khan, 1997; Owston, 1997), but most faculty are largely uninformed about the benefits and drawbacks of online environments and are unclear whether online courses are as effective as face-to-face courses at promoting and supporting student learning (Reeves, 1997).

If we compare the qualities and characteristics of a face-to-face class and an online class, one of the critical differences is the type of interactions that occur within the context of a course. Interaction in an online course occurs primarily through asynchronous and synchronous computer-mediated communication such as e-mail, listservs, and chat. It is the use of these communication tools that can often make the difference between a good online experience and one that falls short of its goals and does not engage students. Our focus, and one that we hope other faculty will adopt, is to encourage and facilitate meaningful interactions between students, faculty and the Web-based resources they encounter.

Student Perspective

In addition to faculty needs and concerns, the needs of students also must be considered in the design and delivery of online courses. In order to build a true electronic community of learners, communication and collaboration among participants should be considered the driving force behind successful online courses. Unfortunately, many online courses (as well as many traditional courses) fail to take advantage of the potential for interactions that can add richness and depth to the construction of knowledge. In our online courses, student homework and projects are often similar to a face-to-face classroom; that is, specific assignments are given and students either post their work on a class listserv or e-mail it to the instructor to be graded. The problem, we have found, is that student work often does not become part of the course materials, and it tends to disappear at the end of the semester. Consequently, students do not always feel that they are participating in creating or adding to a body of knowledge and information for the course, nor do they experience ownership of the content.

Windschitl (1999) has stated that "constructivism is premised on the belief that learners actively create, interpret, and reorganize knowledge in individual ways." In that vein, we try to create a constructivist environment in our online courses, where students are able to manipulate the content of the course to fit their specific learning needs or goals. To do this, they must interact with the information they are researching and writing about, and they must share their views with the other students in the course, not just with the instructor. In a typical online course in our program area, there may be several hundred postings to the class listserv during the semester. Our efforts, therefore, have been toward having students not only interact with their own small number of postings, but use the virtual environment to explore, analyze, discuss, and debate issues and topics that cover the broad spectrum of information that arises during the course.

Dynamic Databases

Most Web pages, including the course pages that we have been developing for several years, are static and do not take advantage of the interactivity offered by the Web. Most Web pages simply duplicate print-based materials in electronic form. Simply converting existing course information to online format is not enough to effectively produce meaningful Web-based courses. Online course developers must focus on creating courses that are more responsive to students and student needs, facilitating social and instructional interactions, creating a sense of a learning community, and delivering timely and useful information. Creative strategies are needed that utilize innovative tools such as Web database tools are needed.

How a Dynamic Database Works

The integration of Web pages and dynamic database technologies allows users to access a database through a Web page and to dynamically generate Web pages that present the requested data. The variable data on the Web page is generated from the database and delivered to the user through a template page. All of the usual abilities of a database, such as searching for information, doing calculations, entering new information, and editing

existing information, are available through the Web browser. This means that any application that can be created using a database can be made available on the Web.

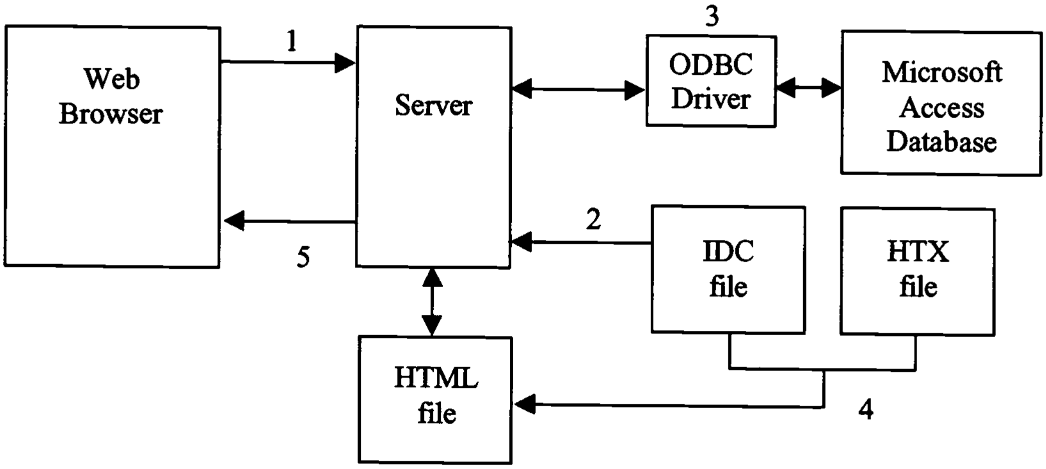

Figure 1: Diagram of Dynamic Web Page Generation Using IDC and HTX Files

1. Using a query form in a Web browser, the user makes a request to the server for an Internet Database Connector (IDC) file.
2. The server reads the IDC file that contains a query usually written in Simple Query Language (SQL). Other information may also be stored in this file, such as passwords and access to certain data.
3. The Internet Database Component of the server opens the database using the Open Database Connectivity (ODBC) driver and the IDC file information and runs the query to access the requested data.
4. The server merges the data from the database with a template file (HTX file) to produce a dynamic HTML document.
5. The server sends then the HTML file back to the user through the Web browser.

Features of Web-Based Databases

According to Inline Internet Systems, Inc. (1998), Web-based databases have several important features:

- Data is centralized and changes may be easily made without changing individual Web pages. This has the potential to reduce duplication and improve accuracy.
- Because the database information is changed through a Web-based form, it is not necessary for users to have the database software on their computers.
- Users do not need to have technology skills to add, revise, or use material in a database since it is driven through forms and search queries. This is particularly important for new or inexperienced users.
- The content in a database may be customized for delivery according to the user's country and language, time of day, and Web browser used.
- Databases created previously and used on one computer or through an intranet may be used to provide dynamic content.
- Because the database information has the potential to be accessed from anywhere in the world with an Internet connection and a Web browser, data can be expanded, updated or deleted easily.

Potential for Dynamic Databases in Teaching and Learning

Web-based database tools provide students and faculty with innovative solutions that promote collaboration and the creation of shared knowledge. Lynch (1999) summarizes this by stating, "To educational institutions this technology offers a challenge in using the technology to drive a more innovative and acceptable learning environment than that offered by the static Web pages of previous years. What is required now, is the classroom environment to adapt this technology into every day practice."

There are several advantages for using dynamic Web database tools:

- There is increased interaction between students and the resources. This interactivity implies involvement and commitment, since it empowers the user to control the environment.
- There is ownership of the material since the content is collective and not instructor-driven.
- The body of knowledge is not static but continues to change without requiring extra work on the part of the faculty member.
- Empowering students with control of content may affect participation, motivation and feeling of community. Material may become more interesting and stimulating when learner control increases.

Examples of Dynamic Databases

Example One: Student Pictures and Biographies for HyperGroups

Students in our online classes use a variety of listservs as a primary means of course communication. To enhance the feeling of an electronic learning community, students' pictures are taken at orientation and uploaded to the server. When a student posts a message to the listserv through a form that gathers their e-mail address, the message is displayed dynamically with their picture. The student simply has to type in their e-mail address for the picture to appear (See Figure 2).

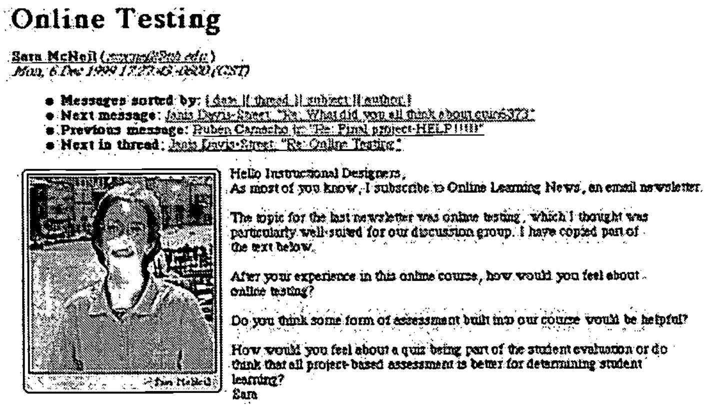

Figure 2: Participant's Pictures Automatically Generated by E-mail Address

Example Two: Computer-Based Instruction Database

Students in a graduate level instructional design course use the Web database tools to contribute different types of materials. For example, with one assignment, students review an online tutorial and post an evaluation of it using a Web form. They are then able to search the tutorial evaluation database by content area and audience/grade level.

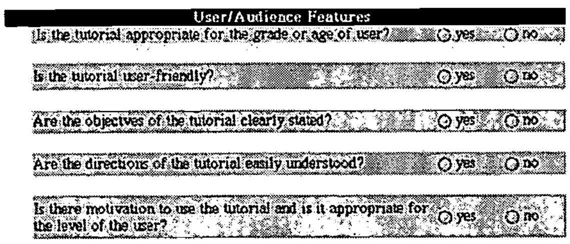

Figure 3: Form Used To Collect Tutorial Evaluation

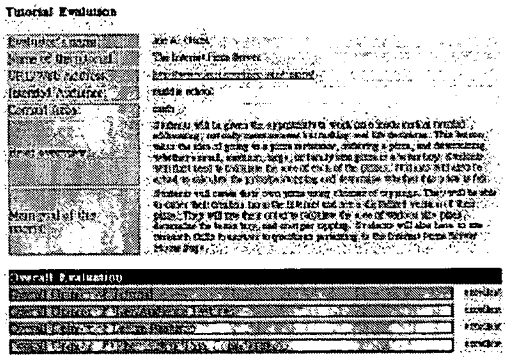

Figure 4: Dynamic HTML Page Generated From Database

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Perhaps the most interesting and creative use of a database is the game design assignment. Students design a computer-based game and submit their description as a newsletter article through a Web form.

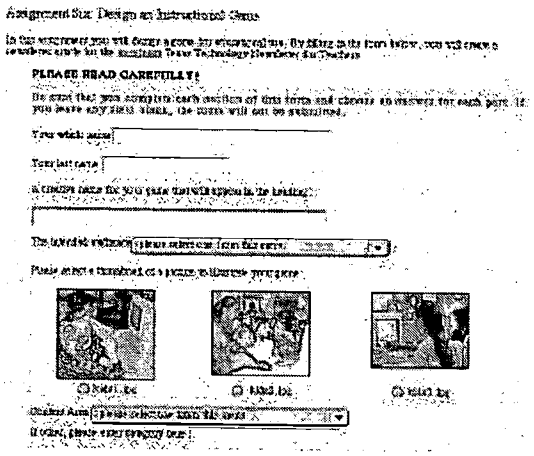


Figure 5: Form Used To Collect Game Design Data

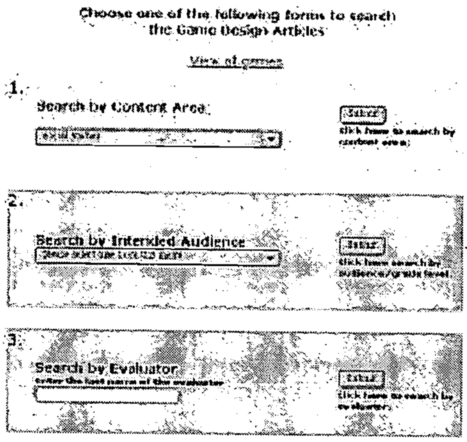


Figure 6: Query Form to Select Game by Content, Audience or Author

Figure 5 illustrates the form used to collect data for the sections of the newsletter. Students use both text fields, pull-down menus, and radio buttons to submit information about the game they have designed. When the student submits the data, it is automatically sent to the database. Students may then use the query form (See Figure 6) to search the database by content area, audience, or author. The results of the query by content are shown in Figure 7. Figure 8 illustrates the merger of the content from the database with the newsletter template, the HTX file, which is then displayed in the browser as a dynamic HTML file, complete with banners and graphics (See Figure 8).

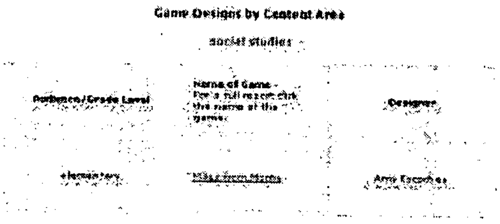


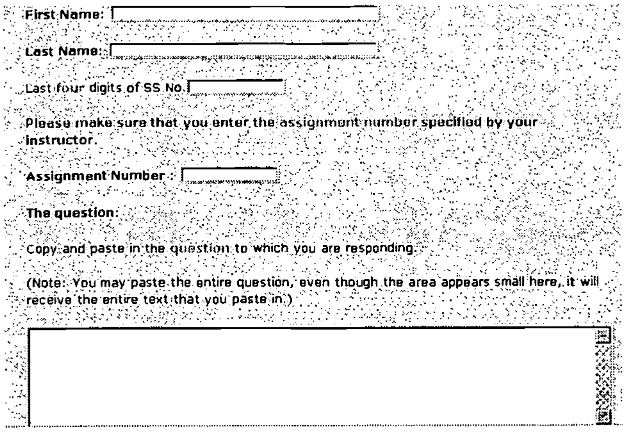
Figure 7: Results of Game Query

Figure 8: Example of Game Design in Newsletter Format

Example Three: Faculty Feedback for Student Assignments

In another online course, submission of student assignments also utilizes the Web database tools. Students are directed to a Web page that contains an online form in which they enter their name, a unique identification

number (the last 4 digits of their Social Security number), and the number of the assignment (See Figure 9). They are also asked to copy and paste the question and then scroll farther down in the form and type in or paste in their answer. If they have created a word-processed document or a Web page in completing the assignment, an attachment feature may be used. Once the submit button is pressed, the student work is sent to the database.



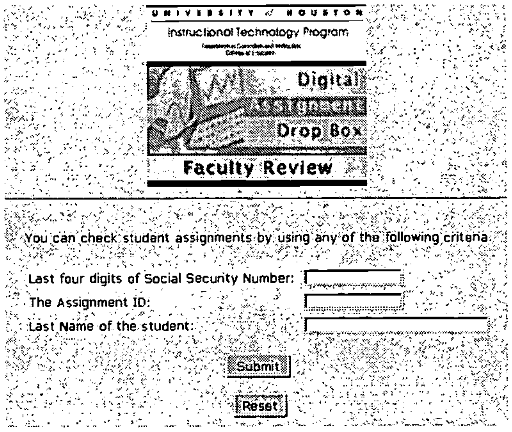


Figure 9: Student Assignment Submission Form

Figure 10: Faculty Review Form

After assignments have been submitted, the instructor uses the Faculty Review form to provide feedback for the assignments that have been posted (See Figure 10). Since all of the student postings are available in the database, the instructor may review all of a particular student's assignments or all of the postings on a specific assignment, depending on what terms are used to sort and view the database entries.

Students may also view the feedback by using the Student Feedback Review form. This page includes the questions, the answers, and the feedback in the order in which the assignments were posted (See Figure 11).

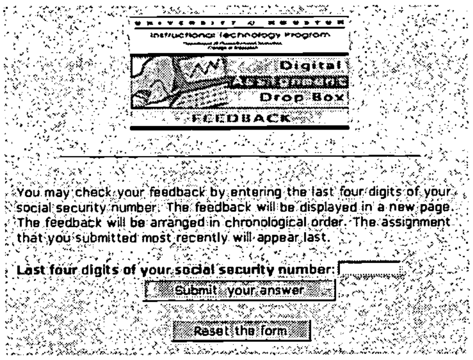


Figure 11: Student Feedback Review Form

Conclusion

The use of dynamic database tools has helped us as we seek to improve our online courses, and they have indeed given students greater control over the information covered in the courses. However, there are some limitations that should be mentioned. First, the technical skills needed to develop and use the dynamic database tools are greater than those needed to create traditional Web sites. Many simple HTML editing tools are available, and converting word-processed files, for example, to static Web pages is a skill that may be mastered very quickly. Conceptualizing how the database tools will function is very different from creating static pages,

and a new set of skills must be learned that include a greater understanding of information design and management. The time needed to design, develop, and evaluate online courses that include database tools requires a larger amount of both time and patience than many educators will be able to commit. Certainly, as with other Web-related tools, software improvements will make the job easier, but at this time, a steep learning curve is the rule. Finally, students who are asked to interact with these tools will need some instruction on how to use and access the interactive elements.

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PRESERVICE TEACHER EDUCATION

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Carine M. Feyten, *University of South Florida*

Three major themes emerge from the papers presented this year for preservice teacher education: collaboration, modeling, and the modeling of collaboration. Collaboration aimed at changing teacher education is taking place among many individuals and groups. Working under the premise that teachers teach as they are taught, teacher educators are modeling effective use of technology in preservice teacher classes. Ultimately, collaboration itself is being modeled to preservice teachers as one of the best ways to bring about major changes in education processes. These three major themes cut across all the domains of teacher education — how interesting! What does that say about the state of Information Technology in Teacher Education as we approach the new millennium?

Collaboration in Teacher Education

Collaboration to make improvements in preservice teacher technology education is taking place at many levels. McManus (Saginaw Valley State University), Charles (Eastern Michigan University), and Rubio (Albion College) describe the Consortium for Outstanding Achievement in Teaching with Technology (COATT), a collaborative effort by ten Michigan colleges and universities. Brown (Washington State University), Appleman (Indiana University), Green (California State University) and Hansen (University of Northern Iowa) compare the goals and activities of the Educational Technology classes at their four separate universities. The courses share as a goal the improvement of the learner's ability to use computing tools in education, but the activities employed to achieve this goal vary. In this same descriptive genre, Chambers and Tromp (University of Melbourne, Australia) outline the development of Instructional Technology (IT) skills as primary (elementary) education students progress in their course work. This development includes both generic IT skills and IT skills specifically related to curriculum areas. LaMaster (San Diego State University) and Morely (Northern State University) have designed a collaborative project between their universities using an electronic bulletin board to provide an opportunity for students to interact concerning pedagogical and professional issues. Seed (Northern Kentucky University) examines a collaborative effort involving interview and e-mail exchanges employed to gather information for evaluation of a collaborative learning environment involving faculty from the Colleges of Education and Arts & Sciences in a chemistry course for elementary and middle school preservice teachers. Peterson (South Dakota State University) focuses on the Discover South Dakota Tellecollaborative Project. This project has been used as an integral part of the curriculum in the required preservice technology class, involving future teachers in an opportunity to experience technology integration in the curriculum.

Collaboratives involving field experiences include the Fifth Dimension experience reported by Zimmerman and Greene (Appalachian State University). Preservice students participated in an after-school program in the enhanced learning environment of the Fifth Dimension center, where children were offered opportunities to experiment with educational software and other technology equipment. Morgan (Minnesota State University–Bemidji) describes a project based on a collaborative model which includes the preservice teacher, faculty supervisor, classroom mentor and school based technology coordinator. In this model, the preservice teacher has the opportunity to check out equipment and software based on a written instructional plan for the integration of the resources into a field based classroom lesson.

There are collaboratives among faculty, successful inservice teachers, and preservice teachers. For example, Dempsey, Sutton, Gallagher, and Steckleberg (University of Nebraska) describe the Scholarship, Technology, and Educational Practice (STEP) program, in which K-12 master teachers team with methods faculty to develop and model ways to integrate technology effectively. Cheeks and Liu (Towson University) describe an information centered technology course for preservice teachers in which students

collaborate with faculty to design projects that would be useful while giving them needed technology skills.

Selinger (University of Warwick, Coventry, UK) describes a project that placed preservice teachers of information and communications technology (ICT) into secondary schools, each in a particular subject area, to develop ways that ICT could be integrated across the curriculum. Preservice teachers benefited, as did inservice teachers, who were often lacking in ICT skills. Other projects involving the use of preservice ICT teachers are not always this successful, but it is expected that the cross-curriculum emphasis will be continued in the UK. Nocente (University of Alberta, Canada) describes a course for both preservice and inservice teachers. The course allows interaction between the two groups as they work on course assignments. Nocente found that inservice teachers who are vocal in their opposition to constructivist teaching can affect preservice teachers.

The goal of several multi-faceted collaborative efforts is to integrate technology into K-12 education by integrating technology into preservice teacher education. Carlson, Clark, Hosticka, Kostin and Schriver (Georgia Southern University) provide a summary of the progress made to date on collaboration involving the University and local school districts. Needs assessment results and establishment of a website and workshops for participants are presented. Future plans include further collaboration and evaluation. Dudt, Yost, and Brzycki (Indiana University of Pennsylvania) describe a consortium of three public universities that seeks the infusion of technology into teacher education programs. Couros (University of Regina, Saskatchewan, Canada) describes the vision and struggles of a college of education. Key participants in collaborative efforts include faculty, administration, library services, the technology committee and technicians of the college of education. Plans are being made for university collaboration with industry, telecommunications providers, and government education facilities. Snider, Gershner, Foster, and Huestis (Texas Woman's University) present a teacher education program called Learning and Integrating New Knowledge and Skills (LINKS) in which teacher educators, preservice teachers, and mentors collaborate to document the acquisition of technology competencies through each phase of teacher education. The Wyoming Capacity Building Project is a collaborative involving the University of Wyoming, the Wyoming State Department of Education, and seven community colleges. According to Westoff (University of Wyoming), the goal of this project is to build a technology enhanced teacher education program that will model effective infusion of technology for future teachers.

Garcia (University of Wisconsin Oshkosh) describes the assessment and planning groundwork laid for a major collaborative involving teacher educators, practicing teachers, and preservice teachers. The grant-funded project will enhance teacher education by modeling integration of technology into undergraduate instruction. Morgan (Minnesota State University–Bemidji) reports on a Federal TP3 Implementation Grant project, Class Act Preparing Tomorrow's teachers to use Technology. The Class Act program augments a four-year competency based, technology focused teacher preparation program, a collaborative among two universities, a community college, school districts and a private foundation.

Modeling Effective Use of Technology in Teacher Education

Teachers often teach in the manner they were taught. To ensure that preservice teachers become competent users of technology in their classrooms, universities are incorporating the use of appropriate technologies in their teacher education courses. Burkhouse and Ruthkosky (Marywood University) call for the infusion of technology in the curriculum as a tool, not a toy or a trophy. They call for the use of technology by teacher educators as a model in the academic community. Merideth and Steinbrom (Drake University) outline a constructivist approach to learning and work for preservice teachers as producers and consumers of technological resources. This approach utilizes FileMaker Pro database customized to gather test, graphics, sound, video, and references from the Internet. The information stored in the database is then used to create lesson activities for K-12 classrooms. Terwindt (Amsterdam Faculty of Education, Netherlands) describes a constructivist professional education program, "the experimental teacher education in the Netherlands" in 1997. Willis and Tucker (Northern Arizona University) describe a constructivist approach with their description of the "Multimedia Content Development Company." Teams of students complete content-centered projects that integrate technology tools in the presentation of topic.

Teacher education programs in the Netherlands are attempting to provide a foundation in the integration of ICT. The EXPLO project is one of these innovative attempts. Westhoek (Ichthus Faculty of Education, Netherlands) reports that this program is related to the Dutch government's Prommit program, based on the learn-as-you-work concept. He further outlines this project as he describes the Producing Student's role in learn-as-you-work and work-as-you-learn paradigms.

Teacher education programs vary in their ability to provide strong programs of instructional technology. Duran (Ohio University) surveyed three groups of preservice teachers in one college of education and found they felt ill-prepared to proceed with technology integration in their own classrooms. Albion (University of Southern Queensland, Australia) examines the influence of problem-based learning and multimedia methodology as a means of increasing preservice teachers' feelings of self-efficacy for

teaching with computers. Hargrave and Sadera (Iowa State University) found that, prior to their teacher education program, preservice teachers hold naïve ideas concerning effective use of technology in the classroom. Student teacher views support traditional teaching methods. The authors conclude that teacher educators must find effective ways to give preservice teachers more comprehensive views of technology in their educational process. Watson (Griffith University, Australia) points to students' expression of the greatest satisfaction with the IT course when it includes adequate human and technological support accompanied by online resource material.

When preservice students experience the effects of new technologies they will be inclined to use them in the classroom. A course described by Brown and Ferry (University of Wollongong, Australia) incorporates concept mapping into preservice training for teachers of science and visual arts. Since the students found that constructing concept maps was helpful in their own learning, it is expected that they will continue to use this tool and incorporate concept mapping into instruction they design for their own future students. Reynolds (University of Wyoming) and Reynolds (Rock River School, Wyoming) have developed a program integrating moral education in the student teaching practicum, using technology as a delivery tool to facilitate student project development. Wilkerson (Baylor University) presents a triad (communication, productivity, and research/instruction) model of technology infusion in the classroom. This triad model is one approach to designing curriculum and experiences in a teacher preparation program.

Higher order thinking skills are used in the creation of electronic portfolios of preservice teacher's accomplishments used for assessment of progress. Morris and Buckland (University of Vermont) report on the use of these portfolios and the evidence that using hypertext and multimedia tools to create these presentations enhances technology skills. Ehli and Sorknes (Northern State University) also report on this method of skill enhancement. These portfolios were used to communicate a personal profile to mentor teachers, K-12 students, and future employers.

McGrew-Zoubi and Hirtle (Sam Houston State University) describe a series of courses and a summer camp that provided field experience for preservice teachers. Both the courses and the summer camp used technology in a variety of ways that required the preservice students to utilize technology in their learning. Further, constructivist methods were used in several instances, putting the students in situations that resembled the learning environment of their future students. Cooper and Hirtle (Sam Houston State University) describe the use of computer message boards during a field experience portion of preservice training and concluded that such computer-mediated communications systems offer valuable means of connection for faculty and students.

Hagen (University of Nebraska) points out that while the use of technology for learning is often a solitary process, teachers and students like to interact. Therefore, group learning appears to be appropriate for preservice teachers as they acquire technology skills. Wentworth, Monroe, Orme, and Lynes (Brigham Young University) used e-mail as a tool to encourage students to reflect on their observations and link their field experiences to theories learned in the university setting.

Jacobsen and Clark (University of Calgary, Canada) describe the steps being made to integrate mandated technology curriculum into an inquiry-based teacher education program. Through a series of technology training workshops, preservice teachers are given tools they will incorporate into their future classrooms. Pan (The College of New Jersey) stresses the importance of teaching preservice teachers to integrate technology correctly into curriculum. He describes a study in which preservice teachers observed elementary students as they explored Microsoft's Magic Bus software. Maushak, Lincecum, and Martin (Texas Tech University) are developing a web site that will assist preservice teachers and teacher educators create and evaluate inquiry-based Internet assignments for K-12 students.

Teacher education programs experience difficulties in making technology transitions. Chiero, R. Bohlin, C. Bohlin, and Harris (California State University, Fresno), and Casey (CalState Fullerton Regional Center) describe the efforts of several teacher education programs to implement state mandated technology infusion. Norton (George Mason University) categorizes technology practices in teacher education classrooms. She identifies technology problems teacher educators face and gives examples of successful solutions.

Carter (Iowa State University) points out that teacher educators need models illustrating successful technology integration so that they can, in turn, model for their preservice students. She describes the development and evaluation of a CD-ROM titled *Videos in Technology Integration*, which features videos of teacher educators using technology in their preservice teacher classrooms. Andre, Schmidt, Nonis, Buck, and Hall (Iowa State University) describe the development of CD-based video clips and case histories demonstrating K-12 teachers using technology in real teaching situations. Staudt and Fuqua (University of the Incarnate Word) describe another use of the videotaping process to enhance teacher education. In this paper they describe the use of video as a self-evaluation tool for preservice teacher preparation. This videotaping program provides accurate data for prospective teachers to reflect and assess their progress toward mastery of state competencies.

Modeling Effective Collaboration

For preservice teachers, collaboration itself models effective ways to bring about major change in education processes. Often experienced teachers do not have time to acquire new technology integration skills and may be inclined to continue their traditional teaching patterns. Preservice teachers can observe classroom realities by working with practicing teachers. Hornung and Bronack describe a unique K-12/university collaborative that pairs preservice teachers with experienced inservice teachers. Preservice teachers observe and assist their mentor teachers a minimum of 20 hours. The pair decides on one area of established curriculum that would be enhanced by appropriate use of technology. The preservice teacher prepares and presents the technology-enhanced lesson. Both gain from the experience, and practicing classroom teachers gain new technology skills that otherwise may never have been used in their classroom.

In a similar program, according to Coe (Midwestern State University), preservice teachers model the integration of technology for mentor K-12 teachers. In this collaborative teacher education classes are taught in public school classrooms. Preservice teachers spend over 50 percent of their learning time in K-12 classrooms and they develop classroom technology enhancement and model its use for K-12 mentor teachers. Christie (Arizona State University West) points out that, in a K-12 school district/university collaborative, all participants learn: university faculty, K-12 teachers and students, and preservice teachers. She describes a partnership in which K-12 teachers and university faculty team-teach middle school students in university computer labs. Dobson (Bloomsburg University of Pennsylvania) reports on a collaborative project involving preservice teachers, inservice teachers, and university faculty. Future teachers were required to use their technology skills in partner schools K-12 classrooms by creating an electronic portfolio containing technology-based activities.

Anderson (Southeast Missouri State) and Anderson (Kenosha Unified School District) describe a grant funded program that provided computer equipment and software including assistive technologies for regular and special education students' use in their field placements. Preliminary results in the form of case studies present a sample of projected outcomes as a result of this study.

Gladhart, Carroll, and Ellsworth (Wichita State University) describe Project EXCITE, which is a major collaborative effort among teacher education faculty and students, student mentors, university technology staff, and faculty and students in K-12 partner schools. The goals of this grant funded project, Expanding our Curriculum Integration through Technology Education (EXCITE), include revising curriculum, training faculty to integrate technology, while meeting the new standards of The National Council for Accreditation of Teacher Education (NCATE). As Gladhart, Carroll, and Ellsworth concluded, "Developing fearless faculty is a lofty goal, but once faculty become leaders, their students will be empowered to be leaders and advocates for change in schools."

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COATT: A statewide initiative to improve pre-service technology education in Michigan

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Abstract

Like many other states, Michigan has recently instituted minimum technology standards for pre-service teachers. A diverse group of teacher preparation institutions in Michigan who believed there was a need to recognize those who reach a higher standard got together to form the Consortium for Outstanding Achievement in Teaching with Technology. The purpose of the Consortium is to set in place a formal process to recognize pre-service, and eventually in-service, teachers for going beyond the mandated standard. Here we discuss both the process of bringing the Consortium together and the progress of our students as they apply for the M-COATT certificate, the first of which will be awarded in the spring of 2000. At this writing our students are preparing their electronic portfolios to showcase their work integrating technology into their classroom teaching. By February our students will have nearly completed the first submissions to our Consortium.

The Origins of COATT

In June of 1999, representative of ten Michigan colleges and universities joined with Senator Carl Levin of Michigan to announce the formation of the Consortium for Outstanding Achievement in Teaching with Technology (COATT). The Consortium is the result of a yearlong effort begun by Levin that brought together diverse teacher preparation institutions to find a way to raise the standards for technology preparation given to pre-service teachers. Research 1 universities, regional comprehensive universities, and small liberal arts colleges are all members of this Consortium.

Each participating institution signed a letter outlining their responsibilities as members of COATT. The Consortium itself will be housed at the College of Education at Eastern Michigan University. The office at EMU will receive applications, organize evaluation teams, and generally administer the certification.

Each participating teacher training institution will assist candidates with the application process. They will name a person to act as a point of contact within the institution for potential COATT candidates. They will promote COATT to potential candidates through flyers, and other communications. Participating institutions will also provide support for candidates seeking COATT certification, such as adequate and relevant learning opportunities in the application of educational technology, and resources for COATT applicants to produce, maintain, and gain access to their COATT digital portfolios.

In addition to their responsibilities to support COATT applicants, participating institutions will retain responsibility for seeing to the health of the consortium across the years. Faculty liaisons will participate in an annual review of the COATT standards and will develop policy with other core members of the COATT organization. Faculty and other qualified personnel from participating institutions will be involved in COATT evaluation teams.

Earning the M-COATT certificate

In the 1999-2000 academic year, COATT will begin awarding a certificate, the M-COATT, to pre-service teachers who demonstrate excellence in the use of technology to enhance student learning. This certificate will exist independently of both degree programs and the state certification process. It will allow educators to demonstrate their proficiency in this area and will help school administrators who make hiring decisions identify teachers who can be technology leaders in their schools. The certificate will also allow institutions of higher education to benchmark their achievements in teacher training in technology against an independent standard of excellence. Students attending COATT member institutions who wish to receive the consortium's certificate must submit a digital portfolio for review by a panel composed of representatives of two or more of COATT's participating institutions (other than the student's own institution).

The COATT Standard

The standards used to award the M-COATT certificate are based on the Michigan Department of Education's [MDE] Seventh Standard for Entry Level Teachers. The Seventh Standard states that all entry-level teachers will have "an ability to use information technology to enhance learning as well as enhance personal and professional productivity." The Standard is divided into seven proficiencies (Michigan Department of Education, 1997):

Entry level teachers will be able to:

a) Design, develop and implement activities that integrate information technology for a variety of student grouping strategies and diverse student populations.
b) Identify and apply resources for staying current in applications of information technology in education.
c) Demonstrate knowledge of multimedia, hypermedia, telecommunications, and distance learning to support teaching/learning.
d) Demonstrate knowledge about instructional management resources that assist in such activities as writing and updating curriculum; creating lesson plans and tests; and promoting, reinforcing, and organizing data regarding student performance.
e) Use information technologies to support student problem solving, data collection, information management, communications, presentations, and decision making including word processing, database management, spreadsheets, and graphic utilities.
f) Demonstrate appreciation of equity, ethical, legal, social, physical, and psychological issues concerning use of information technology.

g) Use information technology to enhance continuing professional development as an educator.

Currently, the State of Michigan asks all entry level teachers to demonstrate achievement at the "basic" level (2 on the MDE's 4 point scale) in four of the areas and at the "proficient" level (3 on the MDE's 4 point scale) on the other three areas.. We expect the M-COATT standards to set a "higher bar" toward which entry level teachers may aim. To be awarded the COATT certificate, candidates will need to demonstrate achievement at the highest level (4 on the MDE's 4-point scale) on at least three of the seven components. At least two of the three components must be from among those components most closely linked to enhanced student learning: 7a, 7c, and 7e.

The Evaluation Process

As mentioned above, all candidates for the COATT certificate will be required to submit a digital portfolio for evaluation. The Consortium found itself faced with the question of just what does a quality portfolio look like? Initially participants in the Consortium offered anecdotal ideas of what they thought would qualify as "M-COATT certified," but actual sample portfolios had not been prepared at the onset of our discussions. The challenge of getting educational technology faculty from diverse institutions to agree on such a standard with the knowledge that a third party would independently evaluate their student's work was formidable. Eventually a rubric was proposed and agreed upon.

A portfolio is a focused presentation to a prospective employer of one's professional knowledge, experiences, and abilities. A student teacher selects important artifacts, the very best and clearest evidences of their growth and learning, to include in a portfolio. Such artifacts can include: a resume and philosophy of teaching; lesson plans and implementations of classroom activities; sample works of their own students; research papers and essays which they have written; video of their classroom teaching; evaluations and letters of commendation about their aptitude with pedagogy or content knowledge; anecdotal records about students or classroom management strategies; or awards of distinction. It is focused because specific skills and dispositions related to teaching are delineated; for example, one can include specific state or national standards for teacher preparation with corresponding evidence of mastery of those standards. Besides educators, professionals in other fields such as entertainment and the fine arts use portfolios. Doolittle (1994) and Campbell, Cignetti, Melenyzer, Nettles, & Wyman (1997) describe the basic outline of a traditional, or linear portfolio. The design of the portfolio should satisfy three sets of criteria that are not equally weighted:

- <u>pedagogical</u>; this is related to the quality of the teaching and learning that is presented and is accompanied by the students' reflections. It is very important to us that technical "style" not distract us from pedagogical substance.
- <u>instructional</u>; having said that, we do value style quite a bit. Components of the portfolio such as navigation and aesthetics make an important statement about the student's ownership of their technological skills. The portfolio should be structured so that the reader can easily navigate and understand the portfolio.
- <u>functional</u>; this addresses the simple question, "How *user-friendly* is the portfolio?"

Early in the COATT process, we set a scope for the M-COATT portfolio as something that a student could design in ten hours, given a basic mechanical understanding of how to construct a hypermedia document. We recognize that not every student-teaching classroom is on a level field insofar as the breadth or depth of available technologies is concerned. While student candidates are expected to be as creative as they wish in applying technology in the service of teaching and learning, those who are in a "technology-poor" classroom can still effectively compete if the degree to which the technology is employed is seamless and promotes learning in individual and unique ways.

It is expected that students will include standard fare such as sample units and lessons, artifacts of learning, artifacts of teaching (an electronic grade book, a classroom presentation, etc.) in their M-COATT portfolio.

We will also look for evidence of thoughtful contemplation on the part of the student - a summary justification for why the student meets a portion of the standard, a portrayal of the classroom environment, and a reflection on how "well" a particular unit or lesson was enacted and received. The COATT liaison at each member institution is responsible for sensitizing their students towards addressing these areas.

We envision submissions that follow good practices of hypermedia and instructional design. The digital portfolio should be *self-guiding*, and organized in a cogent, cohesive manner. Design guidelines for the students' linear portfolio are a good starting point. However, a well-designed digital portfolio will also take advantage of the non-linear presentation of information afforded by hypermedia. One may use the following pervasive questions (Rubio, Michell, Blackwell, Albery, & Kondelik, 2000) to guide their assessment of how that non-linearity was utilized: a) What do I want my reader to know now?, b) What do I want my reader to know next?, and c) How can I take advantage of the multimedia and nonlinearity at my disposal to effectively convey my presentation?

The functional assessment will be facile. Everything should "work" - links, media, etc. The portfolio should alert the reader to specific computer hardware configurations and special software needed to view the portfolio, and include links for downloading the software as appropriate. It should be web-accessible, but is not restricted to HTML. The portfolio should be largely operating system- and browser-independent.

Another question we had to answer in the first year included just when to make the M-COATT portfolios due. We wanted to issue the M-COATT certificate early enough so that recipients would have this certificate in hand for late spring job fairs. But the preparation of a digital portfolio that included actual lessons taught with students was a challenging task, as many of our applicants would only be student teaching in the spring. In addition, the timetable had to accommodate an independent review by university teacher educators. It was decided that there would be two sets of deadlines to accommodate student teachers who taught in the fall, 1999 or the spring, 2000. A web site was opened up in early November which can be use to begin the application procedure; applications can be made and changed online until January 14, 2000. Candidates from the first group will submit a nominal registration fee and a digital portfolio in web-accessible format to their COATT liaison, who is responsible for making sure that the portfolios are installed on web servers that are secured (no further modification) after March 3, 2000. The cooperating teacher will be asked to sign the application to signify that the student teacher did actually teach the unit in their classroom. At least one representative from each member institution will gather in mid-March to review the portfolios. An iterative assessment process will be performed, where each reviewer looks at several portfolios. The assessment rubric will then be finalized, and the portfolios assessed. Representatives will recuse themselves from assessing the work of students from their institution. The first awards will be announced on or around April 1, 2000. Candidates from the second group will have their portfolios secured by May 5, 2000, and will receive award notification on June 2. If selected, the students' name will be placed on the COATT web site, they will receive a certificate, and they will be invited to a public awards ceremony.

Issues

A number of issues have emerged through the process of creating the Consortium and certificate. These include the marketing of the M-COATT, certificate opportunities for in-service teachers, and financing COATT. We set a marketing goal that the M-COATT would become a credential valued by both job seekers and those who make hiring decisions in school districts. In order to bring this about institutions participating in the consortium have agreed to take a leadership role in promoting the certificate to their students. Senator Levin's office has agreed to work with the K-12 community to market the certificate to schools and school districts. We are also working for the endorsement of the M-COATT certificate by all relevant education organizations in the state. These marketing efforts will also include working with the news media to publicize this "first in the nation" approach to upgrading technology training standards for teachers. The question of developing a parallel certificate for in-service teachers is still under consideration. One of the main questions is whether inservice teachers should be offered the same certificate for the same level of work, or a more advanced certificate that would necessarily reflect a more thorough integration of technology in their teaching methods. It is also recognized that the evaluation methodology we will use in

granting the certificate may need to be modified as well. Finally there is the question of how will we pay for this "revenue neutral" project. In this era of reduced state budgets for higher education, some means needed to be found to support the ambitious goals of the COATT project. It has been agreed that the application fees for the M-COATT will be set at a level that helps screen out clearly unqualified applicants, while not discouraging qualified candidates from applying. The hope is that the revenues generated can defray some or all of the costs involved in evaluating the applicant's portfolios. Public and private grant support will be sought to cover the administrative and marketing costs of COATT and whatever portion of the evaluation costs are not met by application fees. It is expected that Consortium institutions may give some in-kind support to COATT in its start-up phase, but we also recognize that as the Consortium scales up, it will be reliant on cash resources.

Conclusion

We have only outlined the COATT standard, described the process of applying for the M-COATT certificate, and begun a discussion of some of the issues facing us as we face this task. At this writing, we are working with our first group of students who are trying to achieve the M-COATT certificate. In February while at the conference, our students will be preparing their initial digital portfolios for submission. Already we are seeing unintended benefits from the COATT process, as teacher educators responsible for preparing students in information technology at very diverse institutions have had a forum to discuss their work as they aim for a common standard. Those of us who have helped create COATT continue to believe that it will make a significant contribution to long-term efforts to improve the technology skills of Michigan educators.

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Computer Technology Courses for Pre-Service Teachers: a Comparison of Four University's Approaches

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Bob Appelman: Indiana University, Bloomington
Timothy Green: California State University, Fullerton
Lisa Hansen: University of Northern Iowa, Cedar Falls

Abstract: This paper is a description of the Educational Technology/Instructional Technology courses developed and delivered within the teacher education programs at four diverse state universities. Each university is presented as an individual case. The goals and activities of the Educational Technology courses offered are the focal point of the comparison.

Introduction

Computer technology skills have been targeted as a critical competency for teachers by organizations that include The National Council for Accreditation of Teacher Education (NCATE) and the National Education Association (NEA). A recent NEA resolution includes the statement, "Teacher preparation in instructional technology, including the development of effective materials, and appropriate instructional strategies must begin in college and university programs and extend through continuing professional development" (1997-98).

Accepting the fact that effective teacher preparation programs must include instructional technology (IT) as part of the program of study raises the issue of deciding how best to incorporate IT into the teacher education curriculum. Teacher education programs across the United States have been approaching the problem of developing IT competency through specifically designed courses. Although virtually all of the courses offered have as their goal the improvement of the learner's ability to use computing tools in educational settings, the activities developed and employed to achieve this goal vary widely from program to program.

Abbie Brown, Bob Appelman Timothy Green and Lisa Hansen are each responsible for teaching computer technology courses that are part of the teacher education programs at state universities (Washington State University, Indiana University, California State University and the University of Northern Iowa, respectively). Each reports on his or her respective environment in the following four cases.

Case #1. California State University, Fullerton

Teacher education programs throughout California are in the midst of analyzing and evaluating how credential students are being prepared to utilize technology in the classroom. A major impetus for this has been brought about by the California Commission on Teacher Credentialing (CCTC). The CCTC has recently developed standards on the use of computer-based technologies in the classroom that teachers must posses. Teacher Education programs in California must document how they are implementing these standards by June of 2000.

The credential program at CSUF is a one-year, post-bachelor program. Students entering the program come from a wide-range of academic backgrounds, with many coming from other colleges or universities. Students therefore come in with varying abilities with regard to

technology. There currently are no technology requirements for admissions into the credential program.

The combination of the recent CCTC standards on computer-based technologies and being in the middle of NCATE accreditation process has prompted the Division of Education at CSUF to take a serious look at how prepared our credential students are in the use of technology when they leave our program. Students can leave our teacher education program without taking a technology course. However, students must demonstrate in their student teaching experiences competencies related to technology. Students are to gain experience in utilizing technology throughout the one-year credential program.

The main technology course in the department (Elementary, Bilingual, and Reading Education) I work for is EDEL415: Microcomputers in the Elementary Classroom. The class is designed for in-service teachers working on their professional credential (the credential teachers receive after their preliminary/probationary credential). Teachers must take this class along with two other non-technology related courses to receive their professional credential. The major goal of the course is to help an elementary teacher develop knowledge and skills that will allow him or her to integrate technology into their classroom. Although this course is designed for in-service teachers, many students take this course even before they are enrolled in the fifth-year credential program. Students enrolled in EDEL415 can range from novice to experienced in regard to their teaching abilities and knowledge about pedagogy.

As part of the master's program in Curriculum and Instruction, a computer emphasis can be taken that leads to a computing certificate for elementary teachers. "The Computing Certificate for Elementary School Teachers has been designed to provide elementary school teachers with a broad understanding of the applications of microcomputers in the elementary school classroom and the instructionally related tasks in the public schools. Competencies will enable participants to become computer curriculum specialists who will guide the integration of computers into the elementary school curriculum, their uses in instruction, and their applications in instructionally related activities at the elementary school."

The certificate consists of 15 semester hours. Listed below are the courses that make up the certificate.

Core Courses (13 units)

EDEL 415 Microcomputers in the Elementary Classroom (3)
EDEL 515 Problem Solving Strategies Including Logo (3)
EDEL 519 Advanced Technologies (3)
EDEL 516 Integrating Elementary School Software into the Curriculum (1)
EDEL 517 Practicum: Elementary School Teachers and Computers (3)

Elective Courses (2 units selected from the following courses)

EDEL 512 Improving Elementary Students Writing with Microcomputers (1)
EDEL 513 Microcomputer Utilities for Elementary School Teachers (1)
EDEL 514 Strategies for Using Data Base Management with Elementary Children (1)

could be done, and what can be done, is continually addressed beginning with the first required technology course.

Professional development becomes the focus instead of the lack of technology available in the field. Assessment of an individual's technology literacy is calibrated using the ISTE Standards for Basic Endorsement in Educational Computing and Technology Literacy. From the beginning, each student is made aware of the importance of self-assessment using these standards, and also with the realization that they should expect to be evaluated with them upon entering the teaching profession.

Every student is required to take an introductory course entitled "Using Computers in Education" with the following description:

(W200 3 cr)

Develops proficiency in computer applications and classroom software; teaches principles and specific ideas about appropriate, responsible, and ethical use to make teaching and learning more effective; promotes critical abilities, skills, and self-confidence for on-going professional development.

From this base the student will attend practicums and/or cohorts during their Sophomore and Junior years that explore teaching methods and technology integration. Each course offering in the School of Education is strongly urged, and supported with consultant resources, to integrate technology into its repertory. If a student wishes to gain a computer endorsement, then a special course sequence is available as listed below.

W210 Survey of Computer-Based Education (3 cr.)
W220 Technical Issues in Computer-Based Education (3 cr)
W310, Computer-Based Teaching Methods (3 cr):
W410 Practicum in Computer-Based Education (6 cr)

Keep in mind that the School of Education exists among strong departments of Computer Science, Radio & Television, Journalism, Music, Fine Arts, Business, Informatics, and Library and Information Science. Electives may be chosen from this sample list below.

Education W205 Computer Graphics for Education (3 cr)
Education F401 Application and Use of Multimedia (3 cr)
Education F401 Educational Simulations and Games (3 cr)
Education F401 Digital Video in the Classroom (3 cr)
Education W450 Internship in Computer Education (3 cr)
Education F500 Teaching With the Internet Across the Curriculum (3 cr)
Education F500 Developing WWW Sites for Public Schools (3 cr)
Education K500 Workshop in Special Education: Assistive Technology (3 cr)
Education R547 Computer Mediated Learning (3 cr)
Education R590 Teaching With the Internet Across the Curriculum (3 cr)
Education R685 Human-Computer Interface Design (3 cr)
Business K201 The Computer in Business (3)
Business X201 Technology (3 cr)
Comp Sci A201 Introduction to Programming (4 cr)
Comp Sci A247 Network Technologies and Administration (4 cr)
Comp Sci A547 Network Technologies and Administration (3 cr)
Fine Arts S300/S500 Video Art (3 cr)
Fine Arts T330 Computer Art (3 cr)
Journalism J463 Desktop Publishing (3 cr)
Library Sci L401 Computer-Based Tools (3 cr)
Music U/Z396 Introduction to MIDI and Computer Music (3 cr)

Case #3. University of Northern Iowa, Cedar Falls

The College of Education at UNI has a strong commitment to technology and requires certain technology skills from its preservice teachers. All students are required to take a basic educational technology course early in their academic careers; for many students, this required course is completed in their first semester in the College of Education. Subsequently, many of the students we see in this course are new to the concepts of technology in education from a teacher's perspective; indeed, many students are hearing words such as "pedagogy" and "objective" for the first time in our course. We therefore have to organize our required course (and additional courses offered to undergraduates) around the fact that we see them before they have taken a methods course.

In addition to offering master's degrees in educational technology and communications and training technology, UNI provides an educational technology minor. We currently have about 22 students minoring in educational technology. This 18-hour minor includes 4 required courses and 2 electives, listed below. Eight educational technology courses are available to undergraduate teacher education majors. The first two courses listed below are the basis for all the others and should be taken first, in this order.

- Educational Media and Classroom Computing is required of most undergraduate education majors. This course is a general introduction to educational technology and media, and combines lectures and labs into a hands-on and survey/reading class. We offer six sections of 60 students each semester.
- Classroom Computer Applications is a follow-up course to Educational Media, and is required of technology minors. It is offered once a year and is much smaller in size (about

10-12 students). This class takes many of the skills and principles learned in Educational Media a step farther.

- Technology in Education is an undergraduate/graduate level course, and is a survey of the history, issues and trends in educational technology. This couse is required of educational technology minors, and should be taken after the two listed above.
- Media Planning and Production is an undergraduate/graduate level course, required of educational technology minors, and should be taken after first two listed above. This class oftens acts as the graduate level introduction to technology course (much as Ed Media does for undergraduates), and thus provides more of a theoretical and in-depth base for skills and process development for undergraduates.
- Databases in Education is an undergraduate/graduate level course, and a minor elective. This course covers the use and development of databases in education, to support and enhance learning.
- Telecommunications in Education is an undergraduate/graduate level course, and a minor elective. Telecommunications encompasses the issues of using computers, video, and other communications methods to expedite learning.
- Media Projects is undergraduate level course and a minor elective. This independent project gives students the opportunity to pursue projects of interest to them, and to further the development of skills.
- Principles of Publication Design is an undergraduate/graduate level course, and a minor elective. This class covers the design and development of print and web-based publications.

Case #4. Washington State University, Pullman

The Department of Teaching and Learning within Washington State University's College of Education currently requires all students seeking certification in elementary education to take a course entitled Technology Used in the Schools (TL445). Approximately 225 students graduate with provisional certification (state license) each year. Beginning next year, this course will also be a requirement in the secondary education certification program (approximately 200 students graduating each year). Currently, this is the only Educational Technology course available for undergraduates in the College of Education.

The teacher certification program at Washington State University (WSU) is selective; students may apply for admission to the program in their sophomore year (a process which includes interviews, a record of eighty hours of direct contact with children in supervised educational settings, and review of the applicant's grade-point average). As freshmen, students at WSU are exposed to orientation experiences that include the use of e-mail and web-based communication; many students have experience with web-based conferencing (many professors are adopting WSU's proprietary Speakeasy web conferencing system as a supplemental class activity). Students are generally well acquainted with word processing, spreadsheet and communications (e-mail) software: a recent survey of the students enrolled in the College of Education's Teaching Elementary Mathematics course indicated that all but one of the fifty-three respondents had access to a computer in their home. Washington State University prides itself on being the seventh "most-wired" university according to Yahoo! Internet Life (1999).

Objectives and Rationale of WSU's TL 445: Upon successful completion of the course, students should increase their ability to implement and evaluate technologically innovative instructional activities, Because the current trend is toward making improved use of digital technologies (i.e. Personal and/or networked computer-based presentations and interactive activities), all course activities will relate directly to computer-based presentation and instruction. It should be noted, however, that many of the concepts and procedures introduced during the course are general standards of effective instructional design and can therefor be applied to any technologically innovative instructional situation. The presumption is that the technologies currently in vogue will very probably be replaced by emergent, differing technologies during the course the of the student's teaching career, while standards of effective design and instruction will remain relatively stable. The course goals and activities are based on the recommended practices put forward by the International Society for Technology in Education (ISTE).

In accordance with the ISTE Recommended Foundations in Technology for All Teachers, (currently accepted by NCATE) students will:

- Be assessed early in the course to ensure their basic competency in the operations and concepts of computers and technology (support is provided for students in need of basic skill development). Basic competence tasks are assigned (i.e. HTML generation and articulation of essential computing concepts) in which students are required to word process, invoke network protocols (e.g. TCP/IP, http) make use of multimedia tools, and manipulate digitized images.

- Develop instructional media for personal and professional use. Students design, produce and evaluate instructional multimedia (specifically, a web site and an authored, stand-alone software package). Students learn to use and employ a variety of productivity tools including image manipulation software, digital cameras, digital sound editing software, internet-based resources, and authoring software (e.g. HyperStudio, web (HTML) editors, Macromedia Director). An anticipated side-benefit of this activity is the development of a professional portfolio of innovative instructional media created by the student and applicable to the student's intended teaching situation. Ethical use of computers and related technologies (with emphasis on copyright issues) are discussed at length during the course of the semester.

- Apply technology as an instructional tool, exploring and evaluating its potential use through problem-based, practical activities that draw on the students' knowledge of both subject matter and pedagogy. Through the application of instructional design protocols and practices (e.g. needs analysis, user-centered design, usability testing), students will develop greater sophistication in both the use of innovative technologies and the facilitation of the learning process. The obligation on the students' part to produce clear documentation of the intended instructional outcome and the product's development is intended to help students better reflect upon and understand the design/production process and its implications for developing instructional materials. In generating their own instructional software, students develop a personal understanding for the need to apply legal and ethical restrictions upon software and software components (including digitized images, video, and sound); it is to be hoped that students with direct, hands-on experience with creating these components will gain a greater appreciation for the time and effort involved in their production as well as the value placed upon them by their creators. A culminating activity of developing an evaluation

protocol for an actual educationally oriented technological innovation encourages students to develop an increased understanding of responsible, ethical and legal uses of technology, information, and software resources as well as the application of quantitative and qualitative measures of success in facilitating the learning process.

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Doing IT Down Under:
Uses of Information Technologies in an Australian Degree for K-6 Teachers

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Abstract: This paper discusses the Information Technology (IT) skills that are developed in the Bachelor of Education (Primary) degree at the University of Melbourne, Australia. Students graduating from this degree will be K-6 (also known as primary or elementary) teachers. The study shows that IT skills are developed over the four years of the course with the students progressively developing both generic IT skills and IT skills specific to curriculum areas.

Introduction

The Bachelor of Education (Primary) [B.Ed.(P)] degree is the principal vehicle for training primary teachers at the University of Melbourne in the Australian state of Victoria. [In Australia the term 'primary' is used to refer to K-6 education, thus what is known in the USA as 'elementary school' is referred to in Australia as 'primary school'.] In the state of Victoria there is a strong emphasis on the uses of Information Technologies (IT) or learning technologies in the classroom (Victorian DoE 1999a) with a number of major IT initiatives in place that make it critical that our graduates have good IT skills. This paper will discuss how IT skills are developed in the four year B.Ed.(P) course for pre-service K-6 teachers.

In 1995 the B.Ed.(P) degree at the University of Melbourne was restructured and updated extensively with a move from an activity-based course to emphasise a scholarly, research-informed basis of teaching and learning. New first year subjects were introduced in 1996 and later year subjects were progressively implemented from 1996 to 1999. See Table 1 for the titles of subjects undertaken by students in the new course. In the 1999 academic year the first cohort of students of the revised course were in their final year. Over the period of the development and implementation of the new course structure there has been an ever-increasing impetus to prepare our students - as much as is possible in the changing world of IT - for significant uses of IT in their teaching careers, which may extend to 2040!

In addition to the restructuring of the course for the above reasons, budget constraints imposed a rethinking of the delivery of the course and of the ways in which students undertake practical experience in schools ('teaching rounds'). From 1997 a reduction of 20% was made to the number of days of supervised practical work in schools. In response, interactive multimedia has been used in some subjects to make 'experiences' with children a well-integrated part of the university course and to maximise the learning experiences of our students while on teaching rounds. Development of multimedia resources has been undertaken within the Faculty of Education and has been progressing as funds and time allow it (see Chambers & Stacey 1999, Asp, Chambers, Scott, Stacey & Steinle 1997, Chambers, Asp, Scott, Stacey & Steinle 1997 for descriptions of some of the multimedia projects for use in teacher education). Using such multimedia resources as part of their course work also models to our students some of the ways that IT can be used to facilitate learning.

The eight first year subjects are: • Studies of Society and Environment • Arts 1 • Health & Physical Education 1 • Language & Literacy 1 • Mathematics 1 • School Experience 1 • Science and Technology 1 • Children, Schools and Society
The eight second year subjects are: • Indigenous Australian Studies • Educational Theories and Practices • Arts 2 • Health & Physical Education 2 [standard or advanced] • Language & Literacy 2 • School Experience 2 • Maths 2 [standard or advanced] • Computers in the Primary Classroom
The ten third year subjects are: • Science and Technology 2 [standard or advanced] • Arts 3 [option] • Children's Literature [option] • Mathematics 3 [standard or advanced] • School Experience 3 • Studies of the Australian Environment [option] • Curriculum and Teaching [standard or advanced] • Children with Special Needs [standard or advanced] • Health & Physical Education 3 [option] • Language & Literacy 3 [standard or advanced]
The nine fourth year subjects are: • Issues and Contexts in Education [standard or advanced] • Research Project / Honours Research Project • Curriculum Integration [standard or advanced] • Arts 4 [option] • Health & Physical Education 4 [option] • Language & Literacy 4 [standard or advanced] • School Experience 4 • Science & Technology 3 [standard or advanced] • Mathematics 4 [standard or advanced]

Table 1: Subjects undertaken by students in the Bachelor of Education (Primary) degree at the University of Melbourne, Australia.

Methodology and Rationale

A survey was undertaken at the end of the 1998 academic year regarding uses of Information Technology (IT) in all subjects of the Bachelor of Education (Primary) course. Information was gathered

in most cases through an interview with the subject coordinator and, for the small number of subjects where a suitable interview time could not be arranged, the subject coordinator completed a survey checklist without interview. Data for years 1 to 3 reflect actual usage of IT for the subjects in 1998, whereas information for year 4 was a projection of intended usage, as 1999 was the first time year 4 of the revised course was taught.

The reasons for undertaking this study were:

- to inform subject coordinators of students' exposure to IT and the skills that could reasonably be expected of students entering a subject;
- to gain an overview of IT skill development in specific subjects so that development of IT skills could progress over the four years students were in the course; and,
- to establish use of IT in the course in 1998 so that these data could be used for comparison in later years.

The IT skills documented are those that were required to complete the subject; although many students within a subject may have used other forms of IT these were not included in this study. For example, students may have emailed lecturers, developed Power Point presentations, or used the Internet for research while undertaking a subject, but these are only documented if they were a specific requirement of the subject. The reason for this was so that we could confidently say that all students had made the stated uses of IT while undertaking a subject.

Results

Basic uses of IT such as file creation and management, using word processors and spreadsheets, and using electronic resources such as the WWW and CD-ROMs for research developed over the four year course, with some subjects such as Science & Technology, Mathematics, and Arts introducing students to IT tools specifically relevant to that learning area. See Figure 1 for a summary of findings.

Uses of IT in Year 1

All first year subjects of the B.Ed(P) required students to submit word processed assignments which incorporates the basic IT skills of file creation and management, entering and formatting text, word processing, and printing. Other basic IT skills and experiences were developed in most subjects with students required to use spreadsheets in four subjects (of eight subjects), to access the Internet for lecture notes and teaching materials in five subjects and to use CD-ROMs to find information for four subjects. Using email and participating in electronic discussions was part of two subjects, with students in 'Mathematics 1' required to report to the electronic discussion forum about their analysis of interviews about children's understanding of decimal numbers they undertook while at a school. Students then had to respond to the findings of other students.

First year students were introduced to the Education Faculty's web site in both 'Mathematics 1' and 'Science & Technology 1' subjects, which included establishing and logging into university computer account, using a web browser, and using the AltaVista student discussion forum. Using databases was introduced in two first year subjects, 'Health and Physical Education 1' required students to upload data they had collected while in schools into a database via a web interface and using databases was also introduced in 'Science & Technology 1'. The uses and evaluation of IT resources in schools was included in three subjects.

As expected, some subjects introduced students to IT tools specifically relevant to their learning areas. In the subject 'Science & Technology 1' sensors and probes were used for data logging to measure and record temperatures, and in 'Mathematics 1' graphics calculators were introduced.

Uses of IT in Year 2

The second year of the course built on skills developed in first year and, as with first year, all subjects required students to use computers to prepare work submitted for assessment. In general, in second year of the course there was a greater emphasis on students developing skills in using electronic

resources available via the Internet, particularly the World Wide Web (WWW) or on CD-ROM. Most second year subjects required students to use the Internet in some way, whether it was accessing the Faculty home page, using email, or searching the WWW for course-related information.

Education library staff introduced students to the local university library system, the 'Buddy' database, which includes paths to access ERIC in the both 'Educational Theories and Practices' and in 'Computers in the Primary Classroom'. The ability to access and evaluate information from the Internet is seen as both crucial to the future teaching careers of our students and an area that was new to most students. As in first year, a number of subjects required students to use of evaluate software for classroom use.

Use of IT in BEd(P) subjects [1998]	BASIC USES OF IT																
	creating files	managing files	word processing	printing	use web to access lecture notes	using spreadsheets	use web to access materials you have	finding info on a CD-ROM	find info on the web	using email	using electronic discussion forum	access database to find info	enter data into a database	use technology in schools	use/evaluate sw for classroom use	developing presentations	
First year subjects																	
School Experience 1	■	■	■	■													
Studies of Society and Environment	■	■	■	■													
Arts 1	■	■	■	■													
Children, Schools and Society	■	■	■	■		■	■	■									
Language & Literacy 1	■	■	■	■			■	■						■			
Health & Physical Education 1	■	■	■	■	■	■		■		■	■		■		■		
Mathematics 1	■	■	■	■	■	■	■				■						
Science and Technology 1	■	■	■	■	■	■	■	■					■		■		
Second year subjects																	
School Experience 2	■	■	■	■													
Indigenous Australian Studies	■	■	■	■	■												
Educational Theories and Practices	■	■	■	■	■							■					
Arts 2	■	■	■	■				■	■					■			
Language & Literacy 2	■	■	■	■				■	■	■		■			■		
Health & Physical Education 2 [std or adv]	■	■	■	■	■	■			■						■		
Maths 2 [std or adv]	■	■	■	■	■		■	■	■	■				■	■		
Computers in the Primary Classroom	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Third year subjects																	
Children with Special Needs [std or adv]	■	■	■	■													
Health & Physical Education 3 [option]	■	■	■	■													
Language & Literacy 3 [std or adv]	■	■	■	■													
School Experience 3	■	■	■	■	■												
Arts 3 (option)	■	■	■	■				■	■					■	■		
Childrenís Literature [option]	■	■	■	■				■	■		■	■					
Mathematics 3 [std or adv]	■	■	■	■	■		■		■		■	■					
Science and Technology 2 [std or adv]	■	■	■	■	■		■	■	■			■		■	■		
Curriculum and Teaching [std or adv]	■	■	■	■			■	■	■			■					
Studies of the Australian Environment [option]	■	■	■	■			■		■	■		■			■		
Fourth year subjects																	
School Experience 4	■	■	■	■	■												
Issues & Contexts in Education [std or adv]	■	■	■	■	■				■			■					
Research Project [std or hons]	■	■	■	■					■			■					
Curriculum Integration [std or adv]	■	■	■	■	■	■		■	■					■	■		
Language & Literacy 4 [std or adv]	■	■	■	■				■	■	■		■			■		

Figure 1: The uses of IT in subjects of the B.Ed.(P) course grouped by year of course.

As expected, the subject 'Computers in the Primary Classroom' introduced a wide range of uses of IT and developed IT skills upon which other subjects could build. For example, the programming language Logo (as part of the computer software Microworlds) was introduced in 'Computers in the Primary Classroom' and the uses of Logo in developing children's mathematical understanding was developed in 'Mathematics 2'. Using HyperStudio to develop simple multimedia resources suitable for use in a K-6 environment and all that it entails – using a scanner, creating and modifying images, working with sound files, etc. –developed in students a range of both practical IT skills and the IT concepts relating to object oriented programming. Creating web pages also allowed students to consolidate their uses of a range of file types and develop another avenue for electronic communication. All lecture and weekly workshop notes for this subject were available online and a CD-ROM (Chambers & Dobbins 1997) with other multimedia resources developed for the subject available to supplement the weekly lecture and workshop. Through this regular access to resources via technology, by the end of second year access to the Internet and WWW was a routine part of all students' academic tasks. This was not true of the students when entering second year.

Uses of IT in Year 3

By third year of the course the IT skills of students are well developed and all subjects assumed basic IT skills and most subjects expected students to use databases, the Internet and CD-ROMs as a routine part of the research process. Again, using and evaluating IT resources for use in schools was required in a number of subjects. Intensive use of web sites was made by a number of third year subjects with 'Mathematics 3' having all lecture notes, a bibliography, workshop feedback and a weekly on-line quiz available only via the WWW. In one subject, 'Studies of the Australian Environment', students consolidated a range of IT skills by developing a multimedia resource and creating a web site.

Uses of IT in Year 4

The fourth year of the revised course was not taught in the 1998 academic year (the new program was not taught until 1999) so the information supplied was of predicted uses of IT in these subjects. All fourth year subjects will have information about the subject and lecture notes available via the web and will expect students to be able to use databases such as ERIC for assignment research. Most fourth year subjects expect and develop basic IT skills and a number, particularly 'Arts 4', 'Science and Technology 3', and 'Mathematics 4' make extensive uses of IT in a subject-specific way. For example, in the subject 'Arts 4' students scan, create and manipulate digital images and in 'Science and Technology 3' intensive usage of IT is required to demonstrate scientific understanding through multimedia resources and to create and use simulation software.

Discussion

Needs of Victorian Teachers

Unlike in the USA or the UK, it is the usual practice for Australian university students to go to a university in their home state, with over 90 per cent of Australian students attending a university in their home state (data extracted from Table 10, p26, DETYA 1998). Thus, it is a reasonable expectation that most students undertaking a teacher education course at the University of Melbourne will be from Victoria and are likely to start and, for many, continue their teaching career in Victoria. Because of this, the initiatives of the Victorian Department of Education (DoE) and its requirement of IT skills of teachers are very likely to be of relevance to teacher education graduates of the University of Melbourne as the Department of Education is the major employer of teachers in the state. Like Education Departments across the developed world, the Victorian Department of Education has encouraged the use of IT in the classroom and Victoria is leading the way in Australia in the uses of IT in the classroom. Among the

initiatives of the Victorian DoE is a program started in 1998 to provide up to 36,700 notebook computers to all principals and teachers in Victorian Government schools over a period of five years. This is a three-year lease arrangement with teachers paying AU$450 over the three year period - approximately AU$3 (US$2) per week (Victorian DoE 1998). This is to encourage teachers to have their own laptop computer so that IT skills can be developed and so that IT tools become a standard part of all teachers' 'toolbox'.

The Victorian DoE has also prepared a 'Learning Technologies Capabilities Guide' (Victorian DoE 1999a) that suggests goals for skill development in a full range of learning technologies and includes a 'Skills Development Matrix' that identifies six key skill areas for Victorian teachers for using IT (Victorian DoE 1999b). These are: (i) using and managing technology; (ii) using basic computer applications; (iii) using desktop publishing and presentation software; (iv) using multimedia; (v) using communication technologies; and (vi) using learning technologies in the key learning areas (Victorian DoE, 1999b). Thus it can be seen that it is crucial that, in addition to the raft of other skills required of a teacher, our new graduates are skilled in these areas of IT use.

IT skill development of our students

In combination with increasing availability of computers - almost all students have access to a computer at home - and the increasing use of computers for recreational activities, our later year students now regard IT tools as 'nothing special' and use them as a routine part of any piece of work without thinking twice. This is a very different situation from when the students now in the final year of the course were in second year (1997) and for many turning on a computer was an uncommon activity. In more recent years students are entering the course with more advanced IT skills and significantly greater exposure to IT, usually through using the WWW for recreational purposes. This change in the students' attitudes and abilities with IT is both a mirror of the changes in the local community and a reflection of the continued exposure and uses of IT required in the subjects the students are studying.

From this study it can be seen that from the first year of the B.Ed.(P) course basic IT skills are introduced and reinforced each year, with some subjects introducing IT tools of specific relevance to that learning area. That IT skills were not further developed and more use made of IT in the third year of the course, in particular in the year following a year-long subject specifically about using computers in K-6 teaching, was made evident through this study. Greater use of IT in the third year of the course is desirable to consolidate and extend the IT experiences and skills developed by students in the first two years of the course. Now that this is evident, later year subjects can respond by increasing the range of IT skills students develop. In addition, as the IT skill levels of students entering the course rise more emphasis can be placed in the area of using IT with children in classrooms to enhance teaching and learning, rather than the mechanics of using IT tools.

Conclusions

It is now demanded that new teachers will be competent in using IT both for their own professional purposes, such as research and administration, and for enhancing teaching and learning in their classrooms. This overview of how IT skills are developed in one teacher education course for prospective K-6 teachers has demonstrated that over the course of four years through requiring our students to undertake certain tasks using IT even the most technologically-reluctant student must engage with IT and must develop the skills demanded of a teacher in the new millennium. The study has exposed some areas where greater uses of IT could be made, in particular in the third year of the programme, and has highlighted the need to keep 'raising the bar' of IT skill development to keep up with the ever-increasing IT skills of entering students.

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Mentoring, Case Studies, and Preservice Teachers: A Study of Analyzing the Use and Impact of an Electronic Bulletin Board

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Abstract: Advances in technology have made access to the Internet available to more and more individuals and have extended the traditional classroom walls. Incorporating the use of the Internet into teacher education programs is an important way to develop future teachers competent in technology implementation. The purpose of the project was to determine if students could interact with students at another university concerning pedagogical and professional issues.

Introduction

Advances in technology have made access to the Internet available to more and more individuals and have extended the traditional classroom walls. Incorporating the use of the Internet into teacher education programs is an important way to develop future teachers competent in technology implementation. Furthermore, it has been suggested that the Internet is the fastest growing educational phenomenon in the history of the world (Dryli & Kinnaman, 1995). Driven by the desire to enhance preservice teachers' technology experiences we created an electronic bulletin board project. Our methods were developed through literature searches of other successful electronic communications studies (Downs & Rakestraw, 1997, Gamas & Solberg, 1997). Gamas and Solberg (1997) identified several strengths of including electronic bulletin board discussions in their courses. Some of these strengths include using time outside of class to research topics, students' have an increased comfort level with their peers, and value of the online discussions and technology use. "Providing a greater integration of technology into teacher preparation programs" was a driving reason for introducing technology into a course (Downs & Rakestraw, 1997).

The purpose of the project was to determine if students could interact with students at another university concerning pedagogical and professional issues. As teacher educators we believe that use of the bulletin board will allow for professional networking and provide students an opportunity to express their beliefs and concerns in an open forum outside of class with peers and current professional Physical Educators.

Methodology

Project participants included undergraduate teacher education majors at two universities (n=44), mentor physical educators (21) and two university professors. WebCT was the software package used to support the electronic bulletin board communication. In addition to the electronic bulletin board students utilized WebCT's internal homepage development feature. Creation of homepages was intended to provide participants with a vehicle for learning and to establish a sense of community. All of the project participants completed the

homepages within the first two weeks of the project. Students and mentors were also encouraged to access the homepages and learn more about their online peers.

The bulletin board project was designed to provide the college students with an experience beyond the traditional classroom and with the opportunity to professionally network. Gamas and Solberg (1997) studied the use of electronic communication tools in five separate university courses. Their methods section suggested the use of professor posted messages to electronic bulletin board to begin the interactions. This same strategy was used in our study. Approximately every three weeks throughout the semester the professor at the Midwestern University site posted a case study and guided questions (collaboratively developed between professors) to the main forum. Participants were encouraged to respond to the cases and questions by posting a message in reply to the case. Topics included cases on the coaching issues, drug/steroid use, student teaching loyalty, and establishing boundaries with students. Participants were encouraged to openly discuss their opinions on the main forum.

Data Sources

Data sources for this project included participant responses to the case studies, interactions between undergraduate students and mentors, and survey results upon completion of the project. Qualitative methods (Bogdan & Biklen, 1992) will be used to document and describe the process of identifying emerging themes. To organize analysis of data sources, the theoretical perspectives and methodological approaches of structuralism will be enlisted. Structuralism views "documents" as "texts" (Manning & Cullum-Swan, 1994, p. 467). As such, once the data is accumulated in written form, it will be read through several times. With each reading a set of tentative themes will develop. The emerging themes and issues arising from the readings will create the codes or interpretive frames that guide and structure the analysis. Trends and commonalties will inform researcher understandings of participants perspectives on the case study issues. Finally, the surveys will provide information concerning the attitudes of the participants toward the value and perceived gains of connecting undergraduates with mentors in an effort to discuss teaching issues.

Results

Data from this project are still being collected, but preliminary results will be reported during the SITE session. The results of this project will add to the collective knowledge of mentoring and technology implementation at the university teacher preparation level. It is further intended to provide insight concerning teachers experiences in school settings versus the idealized perspectives of undergraduate students who have never taught a course with students in the school systems.

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Collaboration: The Chemistry Between Colleagues

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Abstract: This paper examines one collaborative effort developed to improve pre-service teacher attitudes toward teaching with technology. An interview and email exchanges were used to determine the history of the project, the benefits, and the problems associated with this collaborative effort. Recommendations for further collaborative efforts are also included.

Introduction

"We think that interdisciplinary collaboration holds special promise for research on teaching and teacher education because it addresses the multifaceted nature of teaching and learning to teach." (Eisenhart & Borko, 1991)

While attending a conference on technology and teacher education, the keynote speaker began his remarks by asking the audience this question, "How many of you have been approached by faculty from the Arts or Sciences to work with them on using technology for teacher preparation?" I was the only one out of several hundred teacher educators to raise his hand.

During my first year (1995-96) at Northern Kentucky University (NKU), my chair, Ken Carter, asked me to attend a meeting with him and two members of the Chemistry faculty. At that meeting, Vinay Kumar and Julia Bedell described a new course they had developed for elementary and middle school pre-service teachers. The course utilized some of the latest technologies to deliver the content in the lecture sections and to perform experiments in the laboratory. I was excited about what they were doing because I had been exploring the use of many of these same technologies in my eighth grade science classes prior to joining the professorate. What Vinay and Julia were looking for was a faculty member from the School of Education to collaborate with on assessment and evaluation of the project. There was compensation for time and travel as a result of a grant. I volunteered. Thus began a fruitful collaboration between faculty of the Chemistry Department and the School of Education at NKU.

This paper will examine the history, benefits, problems, and future of collaborative programs to improve teacher education programs.

According to Robert Freeman (1993, p.33), collaboration is: "the condition that occurs when two or more people or organizations join forces over a long period of time to produce something neither can produce alone. In the process, each participant contributes something significant and different, derives something of personal and/or organizational benefit, and acknowledges the mutual dependence on the other required to achieve the mutually desired results."

History of the Project

Vinay Kumar, Professor of Chemistry, provided the history of this collaborative effort. "The proposal for this project was originally submitted by Leslie Leverone. Soon after the proposal was funded, Leslie left to accept another job. Before leaving, she asked me if I would be interested in becoming the principal investigator and conduct this project. I said yes. I became interested in this project because of its

two main goals: To improve students' attitudes toward the learning and teaching of chemistry, and to develop students' problem-solving skills through discovery and guided-inquiry activities. Subsequently, Julia Bedell and I expanded the project to include the following additional goals: To integrate technology in both the lecture and lab courses, to enhance learning through multimedia presentations, and to provide information about chemical education, energy and educational technology resources."

Benefits of Collaboration

In an interview with all participants in this collaboration, the following benefits were mentioned. Julia Bedell provided the following comments: "Vinay and I started to work together on this new chemistry curriculum in the fall of 1994. Within the first year, we recognized that an important component of curriculum development is assessment. While developing a pre-and post-survey to assess our proposed new course, we recognized that collaborating with an expert in the area of evaluation would greatly enhance the project. We approached...Vern, who has always maintained a close relationship with the School of Education to arrange a meeting with interested Education faculty members. We were very fortunate that Ken Carter, acting chair of the School of Education, was very supportive and promptly met with us along with Steve Walker, and [you], from his department. Through [your] contributions we were able to develop, administer, and process multiple evaluation instruments that better measured the impact of this new curriculum. Our cooperative efforts which led to scholarly publications and permanent curriculum changes reaffirm the age old saying, 'The whole is greater than the sum of its parts."

Vern Hicks added, "There are several benefits. First of all, you look at different ways of presenting things. Secondly, I think that the people in the School of Education have more experience in communicating to school teachers and identifying with the discipline problems that we don't have in the colleges. So it helps in really meeting the needs of teachers in terms of where they are... I found that some of the tips I picked up while working with teachers and teacher educators, I use in my own classroom. While coming up through the science program, I never had a formal course in education. So some of the questioning techniques, some of the ways of presenting things that KTIP [Kentucky Internship Program] and KERA [Kentucky Education Reform Act] emphasize are finding their way into my own teaching."

Vinay replied to the question, "What benefits have you found through collaborating with other faculty members?"

"We have a strong and friendly working relationship with the School of Education at NKU. Prior to this project, Education and Chemistry faculty had worked jointly to establish and support science and chemistry alliances for middle and high school teachers. The curriculum for the new chemistry course (CHE 105) for pre-service elementary teachers developed under this project was modified with input from the education faculty. Two surveys that are used for assessment in this course were refined based on the input from [you] and Ken Carter, faculty in the School of Education. This type of cross-college interaction has proved to be extremely beneficial and has enabled us to successfully implement the KERA reforms."

I find working with faculty from the Chemistry Department personally and professionally rewarding. Besides the opportunity to attend and present at conferences, I enjoyed writing an article, "Technology: Catalyst for Enhancing Chemical Education for Pre-service Teachers" (1999), with Julia and Vinay. I also feel validated in my field when asked to share and utilize my expertise in educational assessment and research. I recall one particular meeting with Vinay and Julia fondly. We were discussing performance assessment in their class. I told them about rubrics, "the criteria for judging students'

Popham, 1998, p.148). When told that students should be provided with these prior to the performance, Vinay's response was, "You mean you tell the students beforehand how they'll be graded?" I replied in the affirmative. Vinay thought a while and said, "Interesting. It could eliminate some of the problems I have with students arguing about their grades." After our meeting, they developed a lab practical as part of the final exam with a rubric. The students did well.

Problems

During the interview, only two problems connected to this collaboration were mentioned. The first dealt with time. Vern summarized this concern, "It's very hard to find time to work with people from the School of Education because so many of you work in the field and spend so much time advising students. The main problems I've had are in terms of arranging times. I can't think of any friction

I do find it difficult to arrange my schedule to fit with the others. Teaching and supervising off campus makes it hard to attend meetings with faculty from other colleges.

The second concern dealt with lack of recognition for participating in these types of projects. Vinay stated, "Overall, our chair has been supportive. I did point out to him that these activities—developing multimedia lessons or computer-interfacing lab experiments, their assessment based on collaboration with faculty in other colleges, etc.—are extremely time consuming and should be treated as scholarly activities, and recognized as much as doing research with students. As far as deans are concerned, the Dean of Arts and Sciences is very enthusiastic and serves on the board of the grant provider. When he sees faculty from two different colleges collaborating, he personally thinks it's great. "

]here are groups within the sciences that want to collaborate and other groups that think that science [faculty] should work only within their departments and not work with other departments. No offense, but there are those who think that faculty in departments of education show people how to do something without having a substantial background in that field, and this perception is not limited to the sciences."

The School of Education tends to look quite favorably on these types of activities and has encouraged faculty to seize opportunities to collaborate with faculty from other departments.

The Future

As schools, colleges, and departments of education come under more scrutiny by state legislatures and as NKU endeavors to strengthen and enhance P-12 math and science education through its new Center for Integrative Natural Sciences and Mathematics (CINSAM), it will be necessary to build more bridges between faculty. Janice Fauske (1993) notes that lack of collaboration between arts and science faculty and teacher education faculty inhibits effective reform of teacher preparation programs and the development of programs such as CINSAM. To foster and promote collaboration at colleges and universities that improves teacher education programs and increases the likelihood of successful integrated programs, Fauske (1993) recommends five sustaining conditions. The first is administrative support that legitimizes collaboration. Second is viewing collaboration as legitimate research. Establishing arrangements for encouraging communication is third. Fourth is building consensus around shared goals. And fifth is the institutionalization of collaborative practice.

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Discovering South Dakota Through Telecollaborative Means

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Abstract: This paper focuses on the Discover South Dakota Tellecollaborative Project and how South Dakota State University is using the project to tie together technology and teaching in the preservice required computer class. Two semesters of the computer classes have been involved in this project providing some interesting experiences and anecdotes in response to technology and collaboration. The paper will touch on the telecollaborative curriculum in the Discover South Dakota project. Students in the preservice computer classes provide clues for the Mystery City portion of Discover South Dakota, involving them in a rich opportunity to make technology come alive. Finally, the paper will examine how the project reinforces the opportunities that technology provides in the classroom for preservice teachers.

Introduction

The emphasis on technology in preservice education has been significantly heightened in our state. South Dakota was awarded a technology challenge grant in 1998, and has been using the grant to strengthen the means in which K-12 students and teachers interact with preservice students. The technology challenge grant (Learning Organizations for Technology Integration – (LOFTI) provided a connection between Technology Innovations in Education (TIE), K-12 teachers and higher education. The focus of the grant and the people involved in the grant has been to provide technology-rich curriculum to preservice students as well as providing practicing teachers the opportunity to strengthen their skills with technology.

Through this grant, individuals were introduced to a project called Discover South Dakota, which was being piloted with a few school districts around the state. The project facilitated by TIE provided a telecollaborative environment in which fourth, fifth, and sixth graders studied about South Dakota history and geography. The facilitators of the project asked if the Integrating Computers into the Classroom students would like to participate in the Discover South Dakota Project by providing clues for the Mystery City section. The request for participants occurred during the Spring 1999 semester so the project was quickly inserted into the current schedule. After participating, my students indicated verbally at the end of the Spring 1999 semester that this was a project they enjoyed and felt beneficial to understanding technology use in the classroom.

The focus of this paper is on the Discover South Dakota Project as it is being used in the South Dakota State University's Integrating Computers into the Curriculum class. It is an opportunity for the preservice students to interact with K-12 students using technology. First, the paper will touch on the telecollaborative curriculum in the Discover South Dakota project in particular the Mystery City component. Next, the paper will discuss how preservice students become involved in the project and the requirements of the classroom assignment. Finally, the paper will examine how the project reinforces the opportunities that technology provides in the classroom for preservice teachers.

Mystery City

In the book, Virtual Architecture: Designing and Directing Curriculum-Based Telecomputing, (Harris, 1998), telecollboration is defined as "using a computer connected to a telecommunications network, like the Internet, to collaborate with others at a distance" (p. 133). The Discover South Dakota Project involves students by connecting at a distance through the use of the Internet. The project focuses on fourth, fifth, and sixth graders during the South Dakota history curriculum. "South Dakota students can explore the rich and diverse heritage of the Land of Infinite Variety through creative projects and telecollaborative connections to classrooms statewide," (TIE, 1999). Teachers that utilize Discover South Dakota are provided with training and curriculum materials to use during the project. There are various activities associated with Discover South Dakota: three themes, weekly features, and an area for the K-12 students to participate with one another and outside experts. Also available online is a teacher's resource page. There is a cost for K-12 schools to participate in the project.

The three themes are used to explore South Dakota each focusing on specific questions about South Dakota's diversity, people and events, and places. The weekly features include "
which display photos from the nooks and crannies of the Cultural Heritage Center in which students are asked to guess what the object is. Another feature is "Mystery City", which is the feature the EDFN 365 students were involved with. In Mystery City, clues are provided for students to research and reason the answer as to what the Mystery City is for the week. Fourth, fifth, and sixth grade students with the help of their teacher check the Mystery City site during their Monday class. Some students do venture guesses on Monday based on research that they may have completed previously. Clues are posted daily so the classrooms generally check the site daily.

Preservice Participation

In early Spring 1999, preservice students in the Integrating Computers in the Curriculum course were asked to provide clues for the Mystery City portion of the project. The preservice students worked in groups and started to participate in the project as an add-on project in our syllabus. The preservice students were given an option, they could participate in the Mystery City project or choose to complete the course's original final project. Over 85% of the students opted to participate in the Mystery City Project. As part of the project, the groups also created a PowerPoint presentation about their city. They also put together information about their expectation of the project and what they discovered about student's abilities to research by responding to the questions of:

- What went well and what did not go so well
- What was learned about how kids think and do research
- What was unexpected
- How might this approach be adapted for other teaching/learning activities

These groups submitted their Mystery City clues to the project and three groups were chosen to participate. The clues were posted each day by the project director, and the fourth, fifth, and sixth graders sent emails to the selected preservice students, furnishing what the kids thought the correct answer was. The preservice students emailed back to the K-12 students providing feedback about the answer and giving additional suggestions and encouragement to the K-12 students. Three groups participated by facilitating Mystery City during March. These students indicated that the K-12 students were providing reasons for their answers and for the most part were using the clues to deduct the correct answers. The groups averaged about seven messages a day during their week of Mystery City. That number was affected by the high number of classrooms participating in our first week, the second week had a lower rate of participation.

Overall, the preservice students that participated expressed satisfaction with the project. One student emailed comments stating the opportunity showed to her that technology has a place in the classroom, even in the primary and middle school levels. When asked about retaining the project for the next semester, students agreed that the project should stay in the course curriculum; suggesting, however, more structure for participation in the project. Other comments focused on the competitive nature of the project – only three groups can participate so not all the EDFN students experienced contact with the K-12 students. However, the number of groups actually facilitating the project are determined by an outside entity.

The following fall semester, the Mystery City project was formally incorporated into two sections of the Integrating Computers into the Curriculum syllabus. The design plan was to devote time and energy

to research and produce not only clues for Mystery City, but also a virtual tour of the city along with some historical background. Therefore three weeks were allotted for the Mystery City "Unit". Students were instructed in the use of PowerPoint presentations, information searching, and the use of digital cameras and scanners before starting the project. The EDFN 365 students would learn as they completed this project skills including information research using both electronic and traditional resources, PowerPoint presentation skills, integration of resources, and communication via email and discussion boards.

Mystery City was used as the EDFN 365 assessment project for the unit on Multimedia applications. The purpose of the project was to engage students in learning with technology and develop confidence in using technology-integrated curriculum. Each team was to choose a South Dakota city to develop as the Mystery City. The team researched information about the city to develop the clues as well as a multimedia presentation about the city. Students had to use sources that K-12 students would have available to them including the Internet, library and textbooks. Preservice students kept a search log which indicated the date of their search, the sources of information, and who found the information. We talked about formulating clues that wouldn't be dead giveaways yet not so difficult that the fourth, fifth and sixth graders wouldn't be able to guess the city.

The preservice students responded by searching information using various sources and discovered interesting facts about their respective cities. Several students were surprised that they couldn't find information on the Internet – they had become so reliant on it! So we had the opportunity to expand our database discussion by referring to the various newspapers resources online around the state. They spent numerous hours gathering information for the project as well as crosschecking information. For example, one of the groups came up with some great clues based on their personal knowledge but they had to be reminded that K-12 students had to be able to find the answer so they spent time verifying their personal knowledge with existing sources.

Once the students submitted their clues for Mystery City, they turned to creating their presentations for class. In class, information about planning PowerPoint Presentations was shared and students were expected to storyboard their presentations. In the final assessment, not only would their PowerPoint presentation be assessed so to would their presentation ability using the PowerPoint as a visual aid and the ability to collaborate with others be evaluated. The presentations were insightful as to how PowerPoint Presentations are perceived. Several groups read their PowerPoint presentations word for word, which doesn't capture the true use of PowerPoint as a visual aid. Several groups however, grasped the importance of PowerPoint as further illustrating the oral presentation by providing a format for visual information. The other interesting event that occurred was the class's freedom to provide additional information to other groups and to even question the sources in terms of reliability requiring students to use higher order thinking skills to pull together their information and answer the questions. And we all learned something new in terms of South Dakota history.

Three groups of EDFN 365 students had their clues chosen for Mystery City. SDSU's EDFN 365 class was responsible for providing clues during weeks five, six and seven. In <u>week five</u>, right away Monday morning we were notified of the chosen city by email and the first clue was posted to the Discover South Dakota website. Group One was asked to check the web site for the students' guesses beginning Monday morning, checking at least twice daily responding to any emails. If there were any emails, the group would read and respond to the students. The group continued checking throughout the week until the answer was revealed on Friday. Group One received several emails during the first day with various attempts from the K-12 students to reason out the correct answer. According to the group, they had some correct answers the first day but they were surprised at some of the answers they received. The group also indicated that K-12 students backed up their guesses with research by citing textbooks they had read. Tuesday's clue helped many K-12 students answer correctly. Overall this group received email each day of the Mystery City project with some great results.

- Monday's clue: What city in South Dakota had the first telephone exchange?
- Tuesday's clue: What town was made famous by the "dead man's hand"?
- Wednesday's clue: What town has a hotel that is supposedly haunted by the town's first sheriff? (1999).

In <u>week six</u>, again we were notified Monday morning as to which clues had been chosen. Group Two, when informed was very excited about participating. This group had personal ties to the city chosen and came up with clues that would get the K-12 students hunting! For their presentation, they had gone out to take pictures with the digital camera so that their clues would be visual as well as textual. We were informed however, that at this time Mystery City would remain textual clues. The group, however, used

their pictures in their PowerPoint presentation, which added visual clarity to their presentation. Monday came and went with no guesses. The group had a few guesses on Tuesday and Wednesday but participation in Mystery City was not as high as the previous week. The group speculated as to why they did not have a high participation rate. A couple of reasons may have caused less participation. One reason may be that classes use Mystery City as it fits their schedules so if there were tests or other curriculum requirements used in the classroom, students may not have participated for that week of Mystery City. The group also inquired about the level of difficulty of their clues and thought maybe they could have used other facts they had discovered during their search.

- Monday's clue: The development of the railroad caused the whole town to move from its original location to C.B. Kennedy's Homestead.
- Tuesday's clue: This town was the 1995 South Dakota Community of the Year.
- Wednesday's clue: If you are looking for an exhibit of former Prairie life in South Dakota, this group of 40 buildings 3 miles outside of town will show you what you are looking for, (1999).

In <u>week seven</u>, we were notified Monday morning as to the clues for the week. Group Three began their facilitation of Mystery City. Again this group was very excited about the opportunity to participate. This group had also compiled some interesting facts and figures about the "Mystery City". This group used again personal knowledge coupled with facts and figures available in textbooks and Internet to create their clues. This group also gathered pictures from a local historian and used the digital camera to illustrate one of their clues. They had several guesses on Monday but no correct answers. Tuesday and Wednesday brought more guesses. When the K-12 students guessed the correct answer, this group sent the students a picture of the elephant hunt. Group Three also created some excitement in their town because of their participation – the state championship trophy had been locked in the bank vault for years and my students went to take pictures of it for their presentation. As they were taking pictures, many people that had lived there for years stopped to look at the trophy and hear about their project!

- Monday's clue: What is the name of the town that is located 207 miles from the capital of South Dakota?
- Tuesday's clue: On May 15, 1916, a circus was in town for a couple of days. One day one of the circus elephants escaped from its cage and was loose in town. In order to capture the elephant they were forced to kill it with a gun.
- Wednesday's clue: What is the name of the town that was the first team in South Dakota to win three consecutive State Championship Boys Basketball titles? (1915, 1919-1920, - in 1916, 1917 and 1918 there were no state games because of World War I).

Preservice Technology Opportunities

Mystery City as a project has provided preservice students an opportunity to achieve several objectives within the EDFN 365 classroom and provide a model of telecollaborative to my students. According to recent technology and preservice surveys, students know they will have to use technology in their teaching but their current educational situation focuses on acquiring the skills not the modeling of technology (Deal, 1999). Modeling of technology integration is important for the success of preservice students' implementation of technology in their classroom teaching. This project has given EDFN 365 students interaction with K-12 students using Internet as the only means of communication which has provided additional thought in our classroom about the uses of technology in their teaching. Another outcome that was unexpected was the desire to use pictures as clues. We approached the project leaders about this explaining that my students were developing PowerPoint presentations about these cities. Currently, we are exploring the use of pictures as clues and having the EDFN 365 students publish their PowerPoint Presentations on the project website. Having the students participate in a public project also improves the quality of their work. This semester, many of the EDFN 365 students went far beyond my expectations.

It has real-life relevance, which has excited the preservice students and has inspired a couple of them to think of similar projects that they could incorporate into their own classrooms. One student wrote a lesson plan based on her experience, which she plans on delivering and sharing as she goes into her student

teaching. Several of the students in this class are social studies majors and will actually teach South Dakota History –these individuals seemed to look at this project as having possibilities in their classrooms of the future. Students also get an idea of some of the projects that the K-12 students are completing with the use of technology. Besides Mystery City, Discover South Dakota also has space for the K-12 students to publish their work. The EDFN 365 students were amazed at some of the projects these kids are doing from simple web publishing to short movies.

That is what is so exciting about using telecollaborative projects, it provided students a springboard for other ideas that excite and ignite them to use technology as a tool for learning. Several students have indicated that they may continue to participate in projects such as Discover South Dakota because they are aware of the possibilities after their experience. Students suggested activities such as using the same format but using presidents instead of cities. Another group came up with a mystery disease plan.

As several of my groups discovered, they not only have the power to touch their own lives with technology use, but they have reached out to K-12 students, and community members through the project. There are other possibilities of expanding the project to include other technology assignments as well as linking with the Education of Place curriculum that is currently being developed.

Not only does this experience provide students an opportunity to meet the ISTE standards, but also the activity in future will provide students a way to meet their technology graduation requirements. Students attending a state university will be required to demonstrate technology competency upon graduation. As EDFN 365 is a course that goes a long ways to meeting this requirement in the College of Education, the Mystery City project provides a great vehicle for information searching skills, evaluation of information, using technology tools to produce a presentation, communication abilities with email and various other aspects that will meet this requirement

Conclusion

In conclusion, telecollaborative projects provide a link between K-12 and higher education that is beneficial for the preservice teachers and the K-12 students. It provides both with the ability to experience real-life interactions that are exciting. The Discover South Dakota project not only provides a curriculum for school districts, but also helps to structure the Integrating Computers classroom by providing the opportunity to have students create and deliver a technology enhanced lesson. This experience has had a positive influence on the possibilities of technology in teaching, which has been a goal in the class.

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Technology Partners: Preservice Teachers and Students Collaborate to Master Technology Curriculums

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Abstract: Through a field experience in the Fifth Dimension, preservice teachers are acquiring technology competencies required for licensure in the state of North Carolina. This technology rich environment allows observations of numerous learning experiences involving computers and multi-media. Simultaneously, this program offers unique opportunities for children to experiment with educational software and other technology equipment. This paper describes an analysis of both preservice teachers and students and their learning experiences during this program.

Introduction

For years we have conducted research on a learning environment, the Fifth Dimension, that is based in the doctrine that learning and development are cultural-historical in origin (Cole, 1996; Luria, 1979; Scribner & Cole, 1981; Vygotsky, 1978). This view is based on the social constructionist idea that learning is a collaboration of both person and environment (Resnick, Levine, & Teasley, 1991). At our Fifth Dimension sites, children volunteer for a form of play on computers using a variety of multimedia and software. University students enrolled in practicums during their preservice teacher education programs aid children in achieving their goals by participating in setting goals, developing daily objectives, making decisions, and developing strategies.

To enhance the concept of the importance of collaboration of both persons and environments in the context of learning and ultimately teaching for preservice teachers, we have created an after school program using the technological rich learning environment of the Fifth Dimension. Through this program, we have attempted to provide "hands-on" experiences in which play, education, peer interaction, and affiliation are deliberately mixed while using technology as a tool. We have demonstrated that participants in this program achieve higher levels on tasks in which they engage (Nicolopoulou & Cole, 1993), acquire proficiency in using technological tools in the process of attaining personal goals (Schustack, King, Gallego, & Vasquez, 1994), and that special education students who participate in the Fifth Dimension progress in the same manner as their regular education counterparts, with similar success (Zimmerman & Blanton, 1993).

Preservice teachers participated in this after school program as part of a field experience during a class, "Teachers, Schools, and Learners." While preservice teachers are participating in this technology rich environment, they are acquiring technology competencies required for licensure in the state of North Carolina. The environment also allows for the preservice teacher to observe numerous learning experiences involving computers and multi-media and the learning that takes place during these tasks. Simultaneously, the program offers a unique opportunity for children in grades kindergarten through sixth to experiment

with educational software that refines technology skills that are a part of the state's standard course of study.

Technology Competencies for Preservice Teachers and K-8 Students

In 1994 a Task Force was established to recommend educational technology initiatives which would eventually encompass the total North Carolina Educational system. This Task Force created a list of technology competencies for inservice teachers, teacher education faculty, and preservice teachers in the state. Each institution of higher education was given authority to devise and implement a technology program for their preservice students and teacher education faculty. Preservice teachers must now demonstrate competencies on basic technology skills and develop technology portfolios demonstrating competence on advanced skills.

The basic technology competencies defined by the task force include skills and knowledge in the areas of: Computer Operation; Setup, Maintenance, and Trouble Shooting; Word Processing and Introductory Desktop Publishing; Spreadsheets and Graphing; Databases; Networking; Telecommunications; Media Communications including Image and Audioprocessing; and Multimedia Integration. Advanced competencies include: Curriculum; Subject-Specific Knowledge; Design and Management of Learning; Child Development, Learning, and Diversity; Social, Legal, and Ethical Issues. Verification of competence in advanced areas must be demonstrated in a portfolio format. These competencies may be found on the North Carolina Department of Public Instruction web site: http://www.dpi.state.nc.us/tap/techcomp.htm.

All eighth grade students in the state of North Carolina are tested on computer skills. The computer curriculum for the state may be found on this web site: www.dpi.state.nc.us/testing/#curr . This curriculum consists of nine strands: keyboarding; word processing/desktop publishing; telecomputing; database; spreadsheet; societal issues; ethics; computer terms, operation and care; and independent curriculum software use.

Web Site Database

In order to observe the impact of this experience on preservice teachers a web site was created to hold a database of student biographies, fieldnotes from the after school Fifth Dimension sessions, and preservice teacher attitude surveys. This web site: http://www.ced.appstate.edu/intercollege/2800 is a place for preservice teachers to write fieldnotes about their experiences in the Fifth Dimension. General observations and experiences are described and are accessible to preservice teachers and their professors in the sections of "Teachers, Schools, and Learners" that correlate with the Fifth Dimension experience.

Fifth Dimension

About seventy-five percent of the activities in the Fifth Dimension use computers and telecommunications, including educational software, computer games, telecommunications activities for searching the Internet, and tools for computer-mediated and video-mediated conferencing. Subject matter covers the traditional school curriculum and includes communication skills, math, social studies, health, science, technology, and the arts, all with an emphasis on problem solving. Over 120 educational computer games such as "Carmen San Diego", "The Amazon Trail", "Dino Park Tycoon", Opening Night", "Lego Logo", are used in this program. Other technology tasks include Internet searches, digital cameras, and video conferencing equipment.

Analysis

An examination of preservice teacher fieldnotes was completed. Common themes were found. Many comments were made as general site observations discussing the setting and apprehensions about dealing with a new educational environment. One such statement:

When I walked in today it was real quiet again and the doors in the hall were closed. In the computer lab all of the interns were in there working on the games. As we had said in class, we all were not sure about the games and felt like we did not know what we were doing. As Stephen and I walked down the hall he said that he was going to go in and work on games until it was time to get our kids. Well, everyone else was doing the same thing. I guess we all are on the same level and worried about what we are doing. Interesting!

Another common theme to fieldnotes dealt with technology. Preservice teachers may have been exposed to technology as students and they may have been told about educational uses, but until this experience, they may not have observed first hand how technology can be applied to learning. The following entry illustrates the virtues of telecommunications and the inspiration for further learning in technology.

In this course, I find the telecommunications that we set up with UCSD to be very interesting and exciting. It allows me to interact with fellow students across the country. Through these telecommunications, I am able to learn about how their Fifth Dimension operates , as well as their classroom. From this class, I am finding that it is a challenge to learn all of today's technology and how it operates.

Comments from other preservice teachers included feelings of ignorance, although very little despair, about computers.

The whole idea of the lab amazes me. I think it is a wonderful way for the children to learn and for us to learn also. Also, the technology that comes with this class is incredible. I am very "dumb" when it comes to computers so this class will definitely be a challenge for me.

Others wrote that they were excited about the technology aspect of the Fifth Dimension, especially with students who are computer literate.

I am interested in learning how children work with technology since many of the students were practically brought up in the computer era.

A large part of fieldnotes included reflections on the learning process,

I am convinced that when a child sees something more than once she will learn it well and know how to do it.

I was reinforced that children learn after seeing things more than once and that they can do things faster after they get it into their brain as to what they are doing.

the social-constructivist environment,

I enjoy working on computers and being able to go through the Fifth dimension program with the children, not teaching the children, but learning together as we go will be very rewarding.

and motivation.

I learned that they look up to us as older role models, and it is us that motivates them along with their peers.

That some get more excited than others about achieving but if the intern gets excited with them it will motivate them more.

To better understand how classes, that corresponded with field experiences in the Fifth Dimension, met technology competencies with preservice teachers, four professors of these classes were surveyed. Professors answered that they used email, required assignments to be word processed, used web sites to down load articles, required students to subscribe to listservs, taught skills for multimedia presentations, and introduced the state's technology competencies. One section of the basic technology competencies is computer skills operation. In the Fifth Dimension, preservice teachers along with their student partners complete many of these such as:

1.1 Start up and shut down computer system and peripherals
1.2 Identify and use icons, windows, menus
1.3 Start an application and create a document
1.4 Name, save, retrieve, revise a document
1.5 Use printing options

Some of the professors gave more specific information that can be connected with advanced state technology competencies. One professor wrote that she encouraged students to find articles on the web relating to special education, which corresponds with an advanced competency in "essential knowledge and skills":

> 13.4 Use appropriate local, state, and national services or resources to meet diverse learning needs through technology.

Another professor encourages the use of technology in class presentations which meets a requirement under advanced essential knowledge and skills:

> 12.3 Use computers and other technologies effectively and appropriately to communicate information in a variety of formats on student learning to colleagues, parents, and others.

All four professors were practicing the integration of technology in their courses. Positive attitudes toward integrating this technology accompanied the descriptions of their use.

Conclusions

After North Carolina adopted technology competencies for licensure, colleges of teacher education throughout the state scurried to meet the needs of preservice teachers. Faculty at institutions of higher education were offered training in technology and encouraged its integration, when appropriate into their classrooms. It was felt that skills alone would not prepare new teachers for the technology challenge. Technology must be modeled in order to foster positive attitudes and encourage appropriate use in public schools.

The Fifth Dimension has provided a "hands on" technology and learning experience that corresponds with a class on "Teachers, Schools, and Learning". Initial exposure to state technology competencies may be obtained in this setting. Many of the basic and advanced competencies could also be completed in the Fifth Dimension.

Most preservice teachers in our program gained an insight into the value of technology in education. Fulfilling state requirements was seen as an added bonus during the Fifth Dimension. Achieving an understanding of children's learning processes, being involved in a social-constructivist learning environment, and gaining hands-on knowledge of student behavior early in a teacher education program were reported as valuable experiences by our preservice teachers. Overall, this program was highly successful in these areas and hopefully will continue to provide a model for teacher education programs.

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Four Year Collaborative for Preparing Teachers to Use Technology

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Abstract: The Class Act Preparing Tomorrow's Teachers to Use Technology project is a four year teacher preparation program that utilizes technology as a tool for the delivery of instruction as well as an integral part of the teacher preparation program skill development for the beginning teacher candidate. The program is composed of students who apply for admission to a community college, complete a field based teacher education focused year one and two program followed by a competency based technology enhanced professional program at the University. The program reflects a learning community technology linked professional development model.

INTRODUCTION

National Teacher Preparation Needs

The role of the teacher is becoming more complex. Teachers are being asked to learn new methods of teaching, while at the same time they are facing the greater challenges of rapidly increasing technological changes and greater diversity in the classroom aggravated by societal issues outside the classroom related to poverty, crime, and family dysfunction. In a recent survey on the quality of teacher preparation, it was reported that less than half of American teachers reported feeling "very well prepared" to meet many classroom challenges:

> though educators and policy analyst consider educational technology a vehicle for transforming education, relatively few teachers reported feeling very well prepared to integrate educational technology into classroom instruction (20 %)
>
> 54 percent of the teachers taught limited English proficient or culturally divers e students, and 71 percent taught students with disabilities, relatively few teachers who taught these students felt very well prepared to met the needs of these students.
>
> 28 percent of teachers felt very well prepared to used student performance assessment techniques; 41 percent reported feeling very well prepared to implement new teaching methods, and 36 percent reported feeling very well prepared to implement state or district curriculum and performance standards. (National Commission Report on "The Demands of Current School Reforms, 1996)

According to the National Commission on Teaching and America's Future (1996), the demand for teachers in the next two decades will increase substantially. Statistics that underscore this urgency are a combination of societal and teacher force demographics. Higher birth rates and immigration have caused the teaching force to grow from 2.5 million in 1980 to 2.8 million in 1991. It is projected that by the year 2002, we will need over 3.3 million teachers to meet the need for educators to fill positions to meet the growth in student populations. Concurrently, our present teacher work force is at a point were large numbers of experienced teachers are near or at retirement. The commission reported that nearly one fourth of the teachers in America in 1991 were over 50. Over the next decade, more than 200,000 teachers will need to be hired annually. The dramatic change in the teaching force presents an opportunity to influence educational reform via the preparation of a new teacher professional. An individual who understands learning theories, has the ability to address the needs of a divergent student population, can prepare student focused lessons that encourage knowledge creation and creativity in a technology rich community based learning environment.

National Response to Teacher Preparation

National Education Goal 4: Teacher Education and Professional Development

> By the year 2000, the nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire the knowledge and skills needed to instruct and prepare all American students for the next century.

National Education Goal number four, provides evidence of the national level recognition for the improvement of the initial and continuous preparation of teachers. Teacher's for today and tomorrow's schools will need skills and understandings which allow them to teach all students for understanding by in depth understanding of subject matter, a sensitivity to divergent learning styles of students, and the ability to successfully design instruction that takes advantage of constructivist, student centered, technology rich learning environments.

While there are many ingredients for successful school reform, it all comes down to the classroom teacher. Indeed, the success of the entire school reform movement is dependent upon teachers acquiring the skills, perspectives and knowledge necessary to transform the learning of all students. However, because we only now fully appreciate the ways of teaching complex subject matter to diverse students, many of our current teachers remain under- or unprepared. Insufficient or inadequate preservice and inappropriate or incoherent in-service teacher education retard the effort to realize the National Education Goals.
(Teacher Education and Professional Development National Education Goals Panel, July 1995)

A reform of teacher preparation is precursory to reform in public schools in America. Public attention has been focused on the reform of elementary and secondary schools without attending to the preparation of the teachers who will work in these schools. While there are many ingredients for successful school reform, it all comes down to the classroom teacher. The success of the entire school reform movement is dependent upon teachers acquiring the skills, perspectives and knowledge necessary to transform the learning of all students. With an estimated need for two million new teachers over the next decade to replace retiring teachers and to meet increased student enrollment, well-designed teacher education programs are a critical factor in reforming our schools. Reform includes the need to create a technologically literate teaching force to meet the demands of society. Because of this, the integration of technology should be accomplished in relation to other efforts to reform teacher preparation, not as a separate reform initiative.

Minnesota Teacher Preparation Needs: P-12 Graduation Standards Change the Instructional Expectations

Consistent with the national need for qualified teachers, rural Minnesota faces a challenge in recruiting, training and retaining teachers. Teachers are needed who can address the curricular expectations for Minnesota schools. Recently, the Minnesota legislature mandated comprehensive performance-based Graduation Standards for all students. These standards will require students to show competency in critical areas such as communications, inquiry based learning, problem solving citizenship and technology. Imbedded in the Graduation Standards is the requirement that all students have an in-depth working understanding of personal computers and commonly used software, and be comfortable using electronic means to conduct research and analyze results. Not only will Minnesota need to recruit qualified teachers, but these teachers will also need to be trained to guide students in the use the technology available and to demonstrate their knowledge of the graduation standards in an observable, performance based environment.

Minnesota Licensure Requirements Change to Require Competency Based / Technology Enhanced Teacher Preparation Programs

In response to the changing demands of the role of the educator in Minnesota, the Minnesota Board of Teaching, which is responsible for overseeing teacher education has revised the way it licenses teachers. This new teacher licensing structure will be a competency-based system rather than one which grants a

teaching license based solely on completing designated academic courses. The competencies which will be used in this new structure must be based on the standards delineated by the Interstate New Teacher Assessment and Support Consortium (INTASC). For the first time, teacher preparation competencies address the development of constructivist teaching strategies supported by instructional technology resources. In addition to the Minnesota Board of Teaching requirements, the February 1999 draft of the National council for Accreditation of Teacher Education standards for accreditation of teacher education program identifies both the INTASC standards and also lists a specific competency which addressed candidates ability to effectively integrate technology into their instruction. Minnesota Colleges and universities responsible for educating future teachers are required by both state and national accreditation boards to implement a performance based, technology enhance, student centered teacher education programs. This new profile for licensing teachers goes into effect August 1, 2001.

Though Minnesota has a history of educational excellence, a number of challenges face Minnesota schools, most urgently : how to recruit and train enough educators to meet the increasing demand, and how to improve all students' capacity to meet high academic standards. Gerald Christenson, former chancellor of the Minnesota Community College System writes "Our increasingly complex society will require teachers who can deal successfully with change, who are prepared to use new technology and who can recognize that children learn in many different ways" (Christenson).

Class Act Preparing Tomorrow's Teachers to use Technology (Federal PT3 Implementation Grant Awardee): A Response to Reform in Teacher Preparation

PT3 Class Act Project, augments a four year competency based, technology focused teacher preparation program "Class Act" in Northern Minnesota. Class Act was created by a collaborative which included two Universities, a Community College, School Districts, and a private Foundation. The project has two cohorts of preservice teachers who will complete their first two years of preparation at a Community College with a teacher preparation flavor in their liberal studies courses as well as continuous placement in community and public school placements. Students will then transfer to the University for their final two year professional coursework. During their final two years the PT3 Class Act students will be placed in technology enhanced field based placements .

Learning to teach to the identified skill needs of the community and the diverse student population are central Class Act Program objectives. The region's demographics reflect a rural, sparsely populated, low income area. The heritage of the region includes a high Native American population. Research indicates that visual, auditory, inquiry based instruction facilitated by effective use of instructional technology instruction enhances the academic achievement and motivation for all students and in particular Native American students.

The PT3 project will prepare teachers who can deliver inquiry, application, technology rich instruction. To participate as a Class Act student, an application process was completed. The process consisted of a written application, letters of reference, and individual interviews. Those selected, while at the Community College complete typical associate of arts course work. However, the curriculum was modified with an education preparation and issue focus. In addition to the on campus coursework, Class Act students participate in teacher preparation practica that encourage applied contextual, technology-enhanced learning. Participants are placed in both education and community/business based practica from the first semester of their freshman year continuing throughout the completion of their baccalaureate degree.

The following PT3 project examples, document the activities which will be used in the Class Act program to teach effective integration of technology into instruction. The first example is the distribution of lap top computers to Class Act students for use throughout their four year preparation.

Linkage Labs / Tec to Take Kits

Another example are Linkage Labs. Linkage labs are technology enhanced learning environments located regionally to support the instructional technology skill development for preservice, mentor teachers and higher education faculty. Linkage Lab inservices directly relate to the instructional applications for "Tec to Take" kits. Tech to Take "kits" are sets of technology resources that the preservice teacher can take to the field based practica. The Tech to Take kits will insure that the resources for effective technology enhanced instruction are available at the field site. One of the outcomes of Linkage Lab inservices will be the development of technology rich lessons which take advantage of the Tech to Take kits. Preservice teachers, classroom mentors and higher education faculty work in learning teams to create and plan practica where the innovative lessons can be taught.

TEACH Web Site Internet Resource and Communication Component

Another example comprehensive technology support resource for the project is a web crossing discussion forum and resource internet site http://TEACH.bemidji.msus.edu. The TEACH web site is monitored by education experts who facilitate and expand the topics and links for the site based on the needs identified by site users. Another aspect of the TEACH site is the ability to access state and national education experts "master mentors". The "master mentor" feature provides participants direct access to leaders in the field who can answer educational questions in an anytime anywhere internet environment.

Summary

In summary, the overall objective of the Class Act PT3 project is to refine a teacher education program that reflects national teacher education exemplary practice. The curriculum is competency based, field site focus, and collaboratively supported by school, community and institutions of higher education. The PT3 resources will strengthen the technology focus of the curriculum, expand the school and higher education participation, and contribute to the support of instructional technology resources.

During the next three years, the project consortium will continue to refine and expand the implementation of the Class Act PT3 program. The overall goal of the project is to develop a collaborative model for teacher preparation that uses technology as a critical infrastructure for the delivery and modeling of quality instruction. The final outcome goal is to develop educators who have a philosophy that reflects quality student centered instruction that fosters student achievement and supports life long learning for the student and the professional educator.

Scholarship, Technology, and Educational Practice (STEP): Creating Partnerships That Renew Preservice Education

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Abstract: This paper describes a current project funded through the U.S. Department of Education's "Preparing Tomorrow's Teachers to use Technology" initiative. The need and issues related to integrating technology into the preservice program, as well as early models that led to the current project design, are discussed. STEP creates a model of partnership between schools of education and K-12 school districts that prepares preservice teachers to be effective users of technology. Collaborative teams of methods teachers and K-12 teachers will work together to integrate and model technology tools in the preservice curriculum. These educator-teams share responsibility for developing and modeling teacher preparation strategies that incorporate technology tools. Through this project, preservice students observe and interact directly with K-12 master teachers to learn effective teaching strategies that incorporate technology.

Need

Technology increases the availability of information and provides powerful new tools for constructing meaning and creating new knowledge. Furthermore, standards for personal and professional success will in future be predicated on the ability to use technology tools confidently and competently to foster continued intellectual growth. Students must start now to instill effective learning strategies that incorporate technology tools, and it is imperative that students have teachers who can guide them in developing these strategies. Tomorrow's teachers must also be confident and competent users of technology tools: they must be skillful in designing, implementing, and evaluating effective learning environments that utilize these tools. According to Sheingold (1991), it "is unlikely that the ambitious goals for learning and teaching can be met without widespread, creative, and well-integrated uses of technologies of many kinds" (p. 22). This need is felt particularly in Nebraska, where the majority of the state is rural, and where there exist a significant number of low-income communities. Nebraska's rural and low-income communities need teachers who can help students use technology to supplement the scant educational resources commonly available in these areas.

However, the majority of faculty members teaching in Nebraska's teacher preparation programs do not integrate instructional technology into their courses, nor do they model effective teaching strategies that incorporate technology. Preservice students, as a consequence, do not learn about the role of technology in education, and they do not practice the use of technology during field experiences.

Nebraska faculty members reflect a national trend in the use of instructional technology in preservice training programs. In 1999, the International Society for Technology in Education (ISTE) was commissioned to conduct a survey of Schools, Colleges, and Departments of Education (SCDEs). The results of this survey finds that

faculty members have access to technology and can use technology tools for communication and personal productivity. However, the survey also finds demonstrations of effective teaching strategies that incorporate technology neither are modeled in the classroom nor are required of students as part of their field experience or course requirements. Persichitte, Tharp, and Caffarella (1997) report that "actual utilization and contextualized integration of these technologies within personal and workplace settings, for both SCDE students and faculty, is far from commonplace within SCDEs." In 1998, the South Central Regional Technology in Education Consortium (SCRTEC), conducted a regional survey, including Nebraska, that concludes: "Our institutions of higher education are still internally focused on their technology needs and are not yet able to really focus outwardly on training preservice teachers in the best uses of technology . . . ". Further supporting these findings, Sutton (1997) conducted a survey of all methods faculty members at Nebraska's institutions for teacher preparation:

"The data revealed that most Nebraska methods instructors were using some form of instructional technology. However, fewer, only 58%, were requiring their students to use it. In addition, the majority of Nebraska methods instructors were not familiar with the ISTE [Recommended Foundations in Technology for All Teachers], and therefore were most likely not incorporating any of the standards into their teaching."

Several recent surveys, including the ISTE sponsored "Will New Teachers Be Prepared To Teach In A Digital Age?", point to the need for systemic changes in the way preservice students learn about and use instructional technology. First, effective teaching strategies that incorporate technology must be integrated and modeled in preservice education. Second, students must demonstrate as part of their college courses that they understand and can design effective teaching strategies that incorporate instructional technology. Third, students must be given opportunities to observe and interact with master teachers who use technology tools to support teaching and learning.

Finally, faculty members at teacher preparation institutions must be responsible for creating and disseminating models for change in preservice education. This responsibility reflects the reciprocal relationship of research and practice: faculty members need to "identify, study, and disseminate examples of effective technology integration that reflect the current needs in both teacher education and K-12 schools" (ISTE, p. 3, 1999).

Addressing the Need—Past Projects

In 1998, Teachers College of the University of Nebraska-Lincoln (UN-L) was awarded funding through the Eisenhower Professional Development Program for a proposal entitled "Nebraska Educators' Summer Technology Training Institute (NESTTI)." The goal of NESTTI was to ensure that preservice students were provided meaningful opportunities to learn about and use instructional technology in their preservice coursework. However, both national and statewide surveys indicated that faculty lacked time and support to integrate technology into existing preservice courses. Further, these surveys indicated that teacher preparation faculty would benefit from examples of pedagogically sound uses of technology to help them recognize how technology can support preservice curricula. The method for achieving this goal was to immerse faculty in training and modeling activities that reflected sound educational uses of technology. The expectation was that a residential training "camp," with extensive technical support provided, would help ameliorate the issues of time and support. The objective of this training and modeling was to enable faculty members to model the use of instructional technology in their classrooms and to provide opportunities for preservice students to use technology tools as part of their course work.

Methods instructors were selected as the target audience for the project because of their direct role in guiding students to make connections between teaching practice to learning theory. Methods instructors from across the state were invited to participate in a weeklong, residential summer training session at UN-L. Training and modeling activities for the session were based on the content areas of the participants. Attendees were immersed in classroom-oriented uses of technology, and extensive technical support was provided throughout the learning process. Attendees learned how to use software titles that were representative of "genres" of technology tools (e.g., HyperStudio for multimedia applications). But more importantly, participants were introduced to these tools during modeling sessions by K12 teachers and higher education faculty. Through these modeling sessions attendees participated directly in using technology to facilitate learning. These opportunities for connecting technology tools to learning objectives helped participants make connections between technology and their own teaching practices.

Follow-up activities were scheduled throughout the academic year, 1998-1999. The participants themselves generated topics for these sessions and were well attended. During these sessions, participants received

additional training, were able to ask for specific technical support to solve problems, and had the opportunity to share their work with their colleagues.

Data collected during the first year revealed that most participants had made significant progress in integrating technology into their methods courses as a result of their involvement with the NESTTI project.

However, it was recognized that the original NESTTI proposal would have a more long-term potential if participants were given more time to develop multiple products for use in their courses. Furthermore, the first year participants commented that the one-week approach had not left enough time for reflection, a process necessary for developing meaningful projects and products. Consequently, the original NESTTI proposal was rewritten to address this need, and UN-L received a second grant award from the Eisenhower Professional Development Program in 1999. The second year of the NESTTI project followed the same format as the first year with two notable exceptions. First, the training/modeling session was held over a two-week period. Second, participants read selected research articles related to instructional technology, which provided the basis for highly engaged discussions related to the participants' conceptions of and uses for technology. This second year of NESTTI is still ongoing, and results will be available in fall 2000.

Addressing the Need—Current Project

The NESTTI approach has proven very successful, and has served as a useful first-step in faculty professional development related to instructional technology. However, it is recognized that this approach can be improved upon. Training and support for any faculty development project should be immediate and ongoing, not periodic throughout the year. Moreover, learning activities should relate to specific course needs and individual teaching styles of participating faculty in order to be of most benefit to the participants, not generic modeling exercises. Ideally, integrating instructional technology into preservice courses would become part of an ongoing process of renewal in preservice education, and technical support would be provided as a means of facilitating what instructors are already doing in their classrooms.

In 1999, the University of Nebraska-Lincoln and the University of Nebraska-Kearney received a grant award from the U.S. Department of Education as part of the "Preparing Tomorrow's Teachers to use Technology" initiative. This project, entitled "Scholarship, Technology, and Educational Practice (STEP)," is designed specifically to improve upon the NESTTI approach to faculty development and top the improvement of preservice education. This project creates an effective model that supports continuous renewal of teaching content and strategies in preservice education related to instructional technology. Through this project, partnerships are established between methods faculty members and K-12 teachers for integrating and modeling teacher preparation strategies that incorporate technology tools. Furthermore, this project creates meaningful opportunities for preservice students to observe and interact with K-12 teachers who use technology tools in their classrooms. Most importantly, preservice students in this project will work directly with K-12 teachers in developing teaching strategies and materials for use in the teacher's classroom. This project will prepare tomorrow's teachers to design, implement, and evaluate classroom environments in which children learn with technology.

Goals

This project creates a model of partnership between schools of education and K-12 school districts that prepares preservice teachers to be effective users of technology. The project has four goals. First, this project will establish a process for collaboration between teacher preparation faculty members and K-12 teachers. Through this collaboration, faculty members and teachers will share their respective expertise in research and practice for mutual professional development. These educator teams will jointly develop and model teacher preparation strategies that incorporate technology into the preservice curriculum. Second, this project will establish a process for creating authentic learning opportunities for preservice students in which they observe and interact with K-12 teachers to design, implement, and evaluate teaching strategies that will be used in the K-12 classroom. Preservice students will be challenged to examine their own behavior and the practices of their cooperative teachers, learning how scholarship and practice inform and build upon one another. Third, instructional technology training and technical support will directly support the needs and learning objectives established by the faculty members, teachers, and preservice students. Technical expertise will be shared and coordinated to support participating members and project activities, and technical staff will be given opportunities for continued professional growth. Finally, this project will ensure that teachers who fill positions in rural and low-income areas have the skills and knowledge to use technology effectively to overcome the scarcity of educational resources found in these areas.

Objectives for the Project

This project will impact a significant number of preservice faculty members and preservice students over three years. The project will include 20 methods faculty members and at least 20 K-12 teachers. This project will directly impact approximately 1020 preservice students.

1) Increase the number of preservice students using technology tools to support teaching and learning.
2) Disseminate resources, activities, and teaching strategies that integrate technology tools into preservice education programs.
3) Disseminate a collaborative model between higher education and K-12 to evaluate and improve preservice education experiences using technology tools.

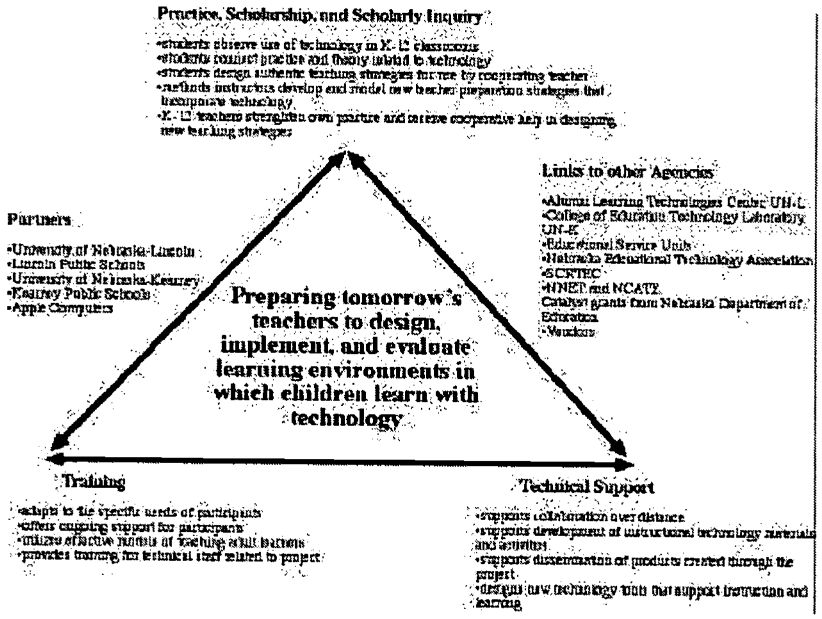
Comprehensive Effort

This proposal describes a broad and inclusive vision for improving preservice education. This project is based on a scholar-practitioner model, which forms a framework for student learning in the preservice program. Through this model, faculty members and teachers are jointly responsible for guiding preservice students as they build connections between scholarship and practice activities. Students interact in field settings in which they can inquire about and reflect upon the use of instructional technology, and how instructional technology affects their own work as educators. The scholar-practitioner model ensures that the goals, objectives, and activities of this project are based on best practices and on scholarly literature.

Furthermore, this proposal couples collaborative activities with ongoing training and technical support to create a comprehensive model for integrating instructional technology into preservice education. The proposal comprises three interrelated functions:

- Practice, Scholarship, and Scholarly inquiry
- Training
- Technical Support

The diagram below helps visualize the relationship of these three components. Each component forms one corner of a triangle, with arrows indicating their reciprocal relationship:



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TEACHING THE USE OF INFORMATION IN A TECHNOLOGY FRAMEWORK

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Abstract: This paper is a summary of procedures used to design and implement an undergraduate course for all entry level students in the College of Education. The question asked: What do pre-service teachers need most in a teacher education program that will effectively prepare them to meet the demands of the 21st Century classroom? The answer is apparent: effective methods of teaching the use of information using a technology framework. The answer to this query was the genesis of a course designed for entry level students in the College of Education that met three unique features: 1) individual student flexibility in selecting research projects and technology tools; 2) collaboration among faculty and students in presenting research strategies and investigating current themes in education; and 3) empowering students with self management skills that prepare them for lifelong learning. This approach successfully presented applications of information, utilizing a technology framework. The conclusion indicates that higher education is improving the learning experience of college students.

Introduction

Teacher education institutions have the opportunity to prepare pre-service teachers to be effective users of information and its accompanying technology. The National Council for Accreditation of Teacher Education (NCATE, 1997) described the vision needed for teacher education programs in the 21st Century classroom to include full utilization of information technology. The American Library Association stressed the importance of information literacy in its new national standards and defined it as the ability to seek and effectively utilize information sources, including knowledge and how to use technologies. (ALA, 1998). Changes in society and technology have resulted in massive changes in education. Learners look to their schools for information beyond academics. This growth in information and technology has precipitated the creation of a community of lifelong learners. Information literacy is at the core of lifelong learning (ALA, 1998). OAT (1995) recognized that technology in all of its applications is still underutilized by many teachers. A band-aid approach following a training program has not been effective. Something different is warranted.

The Course

In the process of preparing 200,000 new teachers annually (President's Committee of Advisors on Science and Technology, 1997), colleges of education have turned to a comprehensive and systematic approach to curriculum redesign that starts upon entry. Towson University has taken a direct approach to addressing the obvious problem of little or ineffective research, technology and curricular integration skills used by pre-service teachers. New students beginning the teacher education program were introduced to a curricular model that focused on best practice in teacher education literature, and included information, research, technology and collaboration.

One of the initial steps taken by the College of Education was to require all entering majors to take a course entitled *Using Information Effectively.* This course was introduced to all freshmen and transfer students and focused on techniques useful for research investigation, connectivity, collaboration, productivity and integration. The purpose of the course was to introduce students to techniques for gathering, evaluating and communicating information using a variety of resources and

educational technology. The course emphasized team collaboration and problem solving techniques to examine current themes and issues in education.

Faculty collaborated on the design of the course, course requirements and assessment criteria and produced a common syllabus for all classes. The main library cooperated by releasing the services of reference librarians to serve in course planning and team teaching. Technology experts from the university's Computer and Network Services joined the team as consultants. The course components included:

- Team Collaboration
- Connectivity
- Team Teaching
- Resource Experts
- Productivity
- Information Evaluation
- Technology Integration
- Portfolio Design & Assessment

The first two sections were taught in the spring of 1997. Twenty students were in each section. The instructors met weekly to discuss the problems, progress and successes noted in the course. A summary of those sessions revealed: inappropriate placement of instruction; too much content covered in specific units; additional lab time needed for students with little experience using technology; the need for more communication between team leaders and faculty; closer guidance in the selection of team projects; and careful explanation of the criteria and expectations for individual and team projects. All of these changes were made before the start of fall 1998. Sixteen sections of this course are currently being offered during the spring 2000 semester.

The Facilities and Resources

The College of Education has supported the integration of technology into the curriculum. It has been one of the dean's top three priorities for the past five years. Funds were made available to equip two PC electronic classrooms each with 31 Dell Optiplex Workstations, Windows 98, SPSS 8.0, and Inspiration 5.0, KidPix Studio Delux, and Hyperstudio 3.2; one MAC classroom with 25 Macintosh G3 workstations with standard configuration; one computer lab with 22 Gateway P-120 workstations, Windows 95, Inspiration 5.0, KidPix Studio, and Hyperstudio 3.2; and one multimedia lab and an assistive technology lab. One additional MAC lab will be going online in fall 2000. Hawkins Hall, which houses the College of Education, is networked and supported by the university. Education faculty has access to a two-way fiber optic distance learning classroom and a compressed video lab. The building is wired for connectivity, which allows Internet access in classrooms. A network administrator and a technical support staff person hired by the College of Education, maintain these areas.

Standard Software for
Windows Based Computers

- Microsoft Office 97
  Includes:
    Word
    PowerPoint
    Excel
    Access
    PhotoEditor
- FrontPage 98
- Internet Explorer 4.0
- Netscape Communicator 4.61
  Includes:
    Navigator

Standard Software for
Macintosh Computers

OS 8.0

Microsoft Office 98
Includes:
    Word
    PowerPoint
    Excel

ClarisWorks 4.0
ClarisImpact 2.0
FrontPage 1.0

Netscape Communicator 4.61

Composer
Messenger

- Adobe Acrobat Reader 3.0
- Quicktime 3.0
- Real Player
- Shockwave and Flash
- PowerTerm
- Telnet
- WS_FTP
- McAfee 4.0
- Toolbook II Publisher 5.0

Includes:
Navigator
Composer
Messenger

Adobe Acrobat Reader 3.0
Quicktime 3.0
RealPlayer
NCSA Telnet
Fetch 3.0
Virex
Hyperstudio 3.1
KidPix Studio Delux
Inspiration 5.0

Information technology is essential in our framework. Stephen C. Ehrmann's (1998) perspective on technology in higher education reminds us of the importance of breaking ranks with the traditional. His view resembles a four-level tower with each level more sophisticated than the one below it. The basement level contains traditional technologies (textbooks, audiovisual materials), and the infrastructure for their use (libraries, labs, etc.). These basic elements support the four traditional pedagogues on the first floor: directed instruction (lecture halls and textbooks), learning by doing (labs, typewriters, libraries), real-time conversations (seminars, office hours), and time-delayed exchange (homework). The second floor houses enhancements to these practices that require students to use instructional technologies. Finally, the third floor represents large-scale structures supporting new educational concepts. Successful integration of technology into college appears to hinge on the willingness of faculty to move beyond the basement and first-floor technologies with which they are most familiar and move into the upper levels that incorporate information technology.

That is precisely what the faculty did. Those who needed additional expertise in course design worked with instructional designers in the university's Center for Instructional Advancement and Technology (CIAT). Two instructional designers, a graphic artist, and a support staff provide easy access to resources for faculty. Currently the institution is supporting training for faculty from across the university to learn a web-based application for designing courses. *CourseInfo* by Blackboard will be used to put 50% of the course *Using Information Effectively* on the web in spring 2000. Five faculty from the College of Education are participating. Those faculty who needed knowledge in computing, databases, spreadsheets, presentations, publications, word processing, the Internet, and project management, registered for workshops provided by the CANS (Computer and Network Services) Technology Center.

It is an indisputable fact that faculty bear the major responsibility for student learning (Davis, 1993). The public has been very vocal in demanding improved student outcomes. One of the methods used by the College of Education to improve student learning is to improve college teaching. Several faculty development initiatives have been implemented to promote the development of expertise in teaching: CIAT, CANS, VICTORWeb (Online Public Access Catalog), and Mircosoft Network.

The Model

Collaboration, research, information technology and assessment are the cornerstones of this model. This model pairs teaching faculty with librarians: each an essential member of the team. It is very challenging to examine the relationship between college faculty and librarians. The proliferation of information sources and educational technology have created a dysfunctional relationship between college faculty and librarians that is based on an outdated teaching/learning paradigm (Tompkins, 1996). Traditionally, teaching has been the purview of faculty, while librarians were viewed as merely custodians of printed information resources. In the current Information Age however, librarians have become the primary instructors to teach research methods and critical thinking skills as applied to information access. There is support for librarians to be seen as key instructional team members and as partners with faculty.

Over the past 20 years, librarians have worked hard to move from teaching isolated library skills to teaching integrated information skills. Effective integration of information skills has two requirements: 1) the skills must directly relate to the content area curriculum and to classroom assignments and 2) the skills need to be tied together in a logical and systematic information process model (Eisenberg, 1996). Successful integrated information skill programs are designed around collaborative projects jointly planned and taught by faculty and library professionals.

In this course, the team agrees upon the goals and objectives. Instruction is planned, follow-up activities identified, homework criteria discussed, team and individual projects assigned and assessment built into each component. Collaboration between faculty and librarian is essential. In addition, there is collaboration between instructors and students as well as between team members. Connectivity on and off campus involves: tele-mentoring, e-mailing assignments, using list-serves, web-based forums and electronic bulletin boards; accessing VICTORWeb, and the World Wide Web and using management strategies to maintain electronic files for portfolio development.

Research is the second part of the model. Students are taught the research process from beginning to end. Emphasis is placed on understanding research in education, locating print and electronic sources, preparing a bibliography, manual and electronic note taking, presenting and documenting research, organizing the final project, and styles of documentation. Teams work with search strategies during formal class sessions, and individual projects are assigned as out-of class assignments.

Information is part three of the model. Students are introduced to information sources ranging from traditional to non-traditional, from book to e-book, from library resource to virtual resource. All formats of material are used including artifacts, realia, proceedings, journals, magazines, newspapers, web sites, books, multimedia, video, and audio. Teams are encouraged to generate topics of interest to them as well as selecting projects for presentation that may combine any of these materials.

Technology is the one component that is apparent throughout the model. Technology productivity tools allow students to use word processing, data base and spreadsheets, graphic design, desktop publishing, video, audio and multimedia design and the creation of educational presentations. The integration of connectivity and productivity allows students to demonstrate what they have learned using performance-based criteria.

This demonstration is evident in student-managed information or educational portfolio development. Authentic assessment allows student to demonstrate desired performance through real-life situations (Meyer, 1992). The method includes projects that require students to demonstrate their problem-solving skills as well as their skills in analyzing and synthesizing information. Improved student performance is directly attributed to authentic assessment (Herman, 1992). Paulson, Paulson & Meyer (1991), define an educational portfolio as *a purposeful collection of student work that exhibits the student's efforts, progress, and achievement. The project must include student participation in selecting contents, the criteria for selection, and judging merit and evidence of student reflection.*

The types of portfolios designed by students are:

- Developmental - includes samples of student's work used by faculty to document a student's improvement over the entire semester, with self-evaluations of specific assignments;
- Proficiency - used to determine eligibility for students to advance in any assigned skill area when competence and performance are demonstrated;
- Showcase - used to document a student's best work accomplished during one semester, but can be used during an entire educational career; and
- Employment skills - includes samples of student's work over time which may be used by a prospective employer to review work readiness skills.

Requiring students to develop student portfolios provides authentic demonstration of accomplishments, and allows students to take responsibility for the work they have done. This motivates them to accomplish more in the future. —

Conclusion

Teaching the use of information in a technology framework proved to be an effective strategy in the College of Education. This course *Using Information Effectively* has demonstrated that when faculty and students collaborate, positive results occur. Student projects met the needs and

interests of students because they were selected by students following insightful collaboration with team members and instructors. The course design was effective because of collaboration and technology support. Students felt empowered and equipped with self management skills to go on to other courses and continue to use knowledge and critical thinking skills acquired, thus promoting lifelong learning.

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DEVELOPING A CROSS-CURRICULAR FOCUS TO INFORMATION AND COMMUNICATION TECHNOLOGY TEACHING

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Abstract: In the UK, instructional technology teachers, (more commonly known there as information and communications technology (ICT) teachers), with the support and co-operation of other curriculum specialists educate students mainly in basic ICT skills and rarely consider the application of ICT in a range of subjects. This paper describes a project to encourage ICT student teachers to work with teachers from other subject areas on a school based cross-curricular project in four local secondary schools. The outcomes of the project are discussed, including the effect on the way preservice teachers changed their perceptions of ICT across the curriculum; the teaching of ICT skills, and what changes were made the following year for the next cohort of preservice teachers.

Introduction

The role of instructional technology teachers in schools varies considerably in UK schools, and how best to prepare preservice teachers of technology in secondary schools (known as information and communication technology teachers in the UK) is a difficult issue. The way ICT is approached can be from fully integrated across the curriculum with a faculty having responsibility for the teaching of one package or application (e.g. English teaching word-processing, mathematics teaching spreadsheets, etc), to generic ICT lessons, or to ICT being team taught in personal and social education sessions. The ICT teacher in each of these scenarios alters notably, moving from a support role in the first scenario, to a full teaching role in the second and third. In addition there are numerous ICT syllabi for public examinations at age 16 and 18, which vary considerably in content from a systems approach to computing to the applications of information processing. At the Institute of Education at Warwick University we are now into the fourth year of training ICT teachers. Since last reporting (Selinger, 1998), preservice teachers' ICT teaching experience and observations are still 'often in lessons in which pupils are taught basic skills, often devoid of a context; and the process of using ICT as a tool to support and enhance all aspects of their studies and understanding is often lost' (p1280) (although there are some different and exemplary lessons emerging more and more which were disseminated to the group and identified as good practice). Ofsted, the schools' inspectorate, has also continued to report unfavourably about the content and delivery of ICT across the curriculum

> The management of information technology is weak in a substantial number of schools. In this subject, it is the curricular provision and management of resources, rather than the quality of teaching in timetabled information technology lessons, that often limit achievement and need to be monitored carefully. The co-ordination of this work across the curriculum is often poorly managed, and too few schools report progress and attainment of all pupils in Key Stage 4.
>
> Ofsted, 1999, para 127

In University sessions the preservice teachers are involved in discussions about the importance of devising ICT lessons which will empower pupils with the tools of tomorrow, and not just teach them the rudiments of an application. As an example I discuss two scenarios for the teaching of spreadsheets. In an ICT lesson the focus would be spreadsheets using some piece of mathematics as the context in which to teach the basic functions of spreadsheets, whereas in a mathematics lesson the focus would be on a topic in mathematics, yet the same aspects of spreadsheets are being taught. There is no consensus as to which provides the most robust learning, and there appears to be little research in this area, and if my own experience is typical of others, what the learner is attending to and learning may not always be clear. However, as a tool in the mathematics lesson, the spreadsheet is being used in a meaningful way.

We discuss ways that can enable students to understand the role of ICT in all their curriculum subjects; and that help them to make informed choices about when, where and how to make use of the technology. The argument I make is that the mathematics staff and the ICT staff in a school ought to jointly plan the teaching of spreadsheets so the purpose and value of the spreadsheet is articulated from the viewpoint of a mathematician, (later the use of spreadsheets in other subjects can be discussed, and the generic functions of spreadsheets made explicit). Learning how to set up and manipulate a spreadsheet is taught in a mathematical context in which students are familiar, and the mathematics is understood, and then, when the basics have been mastered, students develop their mathematical understanding with the spreadsheet acting as a tool, perhaps learning more functions as needed on the way. The class enters into the expert mathematician's domain to observe how spreadsheets are used for doing mathematics. Spreadsheets for example have elevated trial and improvement as a mathematical process. ICT ought to be perceived as a transferable skill and taught as such.

However, it is also pointed out that there is a considerable body of research evidence which demonstrates students' difficulties in applying their learning in one context in another; this means this transferability will not happen automatically (Brown et al, 1989; Lave, 1991). Consequently we agree that ICT teachers, with the support and co-operation of other curriculum specialists, ought to be educating pupils not only in a skills base, but also teaching them to consider the application of ICT in a range of subjects, and to be aware of opportunities for appropriate uses of ICT and how ICT can enhance both the development of their curriculum subjects and their understanding of them.

Implementing the Project

In order to put this to the test, four local schools were approached whose principals had indicated their willingness to involve the 1997/98 group of Postgraduate Certificate in Education (PGCE) ICT preservice teachers beyond their statutory school experience. Previous attempts within the course to encourage ICT preservice teachers to work with peers from other subject areas had met with some limited success, so the prospect of a cross curricular project within a school context might prove even more successful. Two meetings were held with the heads, professional mentors and ICT coordinators from the four schools and a programme was negotiated.

The 27 preservice teachers were then allocated to one of the 4 schools to work in pairs in specific curriculum areas to be identified by the school. They were to spend four sessions in the school, one in the autumn term and three in the spring term and were expected to:

- research the use of ICT in their selected curriculum area
- write a joint report about the use of ICT in the that curriculum subject, (preservice teachers were also expected to find out about how their block placement school used ICT in their selected curriculum area and incorporate that in their report).

- prepare, teach and evaluate two lessons for a group of students who had particular demands, e.g. high attainers, competent ICT users, students with special educational needs. (These lessons had to be negotiated and agreed with the university tutor and the subject teacher in school to whom they had been assigned.)

Within their pairing the preservice teachers were each to teach one of the lessons and be observed by the other, who would write a critical evaluation of the lesson. The report, the lesson plans, resources developed and the evaluations were assessed formally by the University tutor as the second of three subject based assignments the preservice teachers had to complete as part of the course. In addition, a copy of the report together with lesson plans and resources were to be given to the school. The preservice teachers were expected and encouraged to use the medium of ICT innovatively in their preparation of lessons. A structure of the allocated time slots was suggested, as outlined below, but in fact many preservice teachers put in more than twice this time.

> Session 1
> Preservice teachers will be introduced to the ICT facilities in the school, and be given a copy of the schools' ICT policy to read. They will meet the head of department or a representative on the curriculum area in which they are to work who will show them any specific ICT facilities in the department, inform them of ICT policy and activities, show them schemes of work and discuss the integration of ICT. Other resources (books and worksheets, software, etc) will be made available for preservice teachers to explore. Possible ideas for projects will be discussed.
>
> Session 2
> Preservice teachers will observe a lesson being taught in the subject area by the teacher with whom they are going to work. A group of pupils will be identified and the preservice teachers will spend some time talking to them. A topic for the lessons will be negotiated with their teacher.
>
> Sessions 3 and 4
> Each preservice teacher will teach a lesson in either session 3 or 4 and be observed by the other. The subject teacher is invited to support the observation and present a report too if this is desirable and feasible, and to discuss the lesson outcomes with them.
>
> Between sessions 2 and 3
> Lesson plans and resources will be shown to and discussed with the university tutor, and then the subject teacher through electronic communications, where possible.
>
> Selinger, 1997

The schools were asked to comment on the proposal and once agreed, they would then liaise with relevant staff and inform the University tutor of the number of preservice teachers they were willing to take; the subject areas in which preservice teachers would work; and make suggestions for the best time for preservice teachers to come into school. In the event four 2-hour University sessions were allocated to the project, but as stated earlier, many preservice teachers gave far more time to the project than this. They worked in pairs.

A few preservice teachers worked in special needs departments, while the remainder worked in one of several curriculum areas across the secondary age range including science, art, English, food technology, history, mathematics, leisure and tourism GNVQ (a vocational qualification). Two groups designed a web site for the English and history departments, and one group developed a strategy for the use of a talking word processor with special educational needs students. There were several spreadsheet projects (including one that involved baking a very large cake), but the most exciting was by a student who had came onto the PGCE course with an arts background. He found himself working alone in a science department as the 28th member of the course had withdrawn. He was set the task of developing a resource for GCSE (the public examinations for 16 years olds) high attainers in a chemistry topic. He looked through the syllabus and considered ways in which ICT could be used: he settled on radioactive half-life, a topic he knew nothing about. He consulted a PhD student he knew to brief him on the fundamental

concepts, and then designed a spreadsheet activity to model radioactive decay. The science teacher he worked with was ICT literate but not to the same extent as the ICT student, but they worked together on developing an interactive spreadsheet that would challenge the pupils and develop their understanding of the topic. The teacher was delighted with the final product and the pupils' enthusiasm, and it is now built into the scheme of work for the course.

Outcomes

The preservice teachers in the main found the experience extremely worthwhile and productive, and only two groups experienced any real difficulties. In a feedback session at the end of the project a number of issues emerged about working with non-ICT specialists in their own subject areas which their statutory, and more traditional school experience had not revealed to the same extent. It also raised their awareness as to what might potentially lie behind the rhetoric of schools' ICT policies in a way that would not have been so meaningful if they had been alerted to these issues in a taught University session. Below are some of the main findings:

- Only word processing was consistently used across different curriculum areas
- Pupils had poor ICT skills
- There was a lack of opportunity to use ICT rooms
- Learning both the subject and ICT often caused difficulties with students as they were unable to attend to learning new skills in both
- Teacher confidence was generally very low
- The beliefs about the value of ICT for teaching and learning varied considerably and many staff did not share the head's or ICT coordinator's vision
- There was a general lack of awareness of ICT resources for the subject
- Technical difficulties such as logging on to the network, knowledge of applications and the use of PCs at home and Acorns in schools say, often became barriers for teachers using ICT
- Access issues to suitable software, CD-ROMs and the Internet proved to be a barrier to use
- Working collaboratively with a subject specialist was a learning and rewarding experience for both the subject teacher and the ICT preservice teachers
- Subject specialists lacked new ICT skills
- Students' use of ICT applications out of the context of ICT lessons was poorer than the preservice teachers had anticipated.

The preservice teachers said this school-based experience together with the feedback session had made them much more aware of the issues of ICT use across a school. They felt that working within an ICT department alone could be misleading. The experience had highlighted the varying levels of ICT skills amongst teachers and the lack of use in other subjects. They were more prepared for their first teaching post, and agreed that it would be advantageous to make every effort to audit the use of ICT and other curriculum specialists' competence at the earliest possible stage, if their new department had not already done so.

The Following Year

Following on from this success, the schools involved were very keen to repeat the project. They saw the involvement of preservice ICT specialists as a way of encouraging staff in schools to make more use of ICT. However the schools' other development plans for ICT got in the way. Three of the schools were linking together over a high-speed network and had ambitions for the development of an innovative Intranet. Six local primary schools were also to be involved whose pupils usually progressed to one of the three secondary schools at the age of 11. The secondary principals got together and agreed that the university ICT preservice teachers could be instrumental in developing the Intranet, and provide links with the primary schools. In the event the Internet link was not working; the primary schools had not been briefed let alone involved in the secondary schools' plan for the preservice teachers; and the students became very frustrated by the lack of technical know-how of Intranet development. They spent considerable periods of time trying to establish what was required and produced some reasonable attempts at interactive web pages, which given the technical situation could not be published on the Intranet by the time they has completed their work and the PGCE course. The successes of the previous year in encouraging students to consider the issues involved in ICT development across the curriculum were not repeated. The students did learn, however, that cooperation between primary and secondary schools is a difficult process and that technical issues can prohibit curriculum development.

Lessons Learnt and What Next?

In the later project, we had focused too much on the schools' needs and not enough on the preservice teachers' needs. In the first scenario, the project has arisen out of a recognition for preservice teachers to gain a deeper understanding of how and why ICT can support learning in the curriculum, while in the second the need arose out of the schools' wishes to develop an Intranet. The first was curriculum driven, the second was technology led. Another lesson learnt was that preservice teachers need to be involved in developing projects from an existing situation rather than being led into the unknown. They are inexperienced and eager to please, and can be in danger of being exploited in novel situations. Preservice teachers' needs have to be recognised, and schools need to offer support rather than expect the inexperienced preservice teachers to provide training.

Negotiations with the schools had been excellent at top level, but finding willing teachers in the secondary schools to become involved is not always easy given the constraints on teachers' time and the pressure of the curriculum. However, such was the success and mutual benefits, it was agreed to run the project again and this time the 1999/2000 preservice teachers are working on cross phase projects within three secondary schools. Success is likely as the UK Government has made ICT a priority with a budget of over £600 million being made available to schools to update computers; introduce or improve existing networks, connect schools to the Internet, and train teachers in the use of ICT, (DfEE, 1997), and schools are keen to be seen to be in the forefront of development.

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Pairing Up Inservice and Preservice Teachers to Develop an Understanding of Technology Integration

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Abstract: This paper will describe a course taught at the University of Alberta that focuses on technology integration across the curriculum. In this course preservice and inservice teachers are combined into the same class. The experience has been mutually beneficial for the two groups and resulted in interesting classroom dynamics. The goal of the course is to help students develop a better understanding of critical thinking and the role of technology in the classroom. The strategies and assignments used in class are also described in the paper.

Introduction

The purpose of this paper is to describe a course taught at the University of Alberta that focuses on technology integration across the curriculum. The goal of the course is to help students develop a better understanding of critical thinking and the role of technology in the classroom. Naturally then the major assignment for the course requires students develop a project to promote critical thinking while taking advantage of computer technology's unique attributes. The learning strategies used in the course are based on Brown, Collins, and Duguid's (1989) notion of situated cognition and Collins, Brown, and Newman's (1989) notion of learning through cognitive apprenticeship. These authors suggest that concepts need to be contextualized and developed progressively through activities. Cognitive apprenticeship requires making the concept of technology integration explicit through readings and class discussions. This is complimented with lab assignments that focus on developing examples of technology integration with specific applications. These steps prepare the student for the final project by scaffolding onto prior activities. The final project should be built with actual integration in mind. That is students should be in a position to implement their project. It is my belief that these students will then be able to independently create further projects for their classroom.

Before describing the course any further it is important to define technology integration as presented in this course. Taylor (1980) described three roles for computer technology in the school. One, is as the object of instruction, that is students would be learning about computer hardware, software, programming etc. Computer technology's second role is to deliver instruction. In this role Taylor was referring to computer assisted instruction, which today has evolved into web-based instruction and the notion that learning can take place "anywhere, anytime." The third role described by Taylor looks at using computer technology as a tool for information processing and communication tasks. In the course described here technology integration is based on the perspective of this third role. This role has evolved throughout the years and now computer technology is not just seen as a productivity tool but rather as a tool for thinking or as Jonassen (1996) refers to it as a "mindtool". Although the two other roles for computer technology have merit it is this mindtool role that appears to have the most potential for cognitive development (Jonassen, 1996, Logan, 1995, President's Committee of Advisors on Science and Technology, 1997, Reginald Gregoire inc., Bracewell & Laferriere, 1996). This view of technology integration is also supported by the Alberta Government through its prescription of a new curriculum that requires technology outcomes be integrated into core subjects such as Mathematics, Social Studies, Language Arts, and Science (see http://ednet.edc.gov.ab.ca/techoutcomes/). This curriculum looks at using computer tools for problem solving, inquiring, decision making, and communicating.

Looking at technology integration in this way requires that constructivist approaches to teaching and learning be adopted. In many ways the course is more about constructivist pedagogy than it is about technology.

The potential for computer technology to act as a tool for thinking can only be realized within a constructivist activity. The constructivist approach is difficult for some students to grasp because of firmly entrenched traditional beliefs about teaching and learning. Keith Yocam was involved in staff development in the Apple Classrooms of Tomorrow (ACOT) project and observed that " It seems far easier to help a teacher who is already practicing constructivist methods learn to use technology to enhance student learning than it is to help a teacher who has a lot of knowledge about technology but limited knowledge of constructivist pedagogy" (Yocam, 1996, p.268). I try to model constructivist approaches in as many ways as possible in the hopes that class participants will recognize the impact such strategies have had on their own learning and thus consider similar strategies in their teaching. Below is a description of some the activities and assignments used in class.

Course Description

EDSE 478/578 is an undergraduate/graduate course designed to help educators understand the role technology can play in the classroom and to develop some of the skills needed to integrate technology into classroom activities for their students. Initially combining undergraduates and graduate students was done to meet minimum enrollment criteria but it soon became evident that this was an advantageous situation. The graduate students are for the most part teachers enrolled in a part-time M.Ed. program. The undergraduates are students who have completed student teaching and are in the final stages of their program. The graduate students have additional readings and expectations, in terms of scholarly work, are higher. Combining preservice and inservice teachers in the same class has been mutually beneficial for the two groups and resulted in interesting classroom dynamics. It is in fact rare to have preservice and inservice teachers engage in lengthy discussions about teaching and learning. Each group is enriched by the other. The inservice teachers bring wisdom gained through experience and the preservice teachers bring contagious enthusiasm. Revisiting critical thinking, identifying purposeful learning activities, and working with beginning teachers has been a rejuvenating experience for the graduate students.

Students are given a number of articles to read and these are mostly discussed online but the final debriefing on the articles is held in face-to-face discussion. The online discussion of articles gives students more time to reflect on the responses and more time to formulate their own contribution to the discussion. The asynchronous communication component of the course is intended to promote reflective practice. For example, the students are given a number of readings that describe critical thinking and these are discussed online. Various points of view emerge and these are further discussed in small face-to-face groups. The various views are discussed in small groups. Students then develop a working definition of critical thinking and are asked to identify its key attributes. That is, what elements make a learning activity one that will foster critical thinking? Critical thinking is a concept that is widely used in education and yet poorly understood. In this part of the class it is important that students develop an understanding of critical thinking. They need to determine what it is and what it isn't by examining examples of lesson activities and identifying the thought processes and skills a student would need to undergo to achieve the task defined in the activity.

Using a similar technique students are asked to identify the unique attributes of computer technology. That is, what features allow us to do things we could not do before or wouldn't do because the task was too labor-intensive? Students are asked to brainstorm these attributes. It should be mentioned at this point that the prerequisites for this course require students know how to use the Internet, spreadsheets, and databases. Even though students have the prerequisite skills some cannot be considered confident computer users. When asked about the unique attributes of the computer they usually refer to automation of labor-intensive tasks. In many ways they continue to use the technology to perform old tasks faster. For example, they continue to use a word processor as a typewriter and a spreadsheet as a calculator. After much discussion students realize that computer technology lets us communicate with experts or individuals who can offer and entirely different perspective on an issue. The use of the Internet now exposes students to authentic problems and research. Computer technology helps us to manipulate data and reorganize it in a way that makes patterns or relationships evident. It also allows us to visualize data in a way that could not be done before.

Once students have looked at critical thinking and the attributes of technology they are asked to create short lesson activities that require the use of spreadsheets and databases. These activities have to be designed to promote critical thinking and take advantage of the unique attributes of technology. For example, one activity might have students extract authentic data from the STATSCAN site (http://www.statcan.ca/english/Estat/estat.htm) to examine smoking

habits of 15 year olds across the world. Students would have to generate their questions about smoking habits and then query the database for an answer. Ideally one question would lead to another.

Guided discussion of critical thinking and technology integration is used to provoke undergraduate and graduate students into examining their own beliefs about teaching and learning. This examination of beliefs is often difficult for undergraduate students as they make the transition from student to teacher. Many undergraduate students are in the initial stages of forming a teacher identity and coming to grips with their role in the classroom. As a result it is difficult for them to develop meaningful activities instead of "busy" activities. Often these students do not have a clear sense of purpose for the activities they develop. They also lack knowledge of the curriculum. Undergraduate students have small pieces of the picture but at this stage of their career they lack the vision an experienced teacher would have of curriculum. In our face-to-face and online discussions the undergraduate students have many opportunities to ask questions and to develop a better understanding of teaching and learning. In addition, these students listen to the discussion (sometimes heated discussion) amongst the experienced teachers. Not all the teachers in the course are open to trying constructivist strategies in their own classes. This usually generates quite a bit of controversy as other teachers challenge the nonconstructivist teachers' beliefs about teaching and learning.

Regardless of teaching experience both groups struggle with the concept of technology integration. To assist in this concept attainment the students are presented with videotape segments of learning activities that incorporate technology. The videotapes used were purchased from the North Central Regional Technology in Education Consortium (NCRTEC) which is a subgroup of the North Central Regional Educational Laboratory (NCREL) (see NCRTEC's website http://www.ncrtec.org/). The examples are discussed and evaluated in terms of their ability to promote critical thinking and to take advantage of computer technology's unique attributes. This examination of example/nonexample technology activities prepares students for their major assignment.

Keeping with a constructivist perspective the major assignment for this course is meaningful and relevant for the student. The graduate students (inservice teachers) develop a project that can and should be implemented in their own class. For the undergraduate student this task lacks relevance and is difficult because of their lack of familiarity with the curriculum. Therefore these undergraduate students are paired up with teachers in the field who have been interested in technology integration but have not had the time to develop curriculum in this area. The cooperating teachers are carefully selected with the assistance of personnel in the surrounding school districts. It is imperative that these undergraduate students are placed with teachers that support constructivist pedagogy. The undergraduate student meets with the teacher to get background information needed for the project. In this discussion the undergraduate student can describe some of the activities presented in the course. Together the teacher and undergraduate student generate an idea for a technology integration activity that focuses on a specific curricular area. The undergraduate student is responsible for developing the project so that it will work with the technology and resources available in the school. This assignment presents undergraduates with an authentic task and they become accountable to someone else other than their instructor for the course. The teacher and undergraduate student meet face-to-face and online to discuss the project. Draft versions of the project are submitted to the teacher for feedback. The cooperating teachers view the relationship as mutually beneficial and in the end they have a product that can be used in the classroom. Some projects are better than others but nonetheless the result is a valuable learning experience for all those involved.

Conclusion

The course has varying amounts of success. Much of this seems to hinge upon the participant's beliefs about teaching and learning. Students that believe in constructivist approaches tend to enjoy the course and believe the class assignments are practical. Students that do not believe in constructivist approaches feel the course is far too theoretical and the assignments could never be implemented in their own class situation. There seems to be much more resistance from the high school teachers. Some of the hesitation stems from the infrastructure in place at a high school. Teachers are given 60-80 minute blocks of time to cover their subject making it difficult to pursue project-based activities. In addition, teachers of a particular subject area tend to have their own staff rooms thus little dialog is promoted between the teachers of different subject areas. This kind of dialog is necessary for the creation of interdisciplinary projects focusing on authentic tasks. But even without these obstacles there still are teachers who do not believe constructivist strategies could be used effectively to cover all the content that needs to be covered in a high school curriculum. If participants of the course strongly hold such beliefs there can be quite a

bit of tension in the class atmosphere. Sometimes that tension intimidates the undergraduates and can defeat the purpose of combining graduate and undergraduate students into one course. At the same time though this tension stimulates deeper introspection, students are challenged and they need to explain their beliefs not just assert them.

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INFUSING TECHNOLOGY INTO THE PRE-SERVICE CURRICULUM: HOW ARE WE DOING?

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Abstract: This paper reports on a project designed to change the way pre-service teachers use technology. A consortium of university and public school faculty are collaborating to improve pre-service technology integration skills by modeling those skills in their classrooms and in the field and requiring technology components for student field activities. A thorough needs assessment of the population was followed up with a plan to increase instructional effectiveness of faculty and Demonstration Teachers modeling for pre-service teachers.

Introduction – The Need for Change

Pre-service teachers will be the teachers of the 21st century. As such, they must develop the necessary technology knowledge and skills to prepare the next generation of students. If they do not, they will perpetuate the lack of technology expertise that is the national norm of the current generation of teachers (Moursund & Bielefeldt, 1999). Not acquiring these skills during their pre-service program will cost school districts greater hardships because they will ultimately have to bear the financial responsibility for expensive staff development. Pre-service and in-service education systems have struggled to keep up with the rapidly changing pace of technology development (Moursund & Bielefeldt, 1999). Since the publication of *A Nation at Risk*, student to computer ratios have improved from 125:1 in 1983 to 13:1 in 1998. Becker, et al. (1998), however, estimate that the total number of computers in private and public schools is slightly more than one per five students – a 15-fold increase in 15 years. Internet access has now been provided to eighty-five percent of schools and forty-four percent of classrooms (Jerald, 1998). These tools are influencing the way we think about, access, and use information. In an effort to prepare students for the information age, public schools are increasing access to these tools by putting more hardware and software in schools; connecting schools to the internet; and providing cable and satellite capabilities (Zehr, 1997; Zehr, 1998).

Having access to technology tools is only part of the answer. Teachers must become more knowledgeable about technology and be able to integrate these tools into their teaching and student learning projects. School districts throughout the country are making efforts to increase the use of technology through staff development activities and providing on-going technology support. However, this training must begin with pre-service teacher education (Wetzel, Zambo, Buss, & Arbaugh, 1996).

In a 1998 national survey, the International Society for Technology in Education (ISTE) surveyed schools, colleges, and departments of education (SCDEs) in the United States about how they were preparing new teachers to use information technology (IT) in their work. Among other findings, the institutions reported that most of their faculty do not model use of those IT skills in teaching, so therefore, most student teachers do not routinely use that technology during their field experiences and do not work under master teachers / supervisors who can advise them on IT use.

In 1998, a SouthEast and Islands Regional Technology Consortium (SEIR*TEC) survey concluded that that students do not know how to integrate various technologies into their teaching. The Georgia Department of Education (1998) published a technology needs assessment, which found that there is a large gap between the plans for needs and the actual uses of technology and the capacity of the present technology resources and infrastructure to meet those goals.

Carlson and Gooden (1999) surveyed 92% of the Georgia Southern College of Education students who had completed their student teaching experience over a one-year period to investigate how student teachers assimilated and applied technology. This study found that students felt comfortable using word processing and, to a lesser extent, email and the WWW - the only technologies they saw modeled by their professors.

All of these studies, national, state, and local, come to the same conclusions concerning the use of technology in teacher education. Overall these studies recommend that:
1. Technology should be integrated into all courses that pre-service teachers take.
2. Institutions of higher learning should identify examples of technology integration for all courses that pre-service teacher take.
3. College faculty, that teach pre-service teachers, should model effective uses of technology in their classroom.
4. Pre-service teachers need more opportunities to apply Instructional Technology during their field experiences under qualified classroom supervision.

Additionally, the Board of Regents for the University System of Georgia recently mandated curriculum changes in all pre-service education programs. Key elements of these changes include: 1) strengthen the content background of the pre-service teacher to meet rigorous academic standards; and, 2) assure that future teachers are technology-proficient and understand how to infuse technology into the curriculum to improve learning and achievement.

The Project

In order to address these mandated changes and to build an active learning community that bridges the gap between post-secondary institutions and K-12 schools in Southeast Georgia, a consortium was created. The consortium members include an institution of higher education, Georgia Southern University (GSU), GSU's College of Education (COE) and five local public school districts (LEAs). The public school districts include 27 elementary schools, 10 middle schools and 10 high schools.

This consortium was carefully crafted based on the memberships' history of cross-disciplinary collaboration and their potential contribution to innovative teacher preparation program reform that will enable future teachers to infuse technology into the classroom. Each member has unique resources available to support a shared vision of an innovative teacher preparation program and willingness to contribute to the comprehensive effort of improving teaching and learning with new technologies.

This consortium forms a new community of learners that provides sustained support for both the experienced and novice teacher. Further, it helps bridge the gap between college teachers, pre-service teachers, and K-12 classroom teachers by providing continuous professional development. This also paves the way for future teachers who might enter the profession through alternative certification by supporting them as they build the experience they need to become technology-proficient teachers.

This project was designed to document and identify specific gaps and weaknesses in the delivery of instruction to pre-service teachers and to support comprehensive teacher preparation program improvements that infuse technology throughout the teaching and learning experience of all future teachers. The goal of the project is to develop technology-proficient future educators by providing professional development for college faculty and public school demonstration teachers through the integration of technology into the curriculum. This goal is a part of a comprehensive restructuring of GSU's teacher preparation program designed to improve teaching and learning with rigorous academic standards for all students. This goal will be met through an extensive needs assessment; the identification and development of "Best Practices"; extensive training of college faculty, student teacher supervisors and demonstration teachers; and, revision pre-service education curriculum and field experiences. Specifically, this project addresses the following objectives:

1. Assess needs and opportunities for technology program improvements in the pre-service teacher curriculum and course content.
2. Identify and develop a core of strategies and techniques ("best practices") for dissemination to faculty, demonstration teachers and pre-service teachers.
3. Train College of Education methods and practicum faculty to integrate technology into their lessons and to model the effective use of technology.

Project Activities

The project is being implemented in three phases: I) assess needs and identify opportunities for infusing technology into the teacher preparation program, II) develop innovative strategies and techniques to respond to these needs, and III) provide faculty with professional development to integrate new technologies into their courses and model technology-proficient instruction. Within these three phases, the project will be divided into specific tasks.

Task 1.

An extensive needs assessment began in Task 1. Previous to this project, Carlson and Gooden (1999) had assessed the state of technology integration in the College of Education among the pre-service teachers and the faculty. Major findings were that the only technology that was available and used across the board was word processing. Internet technologies had some medium measure of use. The opportunities for this group clearly rests in extending the types of technology used in instruction and application.

To address the other groups working closely with pre-service teachers, both consortium and non-consortium Demonstration Teachers, highly qualified, specially designated public school faculty, were surveyed to establish their technology strengths and areas for possible improvement. One hundred seventeen (117) out of 262 surveys were returned for a 45% return rate. Ninety percent (90%) of the surveys were from females. Consortium teachers comprised 77% of the returned surveys, both consistent with their proportions among all Demonstration Teachers. Fourty-five percent (45%) taught elementary children, 24% middle school, and 31% high school. Experience at each level was between 11 and 12 years teaching. Seventy percent (70%) held a Masters degree or higher. We were interested in the technology training and support for these teachers. Approximately half (46.2%) had completed Georgia's InTech, advanced state sponsored technology training. InTech was also the most recent technology training for the Demonstration teachers (41%), with school-based training (24%) and the Georgia state sponsored Regional Education Services Agency (RESA) training (21%) well behind. Only 3% listed college/university courses as their most recent technology training. In-school technology support was most often provided by the media specialist (37%), with county specialists (19%), in-school technologists (15%), and RESA specialists at 14%.

	0%	20%	40%	60%	80%	100%
High School	74.3	22.9	1.4	1.4		
Teacher Preparation Course	54.3	35.7	8.6	1.4		

Graduate Education	50.8	44.6	1.5	3.1		
Staff Development/ In-service	7.7	32.7	19.2	16.3	18.3	4.8
Self	1.0	29.1	17.5	16.5	30.1	5.8

Table 1: Technology skills acquisition for Demonstration Teachers.

Table 1 shows Demonstration Teachers' responses when asked where they acquired their technology skills. Both teacher preparation and graduate education played relatively minor roles in their skills acquisition. Clearly, this needs to be improved.

	Not Available	Available in Building	Available in Classroom	Available in Home
Word Processing	0.0	42.3	89.7	89.7
Database	1.8	44.9	77.9	78
Spreadsheet	0.9	41.3	83.5	80.5
Desktop Publishing	7.7	45.3	62.5	75.0
Electronic Presentations	6.9	66.7	39.3	31.4
WWW	0.9	48.2	63.7	76.7
Email	0.9	44.3	61.1	73.3
Scanner	16.3	64.4	12.6	28.0
Digital Camera	17.9	70.8	10.4	8.5
Galileo	21.6	59.1	32.9	29.5
Videodisc	44.0	47.6	10.6	3.6
Satellite TV	19.8	59.5	27.8	18.0
GSAMS	50.0	49.9	1.4	1.4
Scientific probes	87.7	9.2	3.1	0.0
Graphing Calculator	53.7	30.6	10.9	15.9
Electronic Notepad	78.9	12.7	5.6	9.8

Table 2: Availability of Technology for Demonstration Teachers.

Table 2 shows that technology, with the exception of highly specialized technology, is available to most teachers somewhere. The lottery money spent on technology has filtered down to the schools in rural southeast Georgia. However, more can be done to improve access to technology, especially in the classroom. Notable was teachers' access to office productivity tools and to the internet at home.

	Average	Standard Deviation
Word Processing	3.7	0.5
Database	2.6	0.9
Spreadsheet	2.6	0.9
Desktop Publishing	2.8	1.1
Electronic Presentations	2.3	1.1
WWW	3.2	0.9
Email	3.3	0.8
Scanner	2.1	1.1
Digital Camera	2.1	1.1
Galileo	2.1	1.2
Videodisc	1.7	1.0
Satellite TV	2.0	1.6
GSAMS	1.4	0.7
Scientific probes	1.1	0.5
Graphing Calculator	1.5	0.9
Electronic Notepad	1.2	0.7

Table 3: Demonstration Teachers' Self-reported Technology Proficiency

Demonstration teachers' technology proficiencies (Table 3) were similar to the proficiencies previously reported in other studies and similar to those reported by pre-service teachers. The only technology that the teachers showed confidence with was word processing, followed by internet-based technologies.

From these needs assessments, we determined that access to technology was adequate and improving, but can be further improved with additional allocation of resources. This observation is offered because access is a prerequisite to infusion, however this project did not propose to address problems of this nature. Teachers still do not have the proficiency in technology use required to integrate the technology into their lessons. Therefore the need is to train the teachers both in use and integration skills simultaneously.

Task 2

The Project Team has set up a Web site to provide information to all project participants. Currently the Web site provides
1. an overview of the COE Technology Infusion Project,
2. local resources (hardware and software) that are available to faculty and students, and
3. links to Web sites that provided resources for integrating technology into the instructional process.

Web sites of additional instructional resources will be added to the list when suggested by participants.

The Project Team has consulted with educators in the consortium (e.g. public school curriculum directors, principals, media specialists, COE faculty, and Demonstration Teachers) in order to start to identifying teachers who are currently infusing technology into their daily lessons. During the Spring semester, appropriate Project Team members will visit the technology-proficient teachers to discuss and observe their practices in their area of expertise

The Project Team set up a series of faculty workshops that were delivered during the Fall Semester. The topic for each of the workshops was developed by input from faculty. The workshops delivered so far are:
1. *Available Resources*. This workshop provided the faculty with the resources (both hardware and software) that are available to them, their students, and the College's Demonstration teachers. Several Web-based Resources were also discussed.
2. *Search Techniques*. This workshop provided faculty with information on how they could effectively search the Web. A comparison of Search Engines was discussed with an emphasis on those that are the most effective in an Educational setting. Boolean logic and how it applies to searching was also discussed.
3. *GA InTech Program*. The Director of the Teacher Training Center, located in SE Georgia, provided an overview of the GA InTech Program. InTech, GA Framework for Integrating Technology, is designed to support the existing P-16 curriculum using technology as a catalyst for changes in the teaching and learning process. All Georgia teachers are expected to have received InTech training by June 2001.
4. *Integrating the Web into the Instructional Process*. This workshop provided the faculty with information on how the WWW could be integrated into the instructional process. Included in the discussion was information on how Web Sites could be downloaded for use in classroom without direct internet connections.

This series of workshops will continue during the Spring semester and will include topics as identified by the faculty and the evaluation process. Public School teachers who are currently infusing technology into their classes and have been identified, by their county school district, as exemplary teachers will also be brought to campus to share their experiences with both faculty and pre-service teachers.

Task 3

As a follow-up to each workshop, Project Team members will identify technologies that will enhance individual courses. This will include specific classroom activities and techniques for modeling the use of various technologies. We are currently developing a database of instructional lessons, that make use of technology, that are being delivered in the school districts that are part of the consortium. This database will allow COE faculty who are in charge of practicum students, to make observation assignments for their students. Future plans include having this database available on the project web site so that it can be searched by all project participants.

Evaluation is an integral component of the overall program. It is both formative and summative by design. Information from the evaluation will provide performance feedback that will help guide the development of strategies for full-scale implementation of teacher preparation program improvements and assure that the program goals and objectives are met. Both qualitative and quantitative data will be collected on a periodic basis to inform all stakeholders of progress toward achieving the intended outcomes as well as establish clear benchmarks for documenting future improvements.

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Preparing Teachers for the Digital Age: Implementing a Dynamic Model of Pedagogical Change

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Abstract: This paper presents the concept and beginning work of one of the Preparing Tomorrow's Teachers to use Technology research grants. The Department of Education initiative is to infuse technology into the teacher education programs to prepare more technologically proficient teachers for future classrooms. The model created by a consortium of 3 public universities in rural Western Pennsylvania looks to infuse technology into the pre-service teachers core curriculum and several teacher education programs. Some 1,500 future teachers per year placed throughout the U.S. and seven foreign countries will be affected by this change. Four goals will be accomplished: 1) Instructional Technology will be moved from the periphery to the core of our curriculum. 2) Future teachers will apply and integrate Instructional Technology into the teaching/learning process. 3) Additional Faculty, instructional designers, and technical support staff will assist with the transition. 4) The consortium will provide the infrastructure support needed for teacher preparation in the digital age. Evaluation strategies will include baseline and follow-up surveys, student portfolios, interviews, and focus groups.

Introduction and Problem

The Commonwealth of Pennsylvania certifies approximately 13,000 teachers yearly and each one must be prepared to teach in the 21st century. These students must master the skills required by a digital age (problem solving, inquiry, and reflection) and have the ability to function in a workforce dependent upon access, utilization and application of information technologies. Today, at the turn of the century, there are already teaching position announcements posted only on the Internet--it is clear that computer illiterates need not apply.

Teachers teach the way they were taught, but unfortunately, they have not been taught in a manner that demonstrates technology infusion. Instead, they have traditionally been taught Instructional Technology in a separate, "isolated" course in the education curriculum. These students will face an uphill battle to integrate instructional technology effectively in content areas because they never see it modeled in their core and content courses in college.

There are many reasons why some college faculties have been slow to integrate technology into their teaching. Certainly, one significant reason is that technology in the classroom changes social relationships.

Some faculty that are exhilarated by the change brought about from integrating technology in their teaching, while others are concerned about how technology impacts their authority, control of students, and knowledge of the teacher's role (Cuban, 1999). Other reasons include: an academic tradition that values deliberation and incrementalism, lack of suitable training, lack of technical and administrative support, lack of systemic incentives (tenure and promotion), traditional pedagogical beliefs, and the lack of hard evidence that technology can serve their needs and make their work move effective and interesting (Albaugh, 1997, Freberg, 1995, Olcott, 1999, Oppenheimer, 1997, OTA, 1995, Spotts, 1999). It is clear that getting faculty to use technology remains a challenge (Olsen, 1999).

To promote the effective use of technology in teaching and learning, we need a new approach. Hence, President Clinton's Educational Technology Initiative appropriately made training and support for teachers to help students learn through computers and the information highway one of the four pillars of his program. The teacher workforce will experience a rapid turnover in the next decade. The need to fill a demand for 2.2 million new teachers is fast approaching, and the question needs to be asked: "Will they be ready for the digital age?"

Project Design

Clarion, Edinboro and Indiana Universities of Pennsylvania are committed to training teachers for the new millenium. These universities have worked together since 1998 as partners in the ADEPTT Consortium (Advancing the Development of Educators in Pennsylvania Through Technology Training). The ADEPTT consortium was funded by the Bell Atlantic and Microsoft corporations to provide foundation training in instructional technology for faculty and K-12 teachers. The consortium is now attempting to go one step further by infusing technology into the pre-service training of all their teacher education students. All three universities agreed on the following goals to be accomplished over a three-year period:

Goal 1: To infuse instructional technology more deeply into the teacher curriculum in both education core courses and selected majors.

The foundation of this goal is eleven key competencies that reflect the recommendations of NCATE and the Pennsylvania Department of Education. The competencies include the following:

- operating systems management
- word processing
- spreadsheets
- web browsers
- email
- presentation software
- databases
- multimedia packages
- video conferencing
- moderating chat rooms
- Internet in teaching

To achieve this goal, we will pursue four objectives, each one building on the preceding as it moves us to a teacher preparation program that has technology infused throughout the curriculum.

First, the grant will train faculty to effectively and appropriately use and teach the eleven key competency skills. This is the starting point of our effort and builds upon the foundation training for faculty provided by the existing consortium of the three universities known as ADEPTT.

Second, we will work to have university faculties model how to teach effectively with technology in education core courses and subject area courses. This objective is critical to change the teaching paradigm so future teachers will learn in a technology-enhanced manner and will be better prepared to teach in this way.

Third, the faculty will be encouraged and supported to create assignments within education core and subject area courses based upon the appropriate use of the eleven competencies. Through its active learning approach, this objective reinforces the acquisition of needed skills by the pre-service teachers. It also provides clear examples for pre-service teachers to use in their teaching careers.

Finally, the end result will be revisions of course syllabi to reflect and recognize the integration of technology into the curriculum. Wherever feasible, such courses will be designated as /T/ courses to identify their technology emphasis.

Goal 2: Integrate instructional technology in the consortium's pre-service observation and field experiences. These experiences provide a gradual process of immersion in which the pre-service teacher sees and "experiences" the K-12 teaching environment. During these exercises, we will take steps to assure that students receive a triple exposure to instructional technology—(1) seeing how it is used in the classroom; (2) using videoconferencing technology to enrich observations and field experiences, and (3) incorporating technology through moderated chat rooms and threaded discussions to help students share their experiences and insights.

In 1997, IUP received the United States Distance Learning Association award for the best distance learning program in the nation. Funded by a FIPSE grant, this program used two-way interactive compressed videoconferencing. Pre-student teachers at IUP were able to unobtrusively observe classes in progress in K-12 schools. Faculty helped explain what was occurring and pointed out tips and strategies. Following the observations, students were able to talk with the K-12 teachers over the video link to discuss what they had seen and to ask why a teacher used particular techniques and methods. Now that the FIPSE grant has concluded, we have ideas, lessons, methods, and the experience to achieve this second goal.

Goal 3: Provide a variety of professional support of opportunities for faculty and pre-service teachers. A critical factor in introducing technology into any environment is the support of peers and technology professionals. Support will come from "teaching circles" which will provide an opportunity to establish and sustain instructional technology networking and peer mentoring opportunities. There will also be consulting faculty who will be able to provide training and one-on-one assistance to their peers applying instructional technology to teaching and pre-service teachers learning to integrate technology into their beginning lessons. The universities are also working to strengthen their help desk services for faculty and students and to expand basic foundation training through the ADEPTT consortium and instructional programs. For example, IUP's "incubator" computer laboratory in the College of Education provides valuable professional and technical support and is a program that will grow to help support these efforts.

Goal 4: Enhance the technological infrastructure of the consortium members to better support project initiatives. A lack of sufficient infrastructure is a major impediment to the infusion of technology into the teacher preparation curriculum. Computer labs will be upgraded so that advanced computing skills can be developed among the graduates of the three universities. The enhanced technology infrastructure will allow students to work in a networked environment with student network spaces, as well as network space for courses to work through. Increasingly, school districts are looking for employees who are familiar with a networked environment. The three universities are committed to ensuring their faculty have adequate multimedia computers to facilitate integration of technology into their courses. Faculty are also actively involved in technology planning. The three universities each have variations of the American Association of Higher Education's Teaching and Learning Technology Roundtables to encourage faculty input on campus technology development.

The Evaluation Component

Baseline data will be collected on the current use and implementation of technology in the teacher preparation curriculum of the three universities. This will be done by surveys with pre-service students, faculty and recently graduated in-service teachers. There will also be an analysis of syllabi. Building on existing Instructional Technology foundation training, we will offer new workshops on Instructional Technology application and integration. The latter workshops will primarily be in the second year of the project. One-on-one consultations and training will also be provided, and evaluations will be conducted of both group workshops and individual consultation after each session. There will be curriculum revisions, courses enhanced with instructional technology, by the third year.

The data from years one and two will be compared to collected syllabi, surveys and portfolios of year three of the project.

Conclusion

The positive aspects of the model are recognized throughout Pennsylvania and on the national level. Pennsylvania Governor Thomas Ridge has made technology and its use a major initiative in K-12 education. Ridge's three-year, $132 million Link-to-Learn initiative is aimed at expanding the use of technology in the

classroom, including new and upgraded computers for schools and technology training for teachers. Nationally, the Clinton-Gore administration has pushed for connectivity to the World Wide Web for every American. Indeed, their administration has the goal of making computers, computer related multimedia, and the World Wide Web standard tools for teaching and learning.

The successful implementation of this model will demonstrate that technology can be infused into all areas of the teacher preparation program. The three schools involved graduate 1500 teachers per year. With this model each graduate will be able to utilize technology in their teaching and be leaders for change in the wired and connected school districts which hire them to teach.

The problems associated with this project are of national concern and seem to be increasing in scope. Consequently, this three-phase project will add important information to the literature of technology and its integration into the teacher preparation curriculum. If the model is successful, it has the potential to be replicated at other teacher preparation programs, particularly since it will already have been tested at three institutions with different programs. Thus, other institutions will be moved toward integrating the use of technology into their teacher preparation programs.

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Increasing Instructional Technology Competencies for Faculty and Students in an Education Preservice Program

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Abstract: Education Faculties around the world continue to struggle to develop instructional technology strategies to build and promote their respective undergraduate Teacher Education programs. Successful implementation of instructional technology (IT) is perceived as to allow our revised programs to produce teachers well able to bring success into our 21st century schools. In order for pre-service teachers to integrate technology as a deep and meaningful element of new instructional practices, teacher education faculty need to both model and support technology as an integral part of their instruction. As the pace of technology accelerates further in and with education, our Faculty's Instructional Technology Committee continues to develop and refine its 'Vision' of how the technology of today can seamlessly be integrated into the instruction of the future. Constructed and represented here are specific goals on how our faculty hopes to approach the overwhelming need for instructional technology competencies in our emerging educators. Our Faculty of Education continues its worthwhile struggle to integrate technology into all levels of instruction, into all of its Teacher Education Programs, and in sharing this struggle, we hope to give insight to others in similar circumstances.

Setting the Context

Saskatchewan's unique demographics, rural economics, and progressive nature, have prompted essential change in the provincial Education system recently. With an inadequate number of graduating teachers each year emerging from either of the province's universities, a growing number of students in remote rural locations, and a lack of instructional resources and educational dollars in our already crowded urban schools, Saskatchewan Education continually struggles to look for viable options toward more efficient instructional methodologies. As we battle to maintain the integrity of our educational programs, recent reactionary developments have risen from our province's necessity to compete in a widening global arena.

It is becoming Saskatchewan Education's mandate to provide the province's school-aged students with a diversity of educational opportunities effectively leading to their future success in the Information Age. Evidence of this directive is apparent in Saskatchewan Education's development and creation of the Evergreen Curriculum (http://www.sasked.gov.sk.ca/docs/evergrn.html), a dynamic web site hosting the province's entire K-12 curriculum and approved educational resources. With the development of the Evergreen Curriculum, all residents of Saskatchewan, Canada, and the world, can view the on-line curriculum documents, analyze lesson plans and resources, and dynamically assess our province's educational 'product'. Further evidence of Saskatchewan's mandate manifests itself in the province's commitment to Distance Education. Distance Education programs continue to develop in rural and urban settings, and Saskatchewan Education continues to pursue partnerships with its educators, universities, multimedia design companies, and local Tel-Co providers. With both the on-line accessibility of our curriculum resources, and the commitment to further Distance Education programs, we can begin to extrapolate what this will mean for the future of our traditional schools.

It is increasingly clear that the teacher of tomorrow can no longer rely on outdated methodologies to effectively teach the 21st century student. William Clark (1994) states in his article referring to the "high-tech classroom of the future" that the evolution of the classroom "will be characterized by the steady replacement of traditional basal programs by multiple media programs and collections of supplemental

materials. Some of these materials will be classroom resident. Others will flow through various manifestations of the information highway" (Clark, 1994, p. 62). The roles of teachers are changing, as are society's expectations upon them. Teachers are now expected to incorporate instructional technology into living practice with IT skills leading the way to success for their students. As requests for educational reform increase, comprehensive changes in traditional teacher roles seem an inevitable part of the total restructuring package.

Distance Education, multimedia, web-based learning, instructional technology; these are terms commonly heard by the average teacher, but rarely completely understood. Not only are the technologies themselves misunderstood but more significantly, their underlying pedagogical implications are scarcely realized. Marita Moll, a strong critic of information technology, states "I believe that information technology can be extremely empowering, extremely motivating and extremely conducive to creating new and exciting classroom environments. However, we need to develop a better understanding of how new technologies will effect our learning environment -- both positively and negatively" (Moll, 1997). This criticism comes as tremendous amounts of dollars continue to be allocated towards technology upgrades for schools. However, at the same time there are lesser dollar amounts contributed towards teacher training in learning theories, research of instructional technologies, or investigations into technology learning outcomes. Ironically, due to the unprecedented speed of technological change, administrations can only reasonably push for the technologically 'average' school. However, in the same push, teachers are left merely adequate in their instructional skills and understanding. Still, the wheels of change roll relentlessly.

As the educational infrastructure continues to evolve in Saskatchewan and the world, Teacher Education Programs are under tremendous pressure to continually improve their 'product'. Our faculty must continually analyze the successes and failures brought by these times of technology-induced growing pains. Our vision remains strongly founded upon technological and pedagogical diversity. However, vision alone is not nearly enough for change to occur. Collectively, faculty must address the shortfall of technological competencies in both graduating students and faculty members. It is with the cold realization of these deficiencies, that planning may commence toward necessary mechanisms of change. Luckily, and I strongly believe that, "we are fortunate to work in a faculty where collaboration and change are the Maeers, Browne, Cooper, 1999)

The above mentioned paper, written by professors from our Faculty last year, details the struggle to produce technologically competent graduates through the University of Regina's Teacher Education program. The goal at this time, as it continues to be, was to expose all graduating students to a varied representation of educational technology theories, research, resources, and pragmatics. Up until 1998, only the slight majority of students were able to take the offered "Computers in Education" class as an elective. Due to course limitations, many students were unable to fit the class into their programs. With the belief that "offering a single core course in computer technology for education might imply that computers were an 'extra' feature in education rather than an integral part" (Stevens, Lonberger, 1999), the Faculty responded with non-credit technology modules that became a requirement for all graduating students. The reasoning for this is to ensure basic computer competency for all emerging teachers of our program. The paper "Pedagogically Appropriate Integration of Informational Technology in an Elementary Preservice Teacher Education Program" (Maeers, Browne, & Cooper, 1998) shares with you those successes.

Faculty Vision and Instructional Technology Innovations

Only one year has passed since faculty members set forth our Faculty's vision for instructional technology In part, the visioning process listed key goals in the implementation of instructional technology. Such goals included the role of IT in several of the following areas: addressing diversity and equity issues, continued curriculum support, advanced web-quest & electronic portfolio development, WebCT (Web-based course tools) course development, and the revamping of the Faculty of Education homepage. Only one year later, great successes have been achieved in all of these areas. However, as technological integration undoubtedly is a moving target, our IT goals have also begun to shift towards higher expectations.

Current Goals and Developments

Goals and innovations in a Faculty of Education must be relevant for students and faculty, as there is a strong necessity to acquire skills and learning theory in order to effectively infuse technology into instruction. However, the path from here to there is not an easy one. In collaboration with the IT Coordinator, the Instructional Technology Committee (ITC) is interested in proposing a dynamic set of goals for the Faculty. The following is a short list of the renewed goals formed in an effort to increase technology competencies throughout the Teacher Education Program. Also included are goals which have not yet been proposed, but are being investigated as to their positive effects on the Faculty's IT future.

Technological Diversity at the Skills Based Level

Development, enhancement, and stimulation of information technology knowledge and skills of students and faculty in relation to operating systems, software applications, communications software, Internet and library resources, presentation software, instructional design software, and courseware, are to be fully realized. Faculty will also be able to use more specialized software such as test-generators, telecommunications software, grade managers, graphing programs, and databases in the execution of their personal and professional duties including professional development, teaching, research, and service. Both faculty and students will use technology, both hardware and software, as personal and professional tools. This will promote technology integration into the majority of courses, as well as to promote faculty modeling constructivist approaches to instruction. To support this development, the IT coordinator will organize ongoing technical workshops to supplement the instructor's knowledge and skills base. In conjunction with workshops, faculty will receive continuing support in the guise of two dedicated Faculty of Education technicians, and frequent visitations and morale support by the IT coordinator.

Technology Diversity in Theory and Practice

Continued development of a theory-based approach to instructional technology implementation is absolutely necessary as a to serve as the backbone to all faculty IT proposals, research, service, and instruction. Moreover, this type of methodical implementation of IT is to be fully modeled, demonstrated, and understood by our pre-service teachers in order for them to take a careful approach to IT integration in their future careers and schools. Faculty and students must continue to consider carefully the works of learning theorists in conjunction with modern practical developers in Instructional Technologies. A communications model is essential here in developing, understanding, and applying theories into personal educational philosophies. This type of theoretical development is well served through continued development of our core classes (ECMP 355) and advanced classes (ECMP 490) in educational technology. Also, already three graduate studies classes have been offered which have an educational technology foundation, and there is continued development towards a graduate studies program specializing in educational and instructional technologies.

Support of On-Line Course Creation

Technical and instructional support of on-line, distance related and other, course creation for faculty featuring a variety of HTML editors, and especially WebCT, is strongly supported, and will continue to be supported in our Faculty. Support of on-line course creation tools will be thorough throughout the Faculty and will be adjusted accordingly to the goals and skills of the primary developer (faculty member). This support will include workshops in basic and advanced HTML, HTML editors, and WebCT development. For our technologically more prepared faculty, Java based development will also be offered and supported. Our Education technicians and IT coordinator are dedicated to support faculty ventures in web-based development to support instruction. Ongoing support in this area will lead to greater technological competencies for faculty, and with our careful regard to developmental principles, this will also lead to better, more diverse, instruction for our preservice teachers.

Essential Partnership with Library Services

The Faculty of Education has formed a partnership with the Education/Fine Arts library and Instructional Technology services in order to supplement and enhance course development and to provide

basic and advanced instructional support. The Education/Fine Arts library has partnered with the IT coordinator and IT committee to provide the development of web, print, and multimedia instructional resources to supplement both terrestrial, and on-line course development. Also, through this partnership, there has been a provision for the development of a software media center where students and faculty are able to demonstrate the use of a variety of current media resources. In conjunction with this, library services will also catalog and provide educational software at request for faculty's use in the classroom, and for the students' use in their field experiences. In return, borrowers are required to both test and evaluate the educational value of the software. This will increase both accessibility and interest of instructional software, as well as providing proper assessment of such software's validity in formal learning situations.

Increased Exposure to Educational Technology Innovations and Practices

Through the office of the IT coordinator, the Faculty of Education will provide more opportunities for faculty and preservice teachers to be exposed to developmental practices in the areas of educational and instructional technologies. This exposure will be developed through two basic key strategies through on-campus and off-campus experiences. Software and hardware 'fairs' will be coordinated biannually. This will allow for the leaders in educational technologies and publishers or developers of educational software to show their 'wares' to the eager faculty and students. This will enhance the faculty's awareness of what innovations exist already and will allow students to experience the innovations first-hand rather than to have had merely a text-book or magazine approach to understanding technological innovation. Also, opportunities will be presented for faculty and staff to view instructional technology strategies in a school setting. This will occur by having either guest speakers (key administrators, educators, etc.) invited to speak about 'what they are doing in their classroom' in terms of technology and instruction, or moreso, to have students and faculty visit either on-site or virtually, where instructional innovation is actually taking place. This grounding of theories with practice will give faculty and students a better 'picture' of what is already available or what needs yet to be developed, and this will create an opportune environment for developing with, or against, already current technological practices.

Increased Course Development in Instructional Technology

Increased development in core classes of Computers in Education including an advanced class continue to be fully developed. Additionally, the development of instructional technology modules complete with dynamic on-line resources will continue to support the needs of all teacher education students. As the classes in 'Computers in Education' are not yet mandatory, the underlying principle of developing the courses and non-credit modules is to provide the opportunity for all preservice teachers to have a strong exposure to technology in instruction. This mandate is due to clear indicators that our school boards look first to hiring teachers who are able to develop innovative instruction in their classrooms primarily based on technology. This need is strongly evident in the requests from school boards, hiring agencies, and educators for graduate classes to be offered in educational technologies. The requests have already spawned three separate graduate courses in IT, and there is definite need to diversify in several more IT related areas. School boards are looking for candidates with a strong IT experience in the classroom, or in a practical setting. We try to offer our preservice teachers the best of both worlds.

Development of an Instructional Technology Development Centre

The development of an exclusive Instructional Technology Development Centre and Sampling Lab, complete with full multimedia authoring capabilities based on high-end multimedia workstations, will soon be fully realized. This Instructional Technology Development Centre will be developed in cooperation and consultation with media experts, instructional designers, and most importantly, experienced educators. The purpose of the center is to give faculty and students first hand experience and the resources to explore multimedia instructional design. The structure of the lab will be continually renewing so as to model most recent instructional technologies. In the development of the center, we will seek partnerships with multimedia design companies such as Macromedia and Adobe. Students will be able to sample, study, learn, and become proficient in specific lateral market software prevalent in the field of instructional and multimedia design. Parallel to this development, the Faculty of Education may seek to include graduate and undergraduate courses specifically geared to providing theoretical and practical

foundations of instructional design. The tandem relationship of both theory in courses, and practical design in the lab components, will further supplement the faculty's overall IT goals, and will provide many students with a specialized background in one of the key areas of educational technology.

Partnerships with Industry, Telecommunication Providers, and Government Education

The Faculty of Education will explore the possibility of a partnership with Industry, local Tel-Co's, and Saskatchewan Education, with the purpose of developing a simulation distance education lab. This simulation lab will help to effectively train pre-service teachers in the methodological and practical processes underlying distance education delivery, as well as to help to have the students internalize the technical aspects of this emerging technology. Participants will be able to model and experience the benefits as well as the shortfalls of the various approaches to distance delivery. The lab will allow students and instructors to actually simulate both the sending and receiving experiences of a distance education environment. The design of the center will allow for the students and instructors to explore first-hand a diversity of opportunities in distance education fundamentals. Both the traditional delivery model for distance education will be explored, as well as the emerging communications model.

Continual Assessment, Evaluation, and Development of IT goals

The continual assessment of instructional technology needs and goals of the Teacher Education Program, both in terms of faculty and students, is essential. This assessment should be linked explicitly with the Saskatchewan Education needs assessment indicators, as well as with our Faculties' mandate for continuing excellence in our Teacher Education Program. The faculty must also look towards external sources to develop strategies in terms of instructional technology and related pedagogical practices even those that the local K-12 bodies have not yet embraced. Workshops, instructional strategies, and skills adjustments will be administered appropriately. Also, strong communication between school boards, provincial governing bodies, relevant national and international organizations, and educators is essential to our growth as a respected center for Teacher Education. In light of such rapid change and development in the field, the faculty will allow flexibility in the IT model. The flexibility is warranted in order to adapt to new instructional technologies as they emerge, and to help develop new technologies in teacher education. Inevitably, this will effectively allow for our Faculty to gain a place on the forefront of educational technology and Teacher Education.

Summary

There is no tried and proven method in which to develop technological competencies in our respective situation. In the world of educational and instructional technology, enduring expertise is an exceptionally rare commodity. We are forced to become leaders in our own right, and hope to share our story, whether successful or not, with other leaders and innovators. As our faculty is dedicated to the principles of effective education, they are flexible and accepting of this model of change. There is really no other choice but to remain flexible in this rapidly changing era. However, to be more effective in nurturing change, administrators must still be aware of common principles that apply to all types of education and professional development. We must still provide for our faculty and students a comforting and confident environment for evolution of learning to occur. With the increase of confidence in technology, there will be an unsuppressed, yet educated, growth in enthusiasm for the integration of technology into the classroom. It is when this enthusiasm becomes widespread, that we will see effective change and real integration of technology into the learning environment. However, confidence in technology is not easy to embrace. Confidence comes only after we can develop a significant infrastructure to support both the instructional needs and the technical needs of our faculty, staff, and students. The needs of both groups must be acknowledged through a diversity of approaches to gain an effortless self-assurance in which to succeed. When we are confident enough to accept our failures, we will be confident enough to succeed.

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Creating a Dynamic Model for Educational Technology in a Field-Based Teacher Education Program

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Absract: The program described below, Learning and Integrating New Knowledge and Skills (LINKS), addresses national, institutional, and teacher education goals as we prepare pre-service teachers to use a variety of technologies to enhance student learning. LINKS redesigns the teacher education program within the Professional Development School (PDS) at Texas Woman's University (TWU) to address the technology proficiencies desired by the schools, recommended by the National Council for the Accreditation of Teacher Education (NCATE, 1997b), and delineated by the professional technology associations. The project encourages faculty to explore new technologies and provide a model of technology integration in their curriculum delivery. It also builds the awareness of mentor teachers regarding the instructional possibilities of technology so that these mentors are more open to pre-service teachers who bring technology into their classrooms.

Introduction

The Teacher Education Reform Movement has been at the forefront of debate in colleges of education for many years, and questions about how best to integrate technology

into teacher education programs are often at the center of this debate. Recommendations range from efforts to convince student teachers to use e-mail to programs designed to infuse technology into every aspect of the teacher education curriculum. E-mail, listservs, and electronic dialogue journals are a few of the recent innovations tried by teacher education faculty in attempts to combat the isolation that pre-service teachers often feel. Virtual workshops, out-of-field certification programs, and add-on technology courses have all been implemented with varying degrees of success. Finally, plans to integrate technology throughout the teacher education curriculum have been reported in increasing numbers over the past few years (Drazdowski, 1998; Parker, 1994; Schrum, 1998).

The efficacy of many of these efforts has been called into question. According to Shaw (1998) in his *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, "a large scale program of rigorous, systematic research on . . . educational technology . . . will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12 schools" (p. 115). In spite of these reservations, Shaw warns that "limitations in our current knowledge must not be used as an excuse to allow our schools to fall further behind other information-based institutions" (p. 125). Dusick (1998) and Roblyer (1998), among others, agree. While Dusick provides an egalitarian perspective arguing that computers must be placed in schools so that all students will have access (p. 12), Roblyer basically asserts that technology is here to stay whether or not we are prepared for it: "We have a multimedia future, the task at hand is to become fluent in our new native tongue" (p. 53).

If, as Shaw, Dusick, Roblyer, and others suggest, "speaking" technology is to become as essential as reading and writing, then plans that provide for the seamless integration of technology into teacher education programs seem most viable, at least in terms of society-wide impact. This paper describes one such effort designed to introduce pre-service teachers to educational technology within an integrated context of meaningful learning. This context is a field-based teacher education program, and the technology indicators are tied to specific requirements within that program. The program described below is supported by a U. S. Department of Education implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org).

The LINKS Program

The Learning and Integrating New Knowledge and Skills (LINKS) Program addresses the four goals of *Quantity*, *Quality*, *Equity*, and *Change* as we prepare pre-service teachers to use a variety of technologies to enhance student learning in rural, urban, and suburban settings. LINKS redesigns the teacher education program within the Professional Development School (PDS) at Texas Woman's University (TWU) to address the technology proficiencies desired by the schools, recommended by the National Council for the Accreditation of Teacher Education (NCATE, 1997b), and delineated by the professional technology associations. The project encourages faculty to explore new technologies and provide a model of technology integration in their curriculum delivery. It also builds the awareness of mentor teachers regarding the instructional possibilities of technology so that these mentor teachers are more open to pre-service teachers who bring technology into their classrooms.

These efforts are reflective of TWU's strategic plan as it relates to the preparation of future teachers and support for incorporating technology into higher education instruction and delivery. Technology integration is already an intrinsic part of the TWU PDS as students document mastery of specific technology skills within the context of required coursework. This integration will be further expanded through the implementation of this proposed LINKS program.

Current Technology Integration Program

The current technology integration program was developed based on the findings from the Basic Technology Competencies for Educators (Flowers, 1997) and has been an integral part of the Professional Education Sequence at TWU for the past two academic years. The four cornerstones of the technology integration program are (a) Foundations, (b) Connectivity, (c) Productivity, and (d) Integration. All pre-service teacher education students provide documentation of various skills related to these four areas as they progress through Intern levels I, II, and Residency. A brief description of the four areas and indicators of mastery is provided below. These areas are not intended to be mutually exclusive, rather they are integrated into the context of the field-based experience and requirements throughout the three-semester course sequence.

Foundations

This program component addresses knowledge of computing systems, develops basic skills for computer operation, examines the evolution of technology, and encourages users to begin to think with technology. Additionally, the social, legal, and ethical issues pertaining to technology use in an information society are addressed. Information Technology Service personnel and library personnel provide an overview of University technology resources.

Connectivity

During the beginning of their Professional Education sequence, this program component provides students with the information and skills needed to make both local and remote electronic information connections. Both the University system (Venus) and the use of a World Wide Web browser (Netscape) are utilized by students for e-mail and connectivity projects which include tele-mentoring, e-mailing assignments to liaisons, and communicating with other field-based participants through Web-pages, electronic bulletin boards, Web-based forums, and list-servs. Managing electronic documents and issues of netiquette and confidentiality are examined as well.

Productivity

This program component provides students at both Intern levels the necessary skills for teacher productivity. Intern I level students focus on word-processing, database use, and spreadsheet use. Intern II level students focus on advanced skills for teacher productivity and the integration of these skills into the curriculum. The use of desktop layout, graphics, and presentation tools is addressed at both levels.

Integration

The integration program component is delivered at both the Intern II and Resident levels. These students focus on learning theories and technology integration models, the examination of student technology tools (tutorial, simulation, exploratory, problem solving, and multi-media), and the integration of technology into various content areas. Advanced forms of media including optical technology, Internet resources, and related multi-media hardware and software are utilized in the creation of student projects. The use of global classrooms, on-line education, and distance education is included. Additionally, students learn networking skills, set-up and maintenance skills, and participate in planning for technology at the campus level.

Indicators of Student Achievement

Students in Intern I produce documents related to the development of teacher productivity skills (a parent letter, student database, and grading spreadsheet designed for individual field placements). Students learn how to discriminate between and evaluate various types of software. Students also describe the use of technology at their respective field sites including evaluation of software located at those sites. Students at all levels are required to email requirements and weekly reflections, and they must participate in a bi-weekly desktop conference group that extends discussion related to the required text: *Integrating Technology for Meaningful Learning* (Grabe & Grabe, 1998).

Students at Intern II and Resident levels produce documents related to the more advanced teacher productivity skills and integration of technology into the curriculum (a newsletter and the use of presentation software for lesson delivery designed for individual field placements). Students describe the technology use at their respective field sites and develop plans related to recommended modifications for a future technology plan at both the classroom and school-wide levels. This plan includes the evaluation of software located at each field site and a plan for implementation at the classroom level. After learning how to evaluate Internet resources, students design a WebQuest using advanced forms of media including evaluated resources. These projects are implemented at the respective school sites utilizing tools mastered in the previous Intern experiences and/or demonstrated during seminar classes conducted at the university. At all levels, students are required to attend a minimum of three lab sessions and six whole-group technology focus seminars which support the development of their skills in the four areas or relate to completion of the required indicators.

Role of Technology Seminar Leaders

This program is not a separate methods course. Instead it is an integrated aspect of the Professional Education sequence designed and delivered by technology facilitators who supports both the pre-service teachers and the instructors of the courses. Technology facilitators (a) provide additional resources and necessary background knowledge for Interns, Residents, and seminar leaders and liaisons through one-on-one support, small-group intervention, and whole-group training sessions; (b) make connections to the field site and provide support for mentor teachers; (c) utilize a course-designed Website for on-line instruction; (d) support desktop conference groups in discussion related to required text readings; (e) develop and conduct technology labs; (f) and document and certify technology competencies of Interns and Residents. As the program has grown to include more Interns and the variability of technology support in the field has increased, curriculum revision is needed to support implementation of this technology vision to a full-scale level at both the University and in field settings.

Proposed Technology Integration Program

The LINKS Program builds on the previously established program through full-scale implementation and is correlated with the PDS field-based education program. The planning for the PDS field-based teacher education program is structured around the Texas-adopted proficiencies for teachers. This includes the proficiencies which describe what teachers must know and be able to effectively demonstrate so that all children have access to quality education (TEA, 1995). The five proficiency domains are (a) Learner-Centered Knowledge, (b) Learner-Centered Instruction, (c) Equity in Excellence for All Learners, (d) Learner-Centered Communication, and (e) Learner-Centered Professional Development. These proficiencies provide the foundation for the Professional Development Appraisal System (PDAS)--the evaluative tool for all Texas classroom teachers.

The LINKS project utilizes this comprehensive and coherent structure to organize the passport tool that guides the pre-service teacher through documentation of technological competencies. These five proficiencies provide a basic structure for the LINKS Technology Passport. Upon declaring an education major (Interdisciplinary Studies) students are given a LINKS Technology Passport to guide them through identifying and documenting technological competencies. The specific competencies in the LINKS Technology Passport are grouped according to two categories--Essential Knowledge and Skills and Expanded Knowledge and Skills. The essential knowledge and skills section reflects the Texas Essential Knowledge and Skills (TEKS) competencies for students in the public schools K-12 (TEA, 1999). Since our teachers are expected to support the development of these competencies by the K-12 student, they must first demonstrate competency of these skills themselves.

The K-12 TEKS technology applications curriculum has four strands--foundations, information acquisition, work in solving problems, and communication. Through the study of technology applications foundations (including technology-related terms, concepts, and data input strategies), learners in public school settings are expected to make informed decisions about technologies and their applications. They learn to identify task requirements; plan

search strategies; and use technology to access, analyze, and evaluate the acquired information. By using technology as a tool that supports the work of individuals and groups in solving problems, students will select the technology appropriate for the task, synthesize knowledge, create solutions, and evaluate the results. Students learn to communicate information in different formats to diverse audiences and to use a variety of technologies. The TEKS technology skills are included in the LINKS project as the *Essential Skills* to be demonstrated and monitored through the LINKS Technology Passport.

Building on the Essential Knowledge and Skills, and structured through the five proficiencies previously discussed, the LINKS project proposes a second category of technology competency focusing on *Expanded Knowledge and Skills*. This category is structured through three levels: (a) Productivity, (b) Connectivity, and (c) Integration. Both the Essential Knowledge and Skills and the Expanded Knowledge and Skills are delineated and documented in the Technology Passport.

The LINKS project implements this new technology curriculum founded on current standards which extend beyond productivity and connectivity to problem solving and integration into instruction at diverse levels and in various content areas. Performance in the new curriculum will be documented in the LINKS Technology Passport in which professors at all levels sign off on student mastery and/or performance of skills related to the technological competencies demonstrated as part of their courses. Students will be certified to be competent in these various areas through a series of benchmarks including one-on-one screenings and documentation provided throughout the professional education coursework sequence also recorded through the Technology Passport.

Significance

The National Council for Accreditation of Teacher Education (NCATE, 1997b) in its description of preparing for the 21st Century classroom emphasizes the need for a vision of a teacher education program which fully utilizes information technology. Such a vision requires major adaptations: (a) greater understanding of the impact of technology on our society, (b) new roles as authority over knowledge moves beyond the teacher and the classroom, and (c) emphasis on the ability to organize and interpret information and assess quality of information and sources in a reflective and critical manner. In order to accomplish such a vision, pre-service teachers must participate in courses designed to encourage the development of teachers as fearless users of technology (NCATE, 1997a). These courses must also offer an integrated and collaborative program that seeks to encourage this development through meaningful activities within authentic contexts. Some of these courses will encourage risk taking and lifelong learning through instructional delivery in non-traditional ways such as distance learning and on-line classes. NCATE further recommends that stimulating effective utilization of technology would include integration across all areas of the curriculum in the teacher education program.

"If the role of teacher education programs is to produce teachers who are able to use the new computer technologies, we must take our pre-service teachers from where they are when they enter and advance them to where the technological society needs them to be" (Sheffield, 1996, p. 52). Performance-based programs are measured in terms of competencies or proficiencies (Buhendwa, 1996; Flowers, 1997). Thus, educational needs at all levels can

only be reached when our pre-service teachers are able to model the desired proficiencies identified in educational technology programs designed around an integrated teacher education vision. The LINKS program encompasses the integration of technology use as intrinsic to all courses leading to professional certification as well as within the professional education field-based courses. In the professional education field-based coursework, pre-service teachers complete their documentation of technology skills and knowledge, demonstrate their use in school settings, and utilize a variety of technology tools in teaching, evaluating, and communicating with diverse students in a variety of school settings.

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Building Capacity in Wyoming: Preparing Preservice Teachers to Integrate Technology

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Abstract: This paper is a report on the Wyoming Capacity Building Project. This statewide project involves the State Department of Education, the University of Wyoming, and the seven community colleges in preparing perservice teachers to integrate technology. This project will build a foundation from which several systemic changes can occur within the delivery and curriculum of the preservice teacher preparation program. Three bodies of literature will guide the development of this foundation: the Concerns Based Adoption Model (CBAM), entrepreneurial leadership with technology, and systems thinking. The objectives are related to preparing and supporting UW and community college as they infuse technology into their courses and model the effective use of technology within their classrooms and their teaching methods. The overall goal of the project is to improve the quality of the preservice teacher preparation curriculum with a focus of preparing future teachers to use technology in effective, appropriate, and innovative ways.

Introduction

The over riding goal of this project is to improve the quality of the Wyoming preservice teacher preparation curriculum and prepare future teachers to use technology in effective, appropriate, and innovative ways. This project will build a foundation from which several systemic changes can occur within the curriculum and delivery of the preservice teacher preparation program. These systemic changes will increase the number of technology-proficient teachers graduating from the University of Wyoming who will be able infuse technology into their curriculum as a tool to improve student learning and achievement. As with any project of this magnitude, change does not come easily and the project team will utilize relevant theories and models from the change literature to guide our processes (Belasco, 1995; Fullan, 1991; Hall & Hord, 1987; Kotter, 1996; Rogers, 1983; Senge, 1990, 1999). Three diagnostic tools from the Concerns Based Adoption Model (CBAM) will be used to manage and facilitate the change processes within this project; Stages of Concern Questionnaire (SoCQ), Levels of Use interview (LoU), and Innovation Configuration Maps (ICM). Additionally, all stakeholders involved in the preparation of preservice teachers within Wyoming are part of the technology project consortium and will be involved in the project activities.

Project Vision

Vision plays a key role within any change effort by assisting to direct, align, and inspire all stakeholders participating in the transformation effort (Kotter, 1996). This vision needs to be imaginable, desirable, feasible, focused, flexible, and communicable. To be successful in transforming the preservice teacher preparation curriculum into a system that will prepare tomorrow's teachers to effectively use technology, our consortium must create a shared vision of the future of education in a technology rich world. The shared vision of this project can be stated as follows:

> To prepare tomorrow's teachers to use technology in effective, appropriate, and innovative ways through the infusion of technology into the preservice teacher preparation curriculum. These future teachers will have the skills and proficiencies to utilize technology as a tool for improving student learning and achievement.

This shared vision will serve three important purposes for the project consortium. First, the shared vision will clarify the general direction in which to make changes to the preservice teacher preparation program. Second, the shared vision will motivate instructors to take action in the right direction since the benefits and personal satisfactions will be far superior to those available without implementing the changes. Third, the

shared vision will help to coordinate the actions of different instructors, departments, agencies, colleges and the University. This vision will be reviewed and communicated to all stakeholders of this project and will be refined as the project progresses. The project goals, objectives, and activities will support this vision and will help in communicating and supporting the vision to all stakeholders.

A project task force team will be selected to equalize the representation and opportunities for all stakeholders and to ensure the unique needs of each are addressed. Members will be selected to represent the university, community college, and K-12 stakeholders and will include representation from the educational community on the Wind River Indian Reservation. The University of Wyoming (UW) and Central Wyoming College (CWC) are engaged in a project to address the educational needs on the Wind River Indian Reservation. A critical need for the schools on the reservation is to recruit and retain teachers who have ties to the Arapaho and Shoshone tribes. UW and CWC are cooperating in the delivery of an off-campus program designed to lead to certification to teach at the K-6 level. Technology plays an important role in the delivery of this program and having a member from the Wind River Indian Reservation as a member of the project task force will provide valuable insights in equalizing and extending the impact of the project to other rural areas of Wyoming. The task force will have approximately 15 K-12, 11 community college, and 31 university members.

Project Goals, Objectives, and Activities

Goal 1: Conduct an assessment of current technology uses in the College of Education at UW, the seven community college campuses, and in K-12 Schools within the State of Wyoming.

Objective 1.1 – Develop a rich description of the levels of use of technology within K-12 schools, UW College of Education, and community colleges from the Levels of Use (LoU) interview data collected by the Wyoming Department of Education.

Objective 1.2 - Review the LoU data and compare the level of use of technology in K-12 schools with that of higher education.

The Wyoming Department of Education has collecting data from 112 K-12 educators on their levels of use of technology in their classrooms and is currently conducting the LoU interviews with higher education faculty during the fall of 1999. Additionally, Dr. Guy Westhoff, Assistant Professor in the Department of Adult Learning and Technology, University of Wyoming, will administer the Stages of Concern Questionnaire (SoCQ) to all higher education faculty involved in the preservice preparation program. The SoCQ will be used to identify the technology concerns of college faculty towards integrating technology into their courses and be used to guide activities in support the remaining goals of the project.

A fall Articulation Conference, held in Casper Wyoming during September 1999, launched the project and introduced participants of the consortium to the activities planned for the year. The project team worked with Wyoming educators in identifying national "best practices" and Wyoming practices that should ideally be integrated into the K-12 and teacher preparation programs.

Goal 2: Conduct a review of the preservice teacher preparation curriculum and the infusion of technology into these courses.

Objective 2.1 - Review the existing preservice teacher preparation curriculum and identify where technology is currently integrated.

Objective 2.2 - Develop a technology infusion matrix listing all courses within the preservice teacher preparation curriculum and the NCATE, ISTE, and state technology integration standards for teacher technology preparation.

Objective 2.3 - Identify where technology standards are taught across all courses.

Determining the current level of technology integration in the curriculum of courses offered within the preservice teacher preparation program will be accomplished through the activities relating to this goal and objectives. Faculty have been requested to submit a syllabus for each course they teach within the preservice teacher preparation program and to volunteer to serve on a review task force that will be headed by Dr. Ed Paradis, the Director of Teacher Education. The task force will meet five times during the academic year to discuss and conduct the review of the course materials. Results of this review will guide the task force in developing a technology infusion matrix that compares the technology skills addressed in each preservice course to the NCATE standards and the ISTE Technology Standard for Teachers. The task force meetings are planned for dates in September, October , November, February, and April. These meetings will utilize the

technology infrastructure of the WEN and other existing systems and be conducted over the video conferencing systems, as well as face-to-face.

Goal 3: Develop recommendations for curricular revisions to improve technology infusion into the preservice teacher preparation curriculum.

Objective 3.1 - Develop recommendations for revisions to the preservice teacher preparation curriculum to reflect appropriate technology integration.

Objective 3.2 – Develop an Innovation Configuration Map (ICM) containing observable descriptors that represent what appropriate technology integration in a K-12 classroom looks like.

Data collected from the activities of goal two, review of the preservice teacher preparation literature, and participation in a curriculum and technology conference will be utilized to formulate the revisions to the preservice teacher preparation curriculum. These recommendations for revisions to the curriculum will focus on supporting the shared vision of the project and will benefit from the participation in the curriculum teleconferences and the Connections 2 Solutions conference described in the following section for goal four.

Goal 4: Design and develop a professional development program for college faculty to enhance the infusion of technology into the preservice teacher preparation curriculum for the State of Wyoming.

Objective 4.1 – Identify best practices for integrating technology into K-12 classrooms that support student learning and improved achievement.

Objective 4.2 - Develop a faculty technology-training program that emphasizes effective and appropriate technology integration techniques and methodologies to enhance the technology integration into the preservice teacher preparation curriculum.

All K-12 educators in the state of Wyoming and UW and Community College faculty involved in preservice teacher preparation programs were invited to the Connections 2 Solutions Conference, sponsored by the WSUP, and held October 20-21 in Sheridan, Wyoming. This conference presented a look at the future of technology in education and allow for discussions with, and presentations by, K-12 and higher education faculty that are using best practices to integrate technology into their classrooms and curriculum. Dr. David Thornburg, Director of the Thornburg Center for Professional Development, gave the keynote address and facilitated one-hour breakout sessions related to four groups: K-12 administrators; K-12 elementary faculty; K-12 secondary faculty, and higher education faculty involved with the preservice teacher preparation curriculum. These breakout sessions allowed faculty to discuss the factors that are most crucial to their level of instruction with each other and with Dr. Thornburg. While there is a great deal of commonality among the technology integration skills and techniques, the individual breakout sessions allowed all elementary, secondary, administration, and higher education faculty to discuss the issues unique to their level of students and their instructional strategies.

Goal 5: Implement the professional development program to prepare higher education faculty involved in preservice teacher preparation to utilize and infuse technology into their courses.

Objective 5.1 - Create a shared vision for the infusion of instructional technologies into college-level instruction within the preservice preparation curriculum that result in preservice students meeting or exceeding national standards.

Objective 5.2 - Implement the faculty technology training program to provide higher education faculty with the skills and methodologies needed to successfully infuse technology into their preservice teacher preparation courses.

The final goal of the Wyoming capacity building project will be to deliver a professional development technology-training program to the entire faculty involved with teaching courses within the preservice teacher preparation curriculum at the University of Wyoming and the seven community college campuses. This professional development program will be an innovative approach to preparing instructors to infuse technology into their classrooms and become role models for integrating technology to their preservice teacher preparation students. This professional development program will be designed to provide "just in time" technology training for all participants that matches the technology integration skills they currently need to improve their teaching.

The Center for Teaching Excellence (CTE) on the campus of the University of Wyoming will assist with the facilitation of this faculty development program and our corporate sponsors will assist in implementing the one-week professional development program. These training workshops will be delivered at three locations around Wyoming and will include the campuses of the University of Wyoming, Central Wyoming College and

Northern Wyoming Community College. Both community colleges have contributed the use of the technology facilities and training costs at their campuses for the one-week program as matching funds.

Conclusion

Accomplishing the goals, objectives, and activities of this project will assist faculty teaching within the preservice teacher preparation program integrate technology into their classrooms in appropriate, effective, and innovative ways. The natural extension of this project will be the development of a Learning Technology Plan for the preservice teacher preparation curriculum for the State of Wyoming. This proposed plan will assist in moving Wyoming towards a comprehensive effort of improving the preservice teacher preparation curriculum and will guide the development of an implementation plan for the revised curriculum and sustaining the professional development program.

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Technology Integration in Colleges of Education: Assessment and Planning

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Abstract: Responding to the call for faculty in institutions of higher education to model teaching and learning with instructional technology in undergraduate classrooms, the College of Education and Human Services at the University of Wisconsin Oshkosh submitted a successful application for funding under the auspices of the *Preparing Tomorrow's Teachers to Teach with Technology* federal grant program. As preparation for this proposal, the current state of the college was assessed using common factors identified in the 1998 Strudler and Wetzel that were identified as consistently moving institutions of higher education towards excellence in technology integration.

In 1995, the Office of Technology Assessment (OTA) published a study of four preservice teacher education programs thought to have exemplary approaches to integrating technology - Peabody College of Vanderbilt University, University of Virginia, University of Northern Iowa, and University of Wyoming. This study by Mergendoller, Johnston, Rockman, and Willis (1994) focused on issues involved in implementing the vision of technology infusion into programs. They noted the following consistent strands across the four universities: leadership at the dean's level to establish technological infrastructure and involve faculty in the use of educational technology; the ability to achieve "the somewhat tricky balance of establishing a culture that strongly encourages faculty technology use, but does not shame individual faculty members who lag somewhat behind" (Mergendoller et. al, 1994 Chapter 10); and preservice teachers at each institution experienced educational technology as an integrated part of their professional preparation across their coursework.

A follow-up study of these programs was conducted by Strudler and Wetzel in 1998 to further delineate the factors that consistently moved sites towards excellence in technology integration. In the recommendations section of their study these factors are enumerated. University of Wisconsin Oshkosh (UWO) used these factors to assist its faculty in determining needs that might be addressed by the catalyst category of the *Preparing Tomorrow's Teachers to Teach with Technology* federal grant program. A simple checklist was developed as follows:

Enabling Factor	**Achieved**	**On-Going**	**Not Observed**
College-wide factors:			
Establish college-wide technology committee	X	X	
Hire administrators who are committed, informed leaders		X	
Insure faculty participation in searches for administrators	X	X	
Be entrepreneurial - seek funding for innovative projects		X	
Make technology prominent in five year plans		X	
Hire faculty who are ready to use technology in their teaching		X	
Professional development factors::			
Students working with faculty			X
Workshops on integration			X
One-on-one learning opportunities			X
Incentives and awards for obtaining new tech and pedagogy skills			X
Hire curriculum integration specialists located in the college		X	

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Provide opportunities for this specialist to work with faculty			X
Embrace increased needs for access and support as a good problem		X	
Provide ample computer access and projection facilities in classrooms		X	
Student learning factors:			
Have students conduct informal technology inventory at beginning of any field experience			X
Plan for systematic integration of technology throughout the teacher education program			X
Consider giving a option of a second tier course for more advanced work	X		
Allow students option of requesting a technology-enhanced placement			X
Create a field-based component for the required technology course			X
Seek creative uses of distance technologies			X

Based on this basic checklist of enabling factors, it was evident that the College of Education and Human Services (COEHS) had laid good groundwork for technology-curriculum integration. COEHS at UWO made significant investments in both technology hardware/software and technology integration in the past two years. This focused on the new Classroom of Tomorrow lab, the creation of additional classrooms rich with technology teaching stations, and the successful hiring of faculty who are technology integration specialists with recent, successful K-12 teaching experience. Recently college wide interactions focused on the need for infusion of technology throughout the teaching and learning experience of all future teachers particularly in those courses where students acquire the subject area expertise they will use in their future classrooms and clinical experiences. Experimentation is currently occurring in team-taught social studies and math/science method courses with both curriculum-instruction and technology faculty members. However, this approach is limited by the number of technology faculty available and thus denies many faculty members this support.

COEHS supports the vision that its entire faculty will model new instructional strategies, multiple teaching-learning styles, and content applications that enable them to make full use of modern technologies for improved learning and achievement. To support this vision, the following needs were identified through use of the checklist based on the Strudler and Wetzel study: working with faculty on technology skills and integration strategies, opportunities for staff members who are curriculum integration specialists to work with faculty who desire their assistance, and expansion of the opportunities for tomorrow's teachers to acquire and observe technology-curriculum integration skills. Based on these needs the following program and objectives were proposed and funded under the initial round of the *Preparing Tomorrow's Teachers to Teach with Technology* grant project.

Project Design: Goal and Objectives

Project Goal To support faculty and tomorrow's teachers in the hands-on infusion of technology into existing curriculum and to provide opportunities for both to apply knowledge gained in field settings with practicing teachers		
Objective	**Outcomes**	**Assessment**
1. Identify faculty interested in using powerful teaching and learning strategies that incorporate instructional technology	▪ 1/3 of faculty from UW Oshkosh College of Education & Human Services identified as first year grant participants	▪ Teaching styles survey ▪ *Stages of Concern Questionnaire*, University of Texas
2. Deliver workshops that model innovative teaching enriched with technology infusion	▪ 1/3 of faculty gain increased understanding of technology and curriculum integration	▪ Participant evaluation of workshop ▪ Bridge to practice
Objective	**Outcomes**	**Assessment**
3. Faculty, with appropriate support, develop and deliver	▪ 1/3 of methods courses model hands-on technology infusion	▪ Demonstration of project implementation by

curriculum projects rich with technology infusion	▪ Development of personal computer skills ▪ Curriculum modifications that model technology proficient instruction	artifacts (i.e. projects, simulations, multimedia materials, etc.) ▪ Reflection with larger group on successes ▪ Pre- and Post-Assessment ✓ *Computer Anxiety Scale*, Rosen ✓ *Attitudes towards Computers Scale*, Sears ✓ *Computer Thoughts Survey*, Weil
4. Tomorrow's teachers develop and deliver in their clinicals curriculum projects rich with technology infusion	▪ 300 students demonstrate technology integration in K-12 classrooms ▪ Faculty participate in K-12 classrooms ▪ Students developing leadership roles in clinical settings	▪ Demonstration of project implementation by artifacts (i.e. projects, simulations, multimedia materials, etc.) ▪ Written reflection on successes
5. Tomorrow's teachers observe current teachers who model exemplary teaching with technology	▪ 300 students observe ongoing innovative practice in classroom environment	▪ Guided observation form completion ▪ Roundtable discussions with methods classes
6. Tomorrow's teachers develop relationship with on-line mentor currently teaching in field who models exemplary teaching with technology	▪ Feedback and advice from current practitioner ▪ Reflection on practice	▪ Participation level/quality form from mentor teachers ▪ Count of interactions from website
7. Faculty and tomorrow's teachers will disseminate best practices to larger education audience	▪ Presentations at state level ▪ Presentations at national level	▪ Submission of proposals for presentations or posters ▪ Presentation/poster artifacts: projects, simulations, multimedia materials, etc.
8. Faculty and tomorrow's teachers collaboratively develop website to meet project needs	▪ Collaboration between educators in real-life problem centered need ▪ Website that provides focus for project objectives	▪ Formative throughout project based on emergent needs ▪ On-line suggestion/evaluation form

This project involves a consortium representing educators at all levels - postsecondary faculty, tomorrow's teachers, practicing teachers - participating together in a collaborative quest aimed at using new learning technologies for improved teaching and learning. The UWO as Local Educational Agent provides learning facilities, postsecondary faculty, and future teachers. Funding sought under the auspices of the Capacity Building grant is used solely for purposes of improving the teaching and learning of UW Oshkosh faculty and future teachers. However, a vital part of this initiative includes practicing teachers serving as role models in the field. Wisconsin's Cooperative Educational Service Area 6 (CESA 6), representing 42 districts, provides practicing teachers identified as innovative teachers using powerful teaching and learning strategies that incorporate instructional technology. These practicing teachers serve, in essence, as case studies for the undergraduate students in the successful integration of technology into the curriculum. Additionally, they function as mentors in curriculum development for future teachers, and as placement opportunities for clinical experiences. Funding for CESA 6 participation comes from an UW System grant, Wisconsin Regional Instructional Technology Support (WRITS). This grant works with exemplary educators who collaborate to

develop constructivist, problem-centered curricular models designed to be presented as workshops to facilitate preK-12 faculty's understanding of technology/curriculum integration.

A core team of four faculty were selected based on the following indicators: identified as being independently successful in integrating technology into their methods courses, recognized as having worked collaboratively with other faculty and having shared with colleagues both through presentations and publication the results of their technology integration, and demonstrated their commitment to the redesign of the teacher preparation program through active participation in university-wide or college-wide committees, workshops and technology projects. It is the responsibility of the members of this core team to attend regular meetings with the project coordinator, provide technology integration workshops for COEHS faculty who commit to participation in this grant, serve as mentors and consultants on both an individual and group basis for faculty, supervise graduate assistants by acting as liaison with staff identifying needs and work schedules, identify opportunities for project dissemination, organize presentations of students and faculty at state and national levels, and maintain active participation in listserv activities of this grant.

Twenty-five faculty members volunteered to serve as grant participants. This represents almost half of the faculty involved with the teacher preparation program and includes faculty from both the COEHS, and the College of Letters and Sciences. Participants have a rudimentary base of personal computer skills, are faculty currently teaching in those areas where tomorrow's teachers receive their methods, content and clinical experiences, and share a commitment to pursuing new pedagogical learning and teaching methodologies. These twenty-four faculty members have committed to attendance at technology integration workshops as offered by the core team, to the development and deliverance of curriculum projects rich with technology infusion, to sharing and reflecting on questions, concerns and successes of projects with colleagues, to the construction of assignments which require students to develop and implement lesson plans utilizing technology/curriculum integration, and to moderate round table discussions with students after observation of either video or live case studies in technology integration. In the subsequent year, these faculty participants will serve as mentors for additional faculty members in the increased development of enriched technology-curriculum integration opportunities. All grant participants receive a library of resource materials on technology integration and will have input on the creation of a COEHS faculty library of software that will support their redesigned curricular plans (i.e. Tom Snyder cooperative software in the social studies, simulations and dry lab software for science, interactive fiction for language arts, etc.). They and their students will also have the opportunity to present work done under the auspices of this grant at statewide conferences.

The faculty grant participants are supported in their project development by the core team and grant coordinator. A series of four workshops presented by the core team have modeled constructivist, problem-centered curriculum utilizing hands-on approaches, just-in-time introduction of technology skills, and authentic assessment opportunities afforded by technology. Core team members are available to work with faculty members on identifying curriculum modifications that model technology proficient instruction. Additionally, three graduate students are supported by this grant and are assigned to faculty grant participants for one-on-one tutoring and problem solving. Faculty worked during the January 2000 interim to develop activities to be implemented in the Spring 2000 semester. They met individually with core team members twice during the implementation cycle and will meet once at the end of the semester as a group to share reflections, concerns, artifacts and successes of their curricular modification project.

Approximately three hundred students are actively involved in this project. Some represent future PreK-8 and Special Education teachers participating in Clinical A or B which are required block courses that integrate method courses with concurrent field experiences. Other future secondary teachers are participating in their Secondary Learning Community which presents subject area methods classes with concurrent field experiences. Additional future foreign language teachers come to the grant via their clinical and methods experience. These students are the first to experience the results of faculty curricular modifications in an effort to model new technology-rich approaches to instruction that require students to be active participants in learning while drawing on multiple sources of information to solve real-world problems in collaboration with others. They have the advantage of designing technology-rich lesson plans to be implemented immediately in their clinical field settings thus serving as potential leaders in the PreK-12 schools.

It is vital to the success of prospective teachers that they have case studies to observe current practitioners using technology/curriculum integration methodologies and constructivist theory in real world settings. Towards this end, the innovative teachers selected for the CESA 6 WRITS grant will serve as case studies by allowing themselves to be videotaped and subsequently critiqued by prospective teachers and faculty. CESA 6 personnel will also be instrumental in identifying technology-rich sites for student placements to meet clinical field experiences.

Students have the opportunity to work with a mentor via email with practicing educators who currently employ innovative learning theory with technology-rich instruction. All students involved in methods coursework with concurrent field experiences are assigned to a mentor. These mentors may be located in Wisconsin and be participating in the WRITS project but it is equally likely that students may be assigned to an out-of-state mentor. Students may engage mentors in discussions about educational practices, technology integration, reflective practice, or use the mentorship as an opportunity to discuss integrating technology in working with diverse student populations.

All of these various approaches to restructuring teaching and learning at the postsecondary area require a central focus area. To provide this focus, faculty and students will collaboratively develop a website for this project. Responsibility for envisioning the site by analyzing needs and perceived ways the web could meet those needs will lie solely with the grant participants. A storyboard will be drafted to design the site, its pages and purpose. Design and layout issues will be considered. Faculty will use Claris HomePage to develop the core of the site; student consultants chosen from the methods classes will do subsequent completion and revision of the site.

Finally, dissemination of the results of the grant project as a whole and the results of curricular redesign have been considered. An ongoing view of the project through posting of activities, timelines, philosophy, and purpose will be available through its web page linked to the UW Oshkosh site. Proposals for presentations regarding the Capacity Building grant, methodology and outcomes will be submitted at the Governor's Wisconsin Educational Technology Conference and at other appropriate statewide conferences such as Wisconsin Council of Social Studies, Wisconsin State Reading Association, Wisconsin Council of Exceptional Children, etc.

Conclusion

This grant project, Development of Instructional Technology for Tomorrow's Teachers, will enable the UWO's College of Human Services and Education to make significant movement towards addressing both the *quantity* of tomorrow's teachers who actively participate in coursework enriched with the use of technology and the *quantity* of today's postsecondary faculty who are integrating technology into their coursework. It will assure the *quality* of that experience by encouraging thoughtful reflection on both the part of tomorrow's teachers and post-secondary faculty on the role of technology in society, its vital infusion into schools and its fundamental impact on restructuring the traditional model of learning and teaching at all levels. Finally, it will address the issue of *equity* for students through the preparation of tomorrow's teachers to work in the surrounding 42 school districts representing an area serving a population that is approximately 62% rural in nature, with 11% minority students, 19% low income students, and 7% students with Limited English Proficiency.

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Tec to Take: An Innovative Strategy for Supporting Preservice Teachers During Field Experiences

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Abstract: Meeting the resource needs of preservice students during their field experience practica is not a new problem. The tec to take project is designed to provide appropriate resources for integrating technology into instruction by addressing the problem of readily accessible resources for technology enhanced instruction. The project is based on a collaborative model which includes the preservice student, the faculty supervisor, the class room mentor and the school based technology coordinator. The opportunity to check out equipment and software (tech to take) is based on a written instructional plan for the integration of the resources into a field based classroom lesson or unit of instruction.

Introduction

Computer to student ratios have declined steadily from 50:1 in 1985 to 20:1 in 1990 to an estimated 9:1 in 1997, affecting traditional classroom practice and even the culture of the schools. The computer, video, and telecommunications of various kinds are having an impact on every aspect of our society: work, leisure, entertainment, household tasks. These inventions are also transforming the way we approach knowledge and sources of expertise. Today, people are no longer required to read about an event; they can see media versions of it unfold before their own eyes and make their own interpretation. Consequently, the ability to obtain and interpret information quickly and accurately is even more important than in the past.

There is no longer a question about whether the new technology will be used in schools. Nearly everyone agrees that students must have access to computers, video, and other technology in the classroom. Many believe these technologies are necessary because competency in their use is an important feature of career preparation; others see equally important outcomes for civic participation. Most importantly, a growing research base confirms technology's potential for enhancing student achievement. What is less certain is how and when these technologies will change the nature of schooling itself.

Arthur E. Wise, President of the National Council for Accreditation of Teacher Education states in the Technology and the new Professional Teacher: Preparing for the 21st Century Classroom, 1997:

> Two million new teachers will be hired over the next decade. Will these new teachers be comfortable and skilled in using technology? What will it take to transform schools of education so that faculty feel comfortable e-mailing students, using listserves for projects and instruction, and introducing candidates to software that enhances instruction? As technology moves from the periphery to the center in P-12 schools, so must it move from the periphery to the center in teacher preparation.
>
> Teacher education institutions must prepare their students to teach in tomorrow's classrooms. Rather than wait to see what tomorrow's classrooms will be like, they must experiment with the effective application of computer technology for teaching and learning in their own campus practice. Today's teacher candidates will teach tomorrow as they are taught today.

Research has long indicated that future teachers take their cues from the practices they observe in classrooms during teaching practica and internships. If students are taught the latest technology uses as part of their teacher education programs, but don't see effective technology practices in the schools, they are unlikely to incorporate technology use in their own teaching. Schools are powerful socializing agencies that greatly affect new teachers' perceptions about what does and what doesn't work in practice.

The introduction of computers and other technologies into schools is occurring at the same time that three decades of research in the cognitive sciences, which has deepened our understanding of how people learn, is prompting a reappraisal of teaching practices. We know from this research that knowledge is not passively received, but actively constructed by learners from a base of prior knowledge, attitudes, and values. Dependence on a single source of information, typically a textbook, must give way to using a variety of information sources. As new technologies become more readily available and less expensive, they will likely serve as a catalyst for ensuring that new approaches to teaching gain a firm foothold in schools.

Despite the technology changes in society, being a teacher in American schools too often consists of helping children and youth acquire information from textbooks and acting as an additional source of expertise. Teachers are provided role models of this approach to teaching from kindergarten through graduate school; their teacher education courses provide hints for making textbook-oriented instruction interesting and productive, and as teaching interns, they both observe and practice instruction based upon mastering information found in books.

The question raised is "how must teachers adapt to take advantage of technology for instruction? In the 1997 National Council for Accreditation of Teacher Education report on preparing the Professional Teacher for the 21st Century the following paradigm shifts are recommended:

New Understandings

Teachers need to understand the deep impact technology is having on society as a whole: how technology has changed the nature of work, of communications, and our understanding of the development of knowledge.

New Approaches

Today, teachers must recognize that information is available from sources that go well beyond textbooks and teachers - mass media, communities, etc. and help students understand and make use of the many ways in which they can gain access to information. Teachers must employ a wide range of technological tools and software as part of their own instructional repertoire.

New Roles

Teachers should help students pursue their own inquiries, making use of technologies to find, organize, and interpret information, and to become reflective and critical about information quality and sources.

New Forms of Professional Development

Teachers must participate in formal courses, some of which may be delivered in non-traditional ways, e.g., via telecommunications; they must also become part of ongoing, informal learning communities with other professionals who share their interests and concerns.

New Attitudes

Finally, teachers need an "attitude" that is fearless in the use of technology, encourages them to take risks, and inspires them to become lifelong learners.

More than in the past, teachers must become advisors to student inquirers, helping them to frame questions for productive investigation, directing them toward information and interpretive sources, helping them to judge the quality of the information they obtain, and coaching them in ways to present their findings effectively to others. This will require teachers to become even better prepared in the content of the subjects they teach, and the means by which the content can be taught and learned.

In light of paradigm's stated above, the next question to pose would be "what changes need to be made in teacher education programs to foster the teaching skills for the 21st Century educator?"

Technology can also serve as the catalyst for reconsidering the entire architecture of teacher education: e.g., how, when, and where candidates will acquire the knowledge and skills they need; and the linkage between preservice and in-service professional development. The integration of technology should be accomplished in relation to other efforts to reform teacher preparation, not as a separate reform initiative.

The literature provides an awareness of the pervasive need for a new type of educator. To prepare educators to meet the challenges of the 21st Century classroom will require the development of preservice models that take advantage of community, public school and higher education partnerships in a technology enhanced environment. Research has documented that few teachers fully exploit the use of computer based technologies (Hunt & Bohllin, 1995). The need to be able to understand the compatibility of computer based technologies and newer research based approaches to teaching and learning such as inquiry based learning, performance assessment, and constructivist curriculum are needed for the quality teacher (Bracey, 1993, Campoy, 1992)

How does the tec to take program facilitate the professional development related to technology integration for the preservice student, the field based mentor and the faculty supervisor?

The following steps will illustrate the tec to take project process.

Step one: A learning community is formed between the preservice teacher, field based mentor, and faculty supervisor (for example a preservice student is linked together with a fourth grade teacher and a university faculty supervisor together they collaborate and identify an instructional topic)

Step two: The learning community identifies an instructional topic that would be suitable for the integration of technology into the instruction (for example grade four graduation standard related to a study of States)

Step three: The learning community identifies the types of hardware, software, and corresponding workshop experiences that they need to effectively implement the technology enhanced instruction (for example the learning community may decide that an appropriate technology component related to the study of States might be to do a community self study utilizing digital cameras, building of a report web site, and cooperating with another school in another State who might be doing a similar project. To be successful, the learning community may need to complete instruction related to digital cameras, web development, and identification of web sites with classroom link projects.)

Step four: Submit a request for a tec to take kit that would include the appropriate hardware and software to accomplish the stated instructional goals of the field based project.

Step five: Implement the lesson/unit with a field based classroom (for example, the preservice teacher in collaboration with the field based mentor and the university supervisor would prepare the materials and plan the lesson outlines that would address the instructional needs of the State project.)

Step six: Assess the student learning as a result of the technology enhanced lesson (for example, the learning community would determine the quality of the learning experience for the fourth grade students. Student satisfaction survey's as well as evaluation of student products related to States would serve as artifacts of the quality and level of student achievement of academic goals.)

Step seven: Reflection by the learning community of the success of the technology integrated instruction (the learning community would review the student achievement outcomes and the management processes of the instruction. Following this review, recommendations would be made for additions or modifications of the instruction for future planning.)

How does the tec to take process address the new paradigm recommended by the 1997 National Council for Accreditation of Teacher Education report on preparing the Professional Teacher for the 21st Century ?

New Understandings

By working in learning communities, the representation of the beginning through the mentor level teacher gives these educators an opportunity to consider alternatives to traditional teaching strategies. The workshops that correspond to the instructional plans provide the opportunity for the educators to learn new skills as a team and apply these skills to an actual classroom experience.

New Approaches

The learning communities will collaborate and review instructional strategies that take advantage of newer instructional technology resources. Because the field based teacher may face curriculum requirement restraints, one of the outcomes of the tec to take program is to support the learning community to identify ways to augment existing curricular goals utilizing technology resources.

New Roles

The instructional technology lessons reflect the consultant, constructivist classroom model. As noted earlier this is the type of instructional model that teacher education programs are advocating in their preparation classes. In order to "break" the cycle of traditional instruction the availability of model field teachers that embrace this approach to instruction is critical for field based placement of preservice teachers. It is anticipated that the tec to take will provide all members of the learning community an opportunity to expand their skills with the student centered style of teaching.

New Forms of Professional Development

The tec to take reflects a continuous need to not only learn how to work effectively with school district curriculum requirements, but also the need to continue to learn how to use new technology based hardware and software. The proposal request process for being able to use the tec to take resources supports professional development by offering software and hardware orientations for the learning communities to assure optimal use of the tools by the educators.

New Attitudes

The learning community model, the use of appropriate instructional technologies, and the ongoing expectation of professional growth is reflective of the career long professional development model advocated by the National Council for Accreditation of Teacher Education as well as the National Teacher Standards Board. The tec to take teacher education program provides a framework for the identification, field testing and reflection of technology enhanced instruction.

Summary

The tec to take program is designed to provide a focus for the creation and implementation of model technology enhanced instruction. Because this approach to teacher education practica is based in a field classroom, several levels of learners benefit from the projects. The preservice teachers has an opportunity to work with real students and utilized recommended teaching strategies and instructional technology resources, the university faculty and field based mentors have an opportunity to work collaboratively in the creation of model field sites for the preservice student and at the same time develop and or expand their instructional technology knowledge and expertise, and most importantly, students in the field based classrooms will have an opportunity to benefit academically from the instructional technology enhanced learning experiences.

Reform in education must begin with the type of educator in the classroom. All of the dollars spent on resources and equipment will do little to alter the day to day realities of the learning process unless preservice and inservice teachers begin to have opportunities to learn "new ways" to conduct the business of education. Initially, the reform will need to be made in the context of the present day to day curriculum. Teachers have minimal time for the inclusion of dramatically new content areas and instructional practices. By developing teacher expertise related to the appropriate use of instructional technology via the

augmentation of existing practice they will no longer see technology as an "add on" experience rather a natural way to conduct and manage the instructional process. Once teachers gain a comfort level with technology new applications will emerge that transcend the augmentation of traditional instruction.

The tec to take is just one way of providing resources for both the beginning and field teachers. It is the project goal that by providing the hardware, software, and skill development support that the beginning and field based educators will be motivated to try out technology enhanced instructional approaches without the concern of limited resources or lack of knowledge for successful implementation of the instruction. It is the goal of this program to foster a supportive learning community environment that models the continuous professional development of educators. This project is built on the philosophy that we are all collaborative members of a community of learners, all with expertise and knowledge contributions ,as well as needs for new knowledge and skills.

Keeping our Perspective: Technology as Tool

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Abstract: Technology is prime among educational buzzwords on the cusp of the millennium. Not only have schools scrambled to qualify for beneficial e-rates to support connectivity; a group of Philadelphia educators has sought approval to operate a virtual k-12 educational organization. Despite technology's high profile, just one in five of the 2.5 million teachers currently employed in public schools is comfortable with its use, according to a current U.S. Department of Education finding. Are teacher educators the usual suspects? Just five years ago, NCATE claimed that most teacher education faculty neither modeled technology use, nor taught prospective teachers to use instructional technologies; recent research agrees. The contention in this paper is that, in order to enjoy respect in the academic community, technology must be seen, as neither toy nor trophy, but as a custom tool integral to curricular purpose.

Technology is surely among "the" buzzwords characterizing conversation on educational reform as the century turns. Not only have schools scrambled to qualify for beneficial e-rates to support their connectivity; a group of Philadelphia educators has sought an e-charter, or approval to operate a virtual k-12 educational organization. The White House Web Site features the challenge of technology literacy, and OERI publications include lengthy lists of URLs supporting professional development of educators to promote such literacy.

But, despite technology's high profile on the cusp of the millennium, a recent national survey by NCES (Lewis et al, 1999) found that only 500,000 of the 2.5 million public school teachers currently teaching consider themselves comfortable in using technologies. Are teacher educators the usual culprits? Just five years ago, NCATE (1995) admitted that the "majority of teacher education faculty do not model technology use, nor do they teach students how to use information technologies for instruction." More recent research by Moursund & Bielefeldt (1999), confirms the sense that technology evolves more rapidly than the ability of teacher educators to make meaningful digital applications in their teaching. Yet, McNabb et al (1999), in a U.S. Department of Education technology planners handbook, cite studies which conclude that "the success or failure of technology depends more on human factors than it does on hardware or software." Clearly, our work remains unfinished.

The contention of this paper is that, in order for technology to enjoy the respect it deserves in the academic community it must be seen as neither a toy nor a trophy, but as a custom tool integral to curricular purpose. In this context, the manner in which we employ technology in teacher education is critical, since the admonition to, "Do as I do, not as I say," is ever present. Our mantra, of utilizing best practice research, calls us to honor, for example, active learning, learners' multiple modalities, and coherence between objective and activity. Further, best practice contends that technology is transparent in good learning situations. Freestanding technology study seems wrong-headed; its inclusion should serve the higher purpose of improving learning. Nevertheless, "Many faculty seem to view technology as a separate type of content, rather than as something that should or could be integrated", again according to NCATE (1995.)

Having once required a separate media course of prospective teachers, faculty at our institution have moved their conversational questions from, "What pieces of equipment must students know how to operate?" to, "How do we most appropriately develop preservice teachers' ability to effectively promote learning in technologically rich environments?" The distinction is significant, as is the conclusion of the national working group convened by the Milken Exchange on Educational Technology which emphasized that the teacher's ability to successfully integrate technology relates to knowledge of the learner and the learning environment as well as to technology competence. (Mc Nabb et al, 1999) In our own experience, the primary faculty task seems to lie in defining--and redefining--reasonable competencies for future educators.

With or without technology, we want our future teachers, for example, to conduct research; to engage in situated problem solving; to select learning resources consistent with objectives they identify for their own students; to design learning experiences for students with varied modalities; to promote reflection on their own instructional practice. Insofar as technology can offer expanded opportunity for implementing such goals, it is critical to set technological expectations for the preparation of skilled professionals. The challenge becomes one of recognizing the technology in the true sense of a tool for enhancing human potential.

To illustrate the point, we consider several of the major student objectives, as each is enhanced by technology.

To Conduct Research

It is idealistic to believe teacher preparation programs can provide all the information prospective teachers will need to solve the instructional problems they may encounter in the classroom. It is realistic to expect that future educators will leave teacher preparation programs armed with the skills necessary to fulfill the role of teacher as researcher. In an introductory education course, students gain an understanding of this often unfamiliar role through the investigation of a realistic problem situation. Students are required to seek out additional information on the issues involved. Many different options for obtaining data are explored and discussed but inevitably, someone will suggest searching electronic databases and the web. Using a research question, students design and test searches, a task which ultimately leads to discussion and questions on search techniques and appropriateness of materials. As a follow-up activity, students have the opportunity to attend a workshop on database/web searching techniques.

To Design Learning Experiences for Students with Varied Modalities

"Learning style is the way in which individuals begin to concentrate on, process, internalize and retain new and different academic information." (Dunn et al, 1995). Proponents of the learning styles movement believe, in order to maximize learning, there must be a congruency between the educator's teaching syle and the learning style of the student. While research on learning styles has come under criticism, best practice suggest incorporating a variety of strategies into a lesson will enhance the learning experience for all students. Prospective teachers who deliver presentations that incorporate overhead transparencies and/or utilize presentation software or incorporate video clips into a lesson to motivate young students about a topic in science education are demonstrating their knowledge of the importance of making learning more accessible to visual learners.

To Engage in Situated Problem Solving

Given the emphasis on promoting higher level thinking, it is imperative that teacher education programs assure the involvement of their candidates in authentic or contextualized problem solving. While this can be accomplished by such time-tested methods as using written stimulus materials, such as case studies, the implementation of digitized video scenarios created by Vanderbilt University's Cognition and Technology Group offers considerable advantages. Prospective teachers who solve mathematical problems from the Adventures of Jasper Woodbury value such qualities as realistic video stimulus, complex "word problem" content requiring minimal reading skill, and random video access permitting immediate retrieval

of essential information. Insofar as teacher candidates learn how to utilize this technology, they have mastered an additional resource for promoting problem solving with middle grade students, and not only developed the skill of operating digitized video.

To Select Learning Resources Consistent with Objectives

Evaluation of resources in terms of their instructional fit has long been an expectation for teachers. Professional journals abound with descriptions of trade books that complement thematic study, for example. In its present iteration, this crucial task of professional judgment must embrace not only print and video, but also cyber sites and software. Regardless, the quality of the judgment rendered is prime. Students initially report delight in finding abundant sources of prepared lesson plans on the Internet, but determining what the plan purports to do, for whom, and how well, requires more sophisticated critique. The same principle, that assessment occurs within a context, holds for software review. The action of professionally selecting materials with the best potential for fulfilling learning objectives links us to best past practice, while the introduction of representative new technologies enriches the repertoire of beginning teachers.

In mathematics education, for example, we can provide opportunity for future teachers to examine significant variations. The Math Forum's Ask Dr. Math serves a very different purpose than some of the more colorfully animated commercial sites. Prospective teachers benefit when contrasting the usefulness of LCSI's Logo-based MicroWorlds as a geometric tool for problem solving and creative-critical thinking, against a fact practice staple such as MathBlaster. Similarly, they should be able to discern the advantages of graphing tools in a mathematics situation.

To Promote Reflection on Their Own Instructional Practice

Essential for the success of committed professionals is the habit of self-examination. Teachers must not only plan learning opportunities for youngsters of diverse talents and needs, they must also assess the effectiveness of their implementation. Listening carefully to learners' discourse and studying work products are two of the many ways of gathering useful information. Indeed, analysis of student misconceptions has a long history in providing significant feedback to instructors.

Video technology offers another tool for reflection. We have found that our prospective teachers place real value on the artifacts which video cameras produce. Two upper level courses require oral presentations followed by questions and answers. Peers write informal constructive comments based on criteria specified for this purpose. Having had brief instructor-provided operating instructions, students record their peer's presentation on video, so that the individual has yet another perspective for reflection. Within a week, students submit a written analysis of their work, using both peer and video feedback. Then the instructor adds her evaluation. Invariably, despite acknowledging the increased pressure imposed by the recording, students applaud it as an independent source. In cases of poorly organized presentations, or those in which eye contact was fleeting or absent, the viewer often realizes the weakness before any word from peer or instructor. But in happier cases, students report satisfaction in realizing that they appeared more composed, or more fluent than they expected would be the case. Having seen and heard their work, they often afford more credibility to the insights offered by others!

Final Thought

As we reflect on the competencies we value for prospective teachers we do so mindful of the fact that teacher educators must be committed to modeling appropriate integration of technology. If we design and implement learning experiences that recognize technology as a tool for enhancing human potential, then, hopefully, future educators will begin to "do as we do".

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Preservice Teachers as Constructivist Producers and Critical Consumers of Technological Resources

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Abstract: This presentation outlines a constructivist approach to educational learning and work for preservice teachers which enables them to move from passive consumers of information to active producers of technological resources for themselves and others. This approach involves secondary methods preservice teachers as critical consumers utilizing a FileMaker Pro™ 3.0 database that has been customized to gather text, graphics, sound, video, and references through the World Wide Web. The preservice teachers then become active producers by applying that information in lesson activities that are made available to others through technology. Mounting lesson activities by preservice secondary teachers from a common site has resulted in a community product or new information bank of over 50 activities in 9 topical areas: English, social studies, science, journalism, guidance, art, math, special education, and business education.

Introduction

In his discussion of the importance and dignity of work, Boyer (1995) states that "life, for all of us, involves producing and consuming" (p. 99). Although it is possible in today's world for an educator to do a great deal of consuming without producing anything original, teachers need to engage in both activities to maintain self-esteem and to assume their places as professionals in a learning community. Technology helps educators balance producing and consuming through the World Wide Web by giving them the tools "to explore, experiment, construct, converse, and reflect on what they are doing, so that they learn from their experiences" (Jonassen et al., 1999, p. 194).

While World Wide Web tools are very valuable, educators at all levels who use the Internet face an explosion of information for which they need strategies to shape work, save human energy, and focus power. Fortunately, technology users can access such forces through databases or information banks to help them do just that. Information banks, according to Jonassen, Peck, & Wilson (1999), "may include text documents, graphics, sound resources, video, animations, or any other medium of information that is appropriate for helping learners understand the content well enough to be able to use it to solve problems"(p. 199). These information banks supplement the efforts of a human by taking advantage of the superior sort and compile functions of a computer to manage information and to search a topic or keyword in minutes, sometimes even seconds. Beyond speed, the foray of a database also produces work in research and information management by its capacity to move easily among any number of indexed fields.

Approaching databases initially and using them effectively can be daunting for preservice teachers as they struggle to learn and integrate content, pedagogy, and technology all at the same time. Yet Morton (1996) asserts, "computer systems in school should be viewed as structured learning environments with complex and comprehensive capabilities.... They should be seen as interactive learning extensions of the children themselves" (p. 417). The same could be said for the computer systems of the children's teachers. This perspective acknowledges the constructivist nature of a technological learning environment as well as validates

and encourages teachers at all levels to see themselves as active contributors to a community of learners who share knowledge and ideas through the World Wide Web.

Active Production of Technological Resources

This presentation outlines a constructivist approach to educational learning and work for preservice teachers which enables them to move from passive consumers of information to active producers of technological resources for themselves and others. This approach involves secondary methods preservice teachers as critical consumers utilizing a FileMaker Pro™ 3.0 database that has been customized to gather text, graphics, sound, video, and references through the World Wide Web. The preservice teachers then become active producers by applying that information in lesson activities that are made available to others through technology. Mounting lesson activities by preservice secondary teachers from a common site has resulted in a community product or new information bank of over 50 activities in 9 topical areas: English, social studies, science, journalism, guidance, art, math, special education, and business education.

Before we can operationalize the constructivist approach to critical consuming and active producing, we ask preservice teachers to seek World Wide Web resources on a curricular topic in their subject area in preparation for lesson planning and presentation. The information knowledge base available through technology is expanding so rapidly that novice users can easily be overwhelmed. Both teachers and students must understand and feel comfortable with technology in order to tap its strength to address individual needs and specialized lesson activities. McLellan (1996) defines this type of shift as "mass customization—customizing both education and technology to individual learner needs and preferences" (p. 5). At this point in their education, preservice teachers are both learners of content and pedagogy with individual needs, and future teachers who will soon be faced with the individual needs of their own students. Technology is truly valuable only when users, like our preservice teachers, are able to assess and transfer information and processes to new situations.

Following an introductory lesson reviewing navigational strategies using a Web browser, we distribute a handout with the address and brief annotation of a number of search engines and educational sites. As preservice teachers begin to find specific materials, their questions and comments reveal that they are ready to learn how to select and download resources. At this point, we discuss thoroughly how to evaluate the credibility and usefulness of World Wide Web resources. Preservice teachers' conversations then turn to how they can use some of the materials in their classrooms. By the end of the two-hour session, students report that they feel confident about exploring the Internet for materials to use in curriculum development and teaching, and they are ready for the Three-Step Approach to Information Organization to focus those resources.

Three-Step Approach to Information Organization

The Three-Step Approach to Information Organization blends technology applications with constructivist strategies to enrich both approaches. In theory, constructivism describes the changes in students' mental schemes that illustrate learning. Planning constructivist activities that involve technology activities requires teachers to consider the following components of practice:

- Lessons should be based on the evolving needs of students
- New information offered within a lesson either confirms or changes students' current beliefs
- Teachers must value students' perceptions of and reponses to lesson information and activities
- Lessons must establish relevance for current and future use

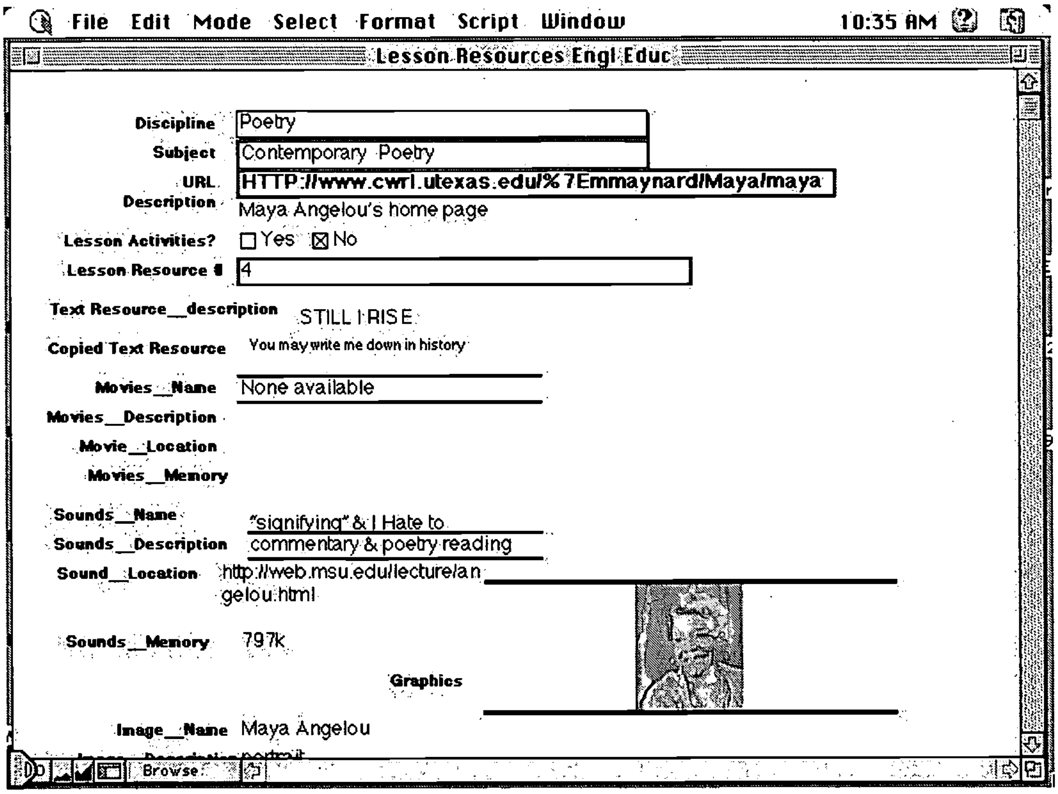
Today, teacher educators must expect students of education to be intellectuals—problem-solvers who resolve cognitive dissonance, perform authentic activities, and have their efforts assessed in ways that reflects a genuine application. The Three-Step Approach to Information Organization meets these criteria by completing the tasks outlined below.

Step I--Critical Thinking Assignment: Students begin this assignment by finding and downloading resources from at least five World Wide Web sites into a Teaching Resources Database that will aid in the development of a lesson activity in their subject area. This assignment reinforces their new skills in navigating and retrieving from the Web, storing, and organizing information. It also helps students understand that quantity does not equal quality, and information does not equal insight.

Step II--Authentic Activity Procedures: Constructing meaning involves evaluating information by sorting and sifting, saving only what is important. This authentic activity builds on a process most of us learned

as part of our first research paper assignment--indexing cards. With the help of technology, we can take that process and update it by having students build their own Teaching Resource Database on a hard drive or disk, directly cutting and pasting information from the Web to the database instead of downloading files without careful analysis. The development of a lesson activity using the database makes it personally relevant and a professional resource that one could continue to expand. See Figure 1 to for fields and database layout.

Figure 1.: Teacher Resource Database Layout



Using an alternate layout within FileMaker Pro™ 3.0, the student can quickly and simply produce handouts or mini-posters of the materials for teaching.

Step III--Published Products: Performance testing of an authentic activity should be nonalgorithmic, complex, and involve judgment and interpretation (Resnick, 1987). By publishing the product of their searches, preservice teachers are authentically challenged to use World Wide Web resources to create a new resource. This new resource is then available for analysis, comment, and use by other professionals in the field. Like all publication, this step encourages preservice teachers to do their best work because the published resource is also available for potential employers to review at the following World Wide Web site address: http://www.educ.drake.edu/sec_meth/secondary.html.

These published products include the following categories: resources needed, exposition, procedure, interactive learning, critical thinking, possible assignment, and World Wide Web resources used within the activity. The secondary lesson activities can present concepts that might be familiar in new and different ways, but they are all based on resources found on the World Wide Web. For example, one lesson activity, "Adaptation in Arctic Conditions," explains the concept of thermoregulation with a lab about how to make blubber. Students are divided into cooperative learning groups that explore the insulating effects of blubber in Arctic conditions. Critical questions are provided for students as they consider the concept. In addition, the page includes a complete lab activity outline and corresponding worksheet. Visitors to this page are sent to a number of World Wide Web sites for further information:

- *How do animals spend the winter?* http://www.waterw.com/~science/november.html

- *Adaptations for an aquatic environment.* http://www.seaworld.org/walrus/adapaqwal.html
- *Polar bear facts.* http://www.polarworld.com/polarfaq.html
- *Polar bear project and information.* http://www.polarworld.com/help.html

All of the lesson activities are launched from a table on the secondary methods web page. Submenus by discipline list activities and their authors. Links from the activity title lead directly to the students' pages, their contribution back to the educational community and the World Wide Web.

Benefits of a Constructivist Approach to Technology

Using a constructivist approach to technology accepts learners as thinkers with valid questions and the ability to create meaning and materials. The benefits of this approach, when properly applied, enrich learning and teaching in the following ways:

- The formulation of questions and assessment of materials can enhance critical thinking and problem solving. Using information obtained from a variety of sources and creating meaningful products to illustrate student learning enables all, teachers and students, to increase their knowledge base and apply that knowledge to new circumstances with emerging technologies.
- Authentic technological activities provide for individual needs and learning styles of students by offering different methods of learning a concept. For example, students might make a video, create an electronic presentation, prepare a concept map, and even use word processing to write a traditional research paper. The important point is that all of these activities are prepared as they would be in a work world.
- Autonomous learning is promoted as students question, explore, and create meaning that arises out of their own unique educational needs and interests. Autonomy is best represented by initiative and creative energy. While technology cannot guarantee that students will succeed, it does motivate them to undertake projects and to persevere in refining them. Such perseverance can then increase self-esteem and satisfaction from intrinsic motivation.
- Collaborative learning in technological situations creates a team atmosphere and produces problem solvers even as it expands human networks. Both Dewey and Vygotsky stress that we naturally learn in social situations. Students working in technology share skills, knowledge, shortcuts, and encouragement with other students on site or with persons across the world through e-mail, chat rooms, and forums.
- Multiple approaches and perspectives allow the student to explore diverse viewpoints and synthesize information critically. Learning with technology reflects the complex nature of knowledge, encouraging the acceptance of knowledge as tentative and tolerance of ambiguity.
- Real-time relevance mirrors our rapidly changing society and its hunger for information about events as they occur. Instant access through technology to newsgroups, electronic publications, and online news reporting provide an active learning environment that facilitate transfer of information quickly.
- Innovative learning environments provide a work-world approach to managing and leading educational innovation. Classroom teachers cannot stay current in all aspects of technology that can be useful to them. They must establish environments where continued learning is modeled and reinforced, and an environment where risk-taking is encouraged.

Hindrances to a Constructivist Approach to Technology

As with any technological process, a constructivist approach to technology can create challenges that act as hindrances in its implementation.

- Time can be a real concern when blending technology with a constructivist methodology. Technology approaches take time to set up and require time to teach both the technological skills needed and the targeted concept. In addition, students require varying amounts of time to construct authentic projects.
- Inequity of resources perpetuates socioeconomic divisions. Lockard, Abrams, & Many (1994) assert that "Computers only call further attention to the fact that schools in the U.S. are anything but equal. Inequities affect everything from basic supplies such as paper and pencils to library resources and even the quality of teachers" (p. 411). The problem is magnified when students from schools with few resources go home to an environment unable to support their technological needs.

- Teachers who have limited knowledge and interest in technology either refuse to use technological approaches or use them ineffectively. Use of technology requires new ways of thinking about instructional delivery. Roblyer et al. (1997) confirms "that properly trained teachers make the difference between success or failure of an integration effort" (p 40).
- Besides the initial cost of establishing technology, schools are faced with continuing cost of repairing and updating equipment and software. Innovations are soon outdated, and newer equipment and software are often incompatible with existing resources.

Conclusion

Preservice teachers with a dynamic need for resources can find or produce a plethora of information. But educators also have a need for a process which enables them to organize and synthesize that information so that it is meaningful as well as useful for current and future projects. The constructivist approach to critical consuming and active producing described in this paper provides proactive procedures for preservice teachers to search, sort, save, synthesize, and create.

Future questions about this approach deal with the ability to sustain and update the site, staying current with database software, and the use of the customized database after students have left the university. We have had contact with former students who are now teachers who look to the Web site for new ideas and indicate that they continue to use the database template that was given to them. Moreover, even if they do not have the same software at their schools, they do have knowledge of the process of evaluation, information gathering, and synthesizing so that they can create their own databases. Using a customized database in a constructivist approach to technology provides a means for students to act as critical consumers and to contribute as producers for the educational community of learners who continue to work with and through technology.

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Learning Practices In Amsterdam

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Abstract: The Amsterdam Faculty of Education is developing and implementing a new curriculum concept for professional education, for which it attained the status of "the experimental teacher education in the Netherlands" in 1997. This concept, fitting in the constructivistic learning paradigm, is nicknamed 'learning through producing'. The Amsterdam Faculty of Education (EFA), which attained the status of "Experimental College of Teacher Education" in the Netherlands through a national contest in 1997, is developing a radically new curriculum concept. In this poster/demonstration session a number of concrete results, as well as the basic ideas behind this curriculum innovation, are demonstrated in an interactive fashion.

Introduction

The Amsterdam Faculty of Education (EFA), which attained the status of "Experimental College of Teacher Education" in the Netherlands through a national contest in 1997, is developing a radically new curriculum concept. In this poster/demonstration session a number of concrete results, as well as the basic ideas behind this curriculum innovation, are demonstrated in an interactive fashion.
A more extensive presentation of these basic ideas can be read in the SITE 2000 paper "Proving Competence: Integrative Assessment and Web-based Portfolio System in a Dynamic Curriculum", by Douwe Wielenga.

The development and implementation ("expedition", as we call this process) of this new curriculum, is our answer to the challenge of educating teachers for the information society, in which they will have to act as "change agents" of education.
Education should, in our view, take place in a learning environment that reflects the way a professional works: students, like professionals, work together on complex tasks. In doing so, they take control and responsibility of their own work and learning processes. Also, this approach makes learning exiting and challenging: learning can, once again, be fun!

Authentic Learning in Professional Education

At as early a stage as possible, the program should create an environment for students which mirrors professional practices. Learning during the program must be linked as far as possible to useful and responsible work resembling work in the profession for which one is being trained.

In professional practice, teachers have to carry out relatively complex tasks that fit in with the objectives of the school. To be able to do this useful work well, they must be able to use 'two kinds of learning'. They should not only be able to acquire on their own initiative the knowledge and skills they need to do their job well (learning of the first kind), but they should also be able to continue to learn from the experience gained and to experiment systematically with actions leading to improvement or change (learning of the second kind). See figure 1 on the next page.

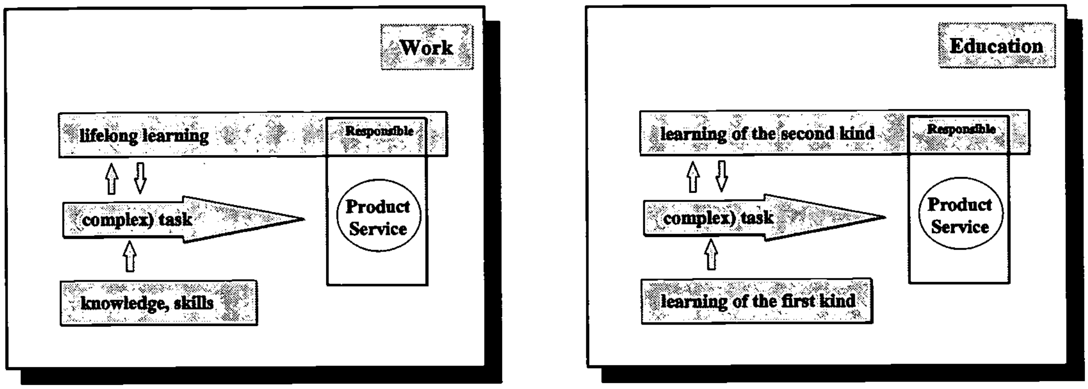

Figure 1: congruence between work and education

Both kinds of learning are important in the concept of 'lifelong learning'. Both are 'guided' by the competencies, which the competent and qualified teacher must have.

So the program should offer environments in which students can (and indeed should) put these two kinds of learning into practice connected to authentic practical work, in order to acquire the skills required for the profession. In this concept, named "learning through producing", we integrated ideas on authentic and meaningful learning, first and second order learning, integrated assessment, and portfolio systems. ICT is used, not as an "add on" technology, but as a catalyst of the curriculum transformation. The key building blocks in this curriculum, and the main subject of this session, are "authentic learning practices", which differ radically from traditional courses. Students work together on complex assignments: they provide products or services, preferably for the professional field, schools for primary and secondary education. In many instances, working for schools involves support in innovation and ICT-implementation in these schools. Students acquire knowledge and skills in order to perform the tasks, set in such an assignment. They are being encouraged to take responsibility of their own learning process by basing student's assessment mainly on the quality and usefulness of the products that they make. Of course that assessment is not solely based on products, but explicitely on the proof of professional competence that is given by the sequence of products, feedback and reflections.

Basic characteristics of these learning practices are:

- Students work on meaningful, authentic assignments; someone (e.g. a school) depends on their products! Students acquire the competencies of a professional teacher by working in consecutive learning practices.
- The student takes control of, and is responsible for, his own learning process. Within the framework of the assignment, the student has the freedom to set his own learning aims.
- The teacher (faculty) acts as a coach in both the learning and the productive processes.
- The learning practice encompasses a full learning cycle, including orientation, planning, execution and evaluation activities. Assessment of students is based on their products as well as on their reflections on the learning process.

Examples will be shown at the poster session. Examples can be seen at http://onderwijs.efa.nl. Information in the English language on the expedition of the Amsterdam Faculty of Education can be seen at the Publications part of the home site of EFA: http://www.efa.nl

The Multimedia Content Development Company: The Evolution of a Hands-On Technology Integration Course for Preservice Teachers

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Abstract
This article describes a strategy for modeling the integration of technology in the curriculum of ETC 447, Technology in the Classroom, a required course for preservice lementary educators at Northern Arizona University. Preservice teachers engage in a classroom simulation in which they "do" desktop publishing, databases, spreadsheets, and hypermedia development--not just hear about them or complete practice activities. The strategy can be modified and implemented at any K-Higher Ed level. Included are samples of the course materials from the course Web site, as well as examples of student work. Although we are currently using ClarisWorks 4.0 in a Macintosh-clone computer lab, the coursework is platform-free and any of a number of applications can be used.

Introduction and Some History

Don Tapscott, in *Educating the Net Generation* (Educational Leadership, 1998) recently says of the K-12 environment, Computers alone won't do the trick. They are a necessary but insufficient condition for moving our schools to new heights of effectiveness. We've still got to learn how best to use this technology. And I have become convinced that the most potent force for change is the students themselves. (p. 7)

This, we think, is also true of preservice teacher education at the university level. One of the difficulties in changing the way educators "do" things may be that our educational system is one in which the new generation of teachers is taught the same way as the last--it is self-replicating. New teachers enter the system from teacher education programs with similar beliefs and experiences as their predecessors; thus, they continue to teach the way they were taught! For change to happen, preservice students need to experience alternative teaching and learning models and strategies as part of their own education.

ECI 447 has been a required technology course for all elementary preservice teachers in the Center for Excellence at Northern Arizona University for over 7 years. It has evolved from a skills-based course where students completed a variety of projects by following instructions in a manual, to a classroom simulation of a Multimedia Content Development Company where teams of students complete a content-centered project in which technology tools are integrated.

At its inception ECI 447 was taught in a lab of Apple II Es which grew, over the years, into first, a lab of hybrid Macintoshes, and now one of 22 Motorola Macintosh clones--equipped with printers, scanners, Proxima display unit, digital cameras--linked together on a network that includes mounted CD-ROM software, student and instructor folders, and fast access to the Internet and World Wide Web.ECI 447 has

become ETC 447 with a prefix that denotes its true goals and objectives, Educational Technology for the K-12 curriculum.

It has been our vision to move from ETC 447 from one in which students followed the traditional computer literacy curriculum of drill and practice routines and activities with little personal engagement in the course materials, few higher order thinking expectations, and, frankly, not much enthusiasm, to one that models authentic practice through hands-on activity and social interaction, enabling our students to "do" technology and "be," for example, authentic desktop publishers and multimedia developers and database managers by using those tools in an environment that promotes risk-taking and personal responsibility for learning. We watched our students plow through the textbook to complete the projects and we graded their papers, and we felt that ETC 447 was hollow: our students gave us good evaluations as helpful and supportive instructors; they reported that they learned alot, but there was no evidence that they had experienced technology in a way that they could take with them into their own classrooms, the real world, to use effectively---they had only "covered" the material.

Strategy for Technology Integration: The New, Improved, I Really Mean It This Time, ETC 447

We have spent several semesters struggling with ETC 447 to move it closer to our vision, adding group work here and new activities there, but finally, over the 3-week winter holiday in December 1998 we looked at each other, said "Let's do it!," and spent our semester break completely recreating the course. For the Spring 1999 semester we introduced **The Multimedia Content Development Company** to ETC 447 students with the following memo taken from the course web site (http://jan.ucc.nau.edu/~emw4/etc447). This memo serves as the introductory piece for an in-depth 10-week project, and models a contract strategy, both between students, and between instructor and students, in which activities, expectations, and completion dates are noted.

LIZARD GRAPHICS, INC.

MEMO

TO: New Software Development Teams

FROM: Sneak E. Lizard, President and CEO

SUBJECT: Software Development

DATE: 1/11/99

Lizard Graphics, Inc. has decided to aggressively move into the educational multimedia software market. You have been organized into several development teams for the purpose of creating prototypes of some possible software for this purpose. This software should be designed for the K-8 market. The software should follow a specific theme. The exact theme that your team chooses is entirely up to you. Some

FIGURE 1. The Sneaky Lizard Memo

Materials for ETC 447

The first week of class meetings (we have 8 sections of ETC 447 on campus taught by four instructors, some that meet once a week and some that meet twice) was spent introducing the course web site and

carefully examining each document of the **Multimedia Content Development Company**. The materials that traditionally would be part of a course syllabus are all available at the web site and include

(1) the syllabus
(2) the competencies (what product instructors expect from each activity)
(3) the grading structure for the course
(4) the schedule for the semester

At the web site, too, are all project materials, such as
(1) the memo that introduces the **Multimedia Content Development Company**
(2) Research Help--lists Web sites for all kinds of research
(3) a description of each team member's responsibility
(4) Resources for graphics and educational Web sites
(5) Search strategies for "surfing" the Web

Each instructor, that first class meeting, used their own method to place students in teams for the project. ETC 447 classes are limited to 20 students, so teams of 4 were planned. Each student then chose a responsible team position, i.e., the Recorder, who keeps track of what goes on at each weekly meeting of the Team, or the Presentation Coordinator, who is responsible for making sure the final presentation is completed and ready for a wider audience of CEE faculty and students.

First Half of Class	Second Half of Class
Week of Jan 11-15	**Week of Jan 11-15**
• Introductions • Syllabus • Setting up DANA accounts through LOUIE • Access E-Mail • Introduction to The Multimedia Content Development Company	• Work teams initiated and meet • Instructor meets with each team: introduce tasks • Teams begin research: WWW, CD-ROM • Assign additional reading • Introduce "All About Multimedia"
Week of Jan 18-22	**Week of Jan 18-22**
• Monday classes do not meet: MLK holiday • Team meetings • Continue research on WWW & CD-ROM	• Continue research on WWW & CD-ROM
Week of Jan 25-29	**Week of Jan 25-29**
• Team meetings • Introduction to PAINT: create a self portrait for team collage to be used on software label	• Work on Self Portrait • Support: Chapter 3 pages 102 - 110

FIGURE 2. The Semester Schedule

During that first week, too, each instructor spent extra time with the 4-person teams to review the concept of the project, helping them to decide on a research topic, and answering questions about team-member responsibilities. This proved to be an important element of the introductory process, for instructors and students. We were able to meet and talk with each other in a small group environment: students were able to have discussions with people they were expected to collaborate with, and the instructors were able to put faces with names across a table instead of across a room.

The Multimedia Content Development Company Unfolds

In those small groups the students made their topic decisions and, for the next two weeks, were encouraged to concentrate on their research--on the Web, in the university library, and on CD-ROM encyclopedias available in the computer lab.

Research topics included The Planets, The Four Food Groups, Greek Gods, Animals of Northern Arizona. Time for thinking, planning, and research is often at a premium in the classroom, whether at the university

or K-12 level. We wanted to model the importance of allowing time for these higher-order skills in order for students to have the best opportunity for success.

In the third week, following their research, the MCDC teams began working on the project. The first activity, using PAINT, was for students to design and create a self portrait. (We use ClarisWorks 4.0, now AppleWorks by Apple Computers, on Macintoshes in our lab, but students are encouraged to recognize the concepts, not the platform, and use other applications and platforms that are also available to them.) These self portraits will be electronically merged to become the cover of their team portfolio. This activity was designed to support and model several levels of learning: the tools available in a PAINT application, the integration of technology in a content-based project, and understanding artistic challenges and possibilities for K-12 classrooms.

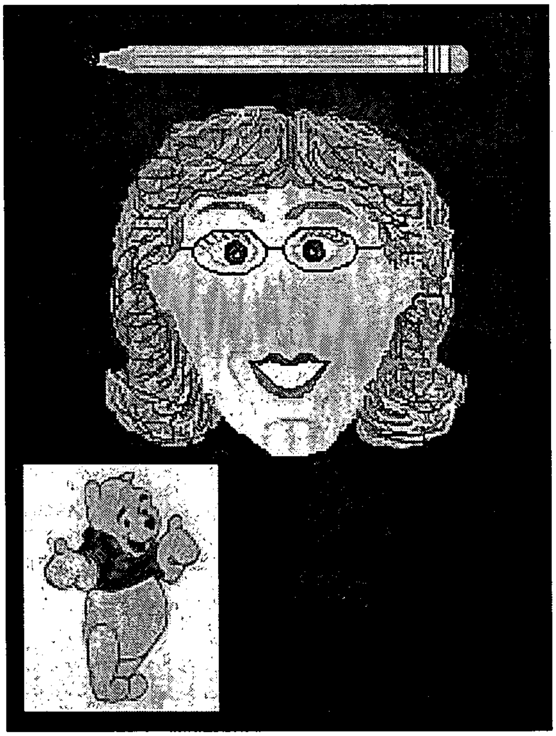

FIGURE 3. Student Self Portrait

To complete the next activity, students created a slide show using the ClarisWorks 4.0 DRAW application, the storyboard planning for what will eventually be their hypermedia document about the research content they have chosen. They learned the DRAW tools and concepts, how to set up a slide show for use in their own classrooms, and played with design elements such as object placement, color, and text.

Slide Show Storyboard in Draw: pages 71-102

Using the Draw program in ClarisWorks create a slide show that illustrates the proposed design of your content portion of the new software. The slide show must meet the following criteria:

- Minimum of 3 slides
- Master Page with a border and color background
- Imported graphics
  - The chosen graphics serve a purpose (specifically relate to the presentation's content)
- Text
  - All text is easily readable
  - Text of different sizes, colors and styles (e.g., bold, italic, etc.)
- Good design
  - Colors are coordinated
  - The elements are uncluttered
  - Is pleasing to look at

FIGURE 4. The Slide Show Competency

The completion of the Multimedia Content Development Company project includes the research content and computer-based activities in which students:

create one-page newsletters about their research for a team prospectus.

create 10-person databases, with a mail merge of three professors to whom they will send invitations for the final presentation.

create spreadsheets to explore expenditures for software, hardware, and visiting content experts needed for their software development.

design and create a 15-20 card team hypermedia document that synthesizes the individual content research and becomes their software, to be showcased at the final presentation.

And, finally, the teams present their completed project to "the company president," their peers and invited guests--a wider audience. The presentation is both a hard-bound portfolio of completed work, such as their newsletters and spreadsheets, but also an electronic showing of their hypermedia content "software." Team members are responsible for securing a presentation room, electronic display carts, planning the order of team presentations, and making sure all the technology "works"---everything that must be done in the "real world." During this presentation teams are also be responsible for videotaping each other for self-critiquing. The constructive self-criticism from viewing the videos allows these preservice teachers a unique opportunity to "see" themselves as presenters and help prepare them for Arizona's video-based performance evaluations for educators.

Conclusion

A recent article in Education Week (October, 1998) reports that technology can have positive benefits in the classroom, but that too often it is used for the wrong purpose. The researcher, Harold Wenglinsky, an associate research scientist at the Educational Testing Service, used performance data from the 1996 National Assessment of Educational Progress (NAEP) to investigate the relationship between educational technology and students' achievement in mathematics. What he found, among other things, is that in 4th and 8th grade "students whose teachers had professional development in computers outperformed students whose teachers didn't." (p. 13) And, furthermore, eighth graders who used mostly "simulations and applications--generally associated with higher-order thinking" (p. 13), rather than drill and practice, performed better on NAEP than students who did not. In fact, "8th graders whose teachers used computers primarily for "drill and practice"--generally associated with lower-order thinking--performed worse." (p. 13)

We don't know yet how ETC 447 students will evaluate this innovative course format--only time will tell. But, for us, the "new, improved" ETC 447 not only meets the stated objectives for our technology curriculum for elementary preservice teachers, but satisfies our vision of what that course should look like in order to model good practice in utilizing technology tools for higher-order, relevant, and engaging activities, hands-on technology integration, and be more than "let's turn the page and follow the steps... drill and practice until you get it right." From the results of Mr. Wenglinsky's study, we think we are at least on the right track.

Restructuring, redesigning, and recreating ETC 447 has been time-consuming and labor-intensive. Thinking and planning for meaningful technology integration is a challenging task, but watching and listening to students work together to make a cooperative decision, or engaged with a problem around a computer, it is worth every effort we make. Moe than that, if we, at the university, preservice level of education, expect to make changes in the way technology is used in the K-12 environment, we must be models for our students, willing to be innovative and risk-taking ourselves, to explore new strategies, methods, and technologies.

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Acknowledgements

Our thanks to Gary Karcz and Dave Bowman, adjunct instructors at CEE, for their willing assistance in redesigning ETC 447 and implementing it immediately in their course sections. We would also like torecognize George Howington, System Administrator for the computer lab, who always says "yes" when we ask for one more extra drop folder on the network, or access to another software application. And thanks, too, to the graduate assistant and lab techs who support our ETC 447 students during open lab time.

Resources

ClarisWorks 4.0, now AppleWorks, www.Apple.com

AN INNOVATIVE TEACHER-TRAINING COURSE INCLUDING THE INTEGRATION OF ICT: THE EXPLO PROJECT OF THE ICHTHUS UNIVERSITY

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Abstract: The Explo project of the Ichthus University trains primary school teachers with vision and skills in the handling of ICT. Explo is a new, experimental teacher training course, related to the Dutch government's Prommitt program (see also Panel session). Explo is meant to be an educational response to the challenges posed by the knowledge society. One of these challenges is that both pupils and students must be prepared for the learn-as-they-work concept of organizations. Another challenge is that ICT plays a key role in these developments. The first part of this paper explains the view of Explo on the use of ICT in education. The second part deals with the Explo course in detail and gives information on the course program.

The role of ICT in education

Computers are used in education in numberless ways:

- As sources of information, such as educational software, CD-ROMs, on-line catalogs and databases on the World Wide Web;
- As means of communication such as e-mail, electronic news and discussion groups, computer conferencing and video conferencing;
- As tools for making products, such as word processors, data bases, presentation programs, author systems, programming languages, etc.;
- As tools for data analysis and process simulation. ICT applications in education are virtually inexhaustible, but not all applications are equally opportune in each study program, for each student and at each point. Having to make choices, it is important for us to establish the relevance of ICT to education.

The digital world is an extra world

The digital world with e-mail, the Internet, multimedia software and other electronic aids considerably increases the number of ways we process information and communicate. Besides being a playground and a market square, the Internet is used intensively as a working and learning environment. The "web" is not only an oracle, but also a tool shed to design and construct things. It's not only a means of storage and distribution for educational materials, but also a publication tool for students. It's not only a coaching and consultation channel, but also a virtual space for cooperation and discussion. There are three reasons why education should familiarize itself with this new learning environment, firstly: to teach pupils how to use the possibilities of ICT in a meaningful rather than superficial way, secondly: to enhance pupils' learning competence and thirdly: to prepare pupils for professions in which the use of ICT is increasing.

The computer as the students' tool

In traditional education, lecturers primarily transferred information. Nowadays students can also use computers to gather, order, analyze and edit information, to report on these activities, to simulate processes, cooperate on assignments, communicate about common interests and to exchange information. Explo uses computers especially as students' tools to make the learning process more productive.

Distance teaching supplementing face-to-face instructions

ICT offers new possibilities for distance teaching. Ichtus Hogeschool uses those possibilities for the foreign program for Dutch enrolled students. For Explo, however, where Ichtus deals with young students, priorities are different: the contacts between students, lecturers and fellow pupils are highly valued. The school building is seen as the social meeting point and as the place for face-to-face instructions. Distance learning does not replace these contacts but supplements them: face-to-face meetings are supplemented with electronic work groups, practical training with multimedia simulations, lecturers' consulting hours with electronic consulting hours, searching for information in the library with the consultation of electronic catalogs, etc.

ICT as a component of the teaching profession

ICT is used in all graduate professions. It completely alters the nature of some professions, such as those of publishers or librarians. But there are also professions that until now have been less in the digital forefront, such as the teaching profession. As a result, the digital "tools of the trade" for the teaching profession have hardly been developed. Most of the possibilities of ICT for teachers in elementary schools, secondary schools and higher education remain to be explored. They include better gearing of the study programs on offer to the learning profiles, learning styles and needs of individual pupils (adaptive education), cooperative learning, and ways of learning that are increasingly designed and implemented by pupils themselves.

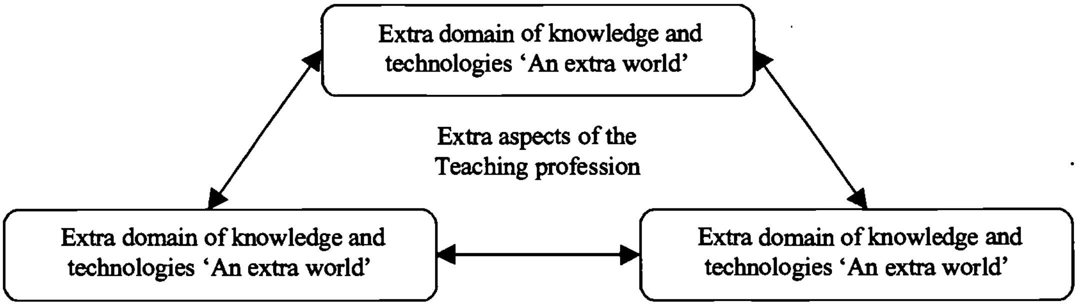

Figure 1. relevance of ICT for education

The curriculum's three phases

The curriculum is divided into the following three phases:
1. An one-year foundation course, in which students orient themselves to the teaching profession, asking themselves as the most important question: do I want to be and can I be an elementary-school teacher;
2. A main phase (18 months) offering a broadening of the various subjects and themes, the most important question being: what do children have to learn and how do I get them to learn it;
3. A specialization phase, taking another eighteen months, focusing either on the lower grades or the higher grades, the most important question being: what are my educational views and how can I implement them in an elementary school.

Assessments of students' progress take place at the end of each phase.

The curriculum's five strategies

1. Each year of study consists of four terms, each term having its central theme. Themes are based on students' development from freshman to novice teacher. Each theme is elaborated in tasks, cases and projects, introduced by and evaluated with tutors in groups of 12 students.
2. The internship strategy is closely linked with the theme strategy, since internship assignments, too, conducted in pairs, match the theme of the relevant term. One of the implications is that, in a particular term, students take internships in a particular grade of an elementary school.

3. The skills strategy consists of intensive training directed by a subject specialist. Like the internship assignments, these skills are closely linked with the theme strategy.
4. The reflection strategy teaches the student how to react to his or her development, to strengths and weaknesses and to achieving or failing to achieve certain learning objectives. An important aid in this strategy is the multimedia portfolio, in which students collect their plans, products, assessments and responses coherently.
5. The autonomous-learning strategy, though not linked with the theme strategy, *does* have a clear structure. As a result of independent-study programs, each student can set his or her pace in acquiring the required subject knowledge. Especially those students who have already completed subject components in their previous education can complete these subjects at a great rate. It is also possible for students to do in-dept analysis.

Variable class size

Students attend lectures and seminars in groups not larger than 60 persons at the most. In lectures, lecturers or guest lecturers give the required information suitable for large groups; in particular, a lecturer will expound on a term's theme from various angles and will give support regarding the contents of independent-study subjects. In seminars, students give presentations about their projects. The teaching of skills is done in work groups of 24. Introductions to and evaluations of thematic assignments are done in basic groups of 12. Students will perform some assignments in groups of 3 or 4. Internships are taken in pairs, and independent study is done individually.

Incorporation of ICT into the curriculum

The incorporation of ICT into the curriculum is based on six viewpoints:
1. To develop wide-range learning competence, students use ICT during the entire program in carrying out their learning activities with increasing command; these are the process-oriented and learning-process-oriented applications of ICT. They are closely linked with the program's concept (learning to learn-as-you-work);
2. To develop vision and skill in the use of ICT in elementary education, ICT-for-elementary education will feature in each theme-term in a way fitting the theme; these are the profession-oriented applications of ICT;
3. To enhance students' practicing and processing possibilities, multimedia software is used, such as "tutorials", training programs, simulations and hypertexts. These are the new learning aids used along with traditional learning aids such as textbooks;
4. To improve the efficiency and effectiveness of (traditional) teaching and learning methods, these are supplemented with and reformed with the use of ICT, and in some cases even replaced by ICT; these are the instruction-system applications of ICT;
5. To test new possibilities, a range of facilities is available on the Intranet; these are the technical applications of ICT for students and lecturers;
6. To monitor learning and teaching, several electronic systems are available, such as the multimedia portfolio, the study-progress registration system, electronic questionnaires for the evaluation of courses and, of course, computer-supported testing systems.

Thematic setup

As was set out earlier, Explo is a four-year thematic program, each year having four thematic terms. Each theme features ICT-for-elementary education in a manner fitting the theme.
1. The first-year theme is "The challenge of the teaching profession", enabling wide-range orientation to the profession. Students acquire basic skills for elementary education, including basic ICT skills. In principle, no special ICT courses are taught, but students make productions (a multimedia handbook for novice teachers), requiring them to learn how to command the entire range of elementary ICT skills. An ICT core item is included in each of the four theme terms of the first year. Moreover, students in the internship school together with children explore an educational aspect of ICT, on which they give a presentation to lecturers and fellow students during the program.
2. The second-year theme is "The class is the world" and emphasizes the relating of items to each other: playing and learning, emotion and cognition, subject matter and the outside world, inside and outside (primary) school. Thanks to the Internet, the class can bring in the whole world and Explo students in the internship schools will see to that as well. Furthermore, ICT is used in reading and arithmetic lessons, in subjects like art and music and subject integration in elementary schools.

3. The third-year theme is "Aspects of the quality of education" and focuses on adapting the study programs offered to the special needs of children with different talents and backgrounds. It deals with "colorful" education, with increasing the number of study programs on offer, and with the diversity in teaching particular subjects and education theory. In this year, students develop their view of the educational value of ICT in elementary schools.
4. The theme of the fourth year is "Schools are made by people". It emphasizes the development of students' individual professional profiles. In this year they take their trainee-teacher internship and students write their "masterpiece" final papers. The theme depends on the specialty selected by each student. The use of ICT to keep in touch with lecturers and fellow students during the long internship term will undoubtedly be a prominent feature.

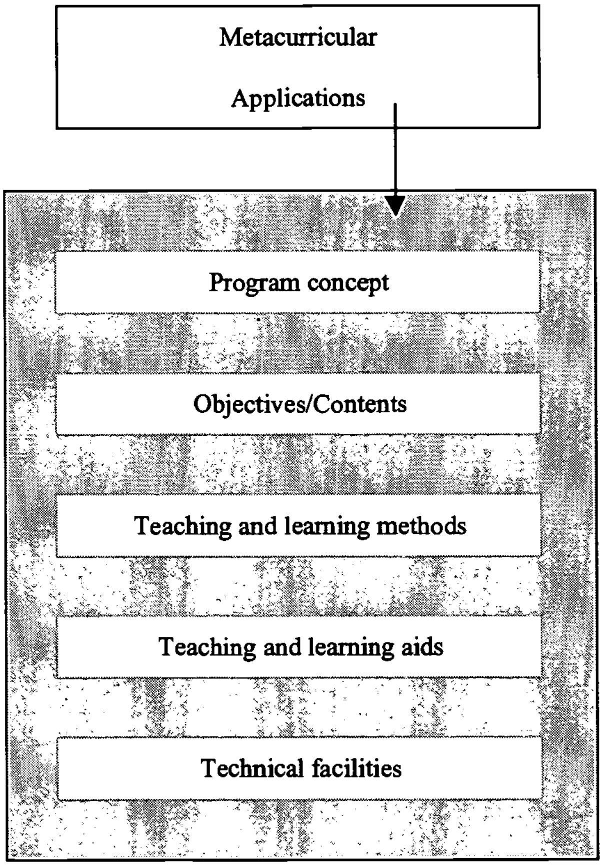

Figure 1. Incorporation of ICT into the curriculum

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THE PRODUCING STUDENT: LEARN-AS-YOU-WORK AND WORK-AS-YOU-LEARN, AN EDUCATIONAL PARADIGM FOR TOMORROW'S SOCIETY

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Abstract: In this poster students and coaches show digital products and the digital work surrounding as used in the new course of the Ichthus University. This poster presents examples of the new education model as described in the paper: "An innovative teacher training course including the integration of ICT; The Explo project of the Ichthus University"

Teachers for tomorrow's society

Explo's objective is to train students as teachers in elementary education who meet the demands of day-to-day educational practice as well as the requirements laid down in the national statutory professional profile. Central issues are the development of independent learning, learning to learn-as-you-work and exploring the role of ICT in education. Besides profession-oriented training, the program's objectives are social and cultural training and further development of students' personalities. The program is not at all free from value judgments. On the contrary, Explo aims to make students experience a school as a community, where people, learning together, are willing to accept responsibility for each other and where sufficient challenge is offered besides due care. But teachers for tomorrow's society need to be equipped with more.

Schools in their social context

The educational point of departure is the social and cultural backgrounds of elementary-school pupils and the school's immediate environment. In the area where Ichthus University is based, this means that both the curriculum and the internship reflect urban problems. The program promotes the students' sensitivity to the social diversity in school classes. Teachers not only transfer culture, but must also be able to criticize the dominant culture. Thus, students are counseled in discovering the values underlying the dominant culture and, consequently, education.

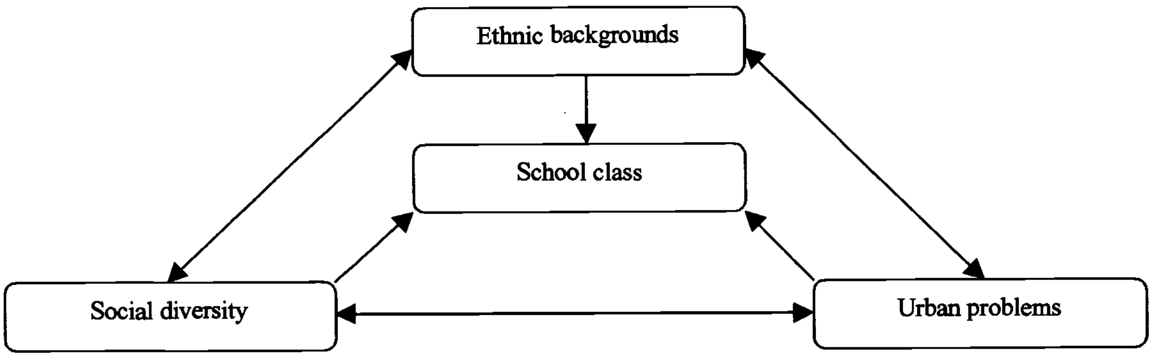

Figure 1. schools in their social context

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Basic attitude toward children and education

An elementary school is primarily a community in which children and grown-ups explore the world together. Paramount in the educator's relationship with the child is the respect for the uniqueness of every human being. For elementary-school teachers it is essential to have ideals from which they want to educate children, share their lives and be their "neighbor". All that is taught in the school will become meaningful only in such a relationship. On the one hand, we expect our students to be guided by this basic educational attitude when they choose to become teachers. On the other hand, the program enables to further develop this basic attitude.

Generalist teachers

Elementary education demands teachers with great employability. Students taking Explo's basic program are thus taught all subject areas and take internships in both the lower and higher grades. Consequently, the basic program provides training in the following competencies:

- General teaching competencies;
- Special competencies, such as public community care (in the context of the re-integration of the disabled into non-special education), teaching in a multi-ethnic context, breaking traditional role patterns, handling norms and values, etc.;
- Competencies in school organization;
- Subject-related competencies to meet the requirements for elementary-school subjects.

After two years and a half, students can choose whether to specialize in the lower grades or the higher grades with regard to these competencies.

Lifelong learning

After completing the program, novice teachers will not have completed their development. The exit qualifications of traditional teacher-training colleges are directed mainly toward the starting-level competencies of elementary-school teachers. "Competency for continued development" is nevertheless of the utmost importance: the ability to adequately respond to new developments both in education and in subject areas. This requires that students learn how to respond critically to present-day education and learn how to learn-as-they-work. This means that they learn from their assignments and their internships, from fellow students, books, websites, lecturers, their social and digital networks, etc. In other words, during the program students learn how to become learning professionals.

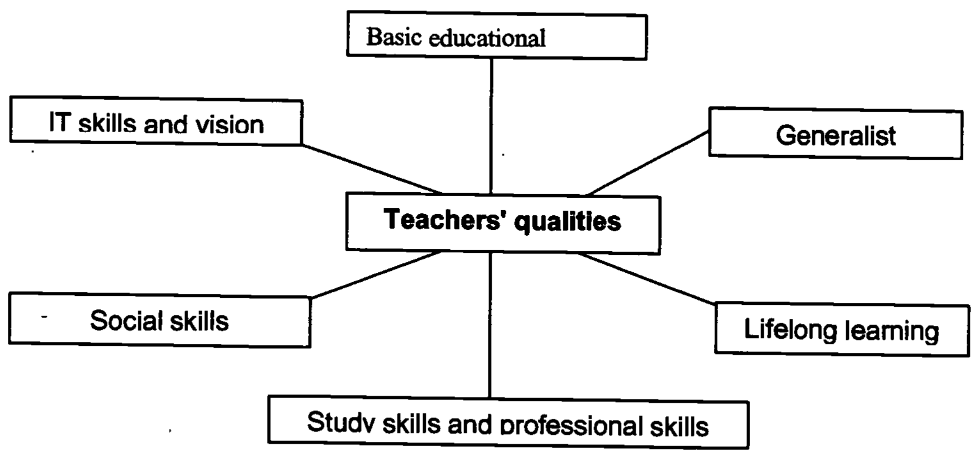

Figure 1. Teachers for tomorrow's society

Study skills and professional skills

In all of the program's components, students work on the acquisition of general study skills and professional skills derived from the professional profile. In Explo we especially emphasize information skills in addition to reasoning skills and methodical action.

Social skills

Since teachers work in teams and must be good communicators in all kinds of consultation settings, Explo teaches students cooperation and communication skills. Students regularly work on assignments in small groups, take internships in pairs, participate in discussion-training courses, etc.

ICT in education: vision and skill

In Explo, the development of views and skills is not an isolated activity, limited to any one subject, component or theme. It is integral to all components of the curriculum. In Explo, we wish to train teachers who:

- Learn-as-they-work and are innovative;
- function in a multi-cultural and international environment;
- and in doing so use ICT with vision and skill.

In Explo, five uses of ICT derive from this mission; ICT serves as:

1. A link between learning-as-you-work in practice and learning-as-you-work during coursework (the Internet);
2. An aid in providing adaptive education in elementary schools in a multicultural and international context (multimedia software, the Internet);
3. A means for students to develop vision and skills in the use of ICT in education: "being digital" (a laptop as a mobile toolbox for daily use);
4. A motor for lecturers and students to be innovative colleagues in designing (digital) learning environments (the Intranet to share knowledge);
5. A hub for the exchange of knowledge (website, electronic discussion platform) and to maintain the organization's external contacts (e-mail).

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Preparing Technology-Proficient Teachers

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Abstract: This study explores the perception of preservice teachers regarding the extent to which their institutions are providing the experiences needed for them to use information technology in their future practice. A major research institution in Southeastern Ohio was selected as the case. Eighteen student teachers within three focus groups--fall, winter, spring--participated in this study. Data collection and analysis were conducted on a continuous basis throughout the 1998-1999 academic year. The study findings indicated that only one course had a primary focus of information technology in the undergraduate curriculum. Preservice teachers experienced somewhat random exposure to information technology in the teaching and learning process in their content and education classes. In field experiences, students viewed only scattered examples of technology use by practicing teachers, and therefore very limited modeling of technology usage. The author recommends increased efforts to integrate information technology into preservice courses and field experiences.

Introduction

The infusion of information technology into the teaching and learning process is challenging to preservice teacher preparation programs. Yet these programs are viewed as the most direct and cost-effective way to prepare the approximately 2 million new teachers who will be teaching in the next decade (National Council for Accreditation of Teacher Education [NCATE], 1997 October).

Although institutions of higher education vary in their specific responses to this challenge, most institutions require at least one educational computing course as a core component of their teacher preparation programs (Leh, 1998). Such courses play a critical role in introducing preservice teachers to fundamental information technology components and skills (Kim and Peterson, 1992). Studies have documented improvement in the amount and quality of coursework in educational computing. However, it is recognized that one required class is inadequate to prepare preservice teachers to use information technology effectively in their future practice (Hunt, 1994; Strudler, 1991; Wetzel, 1993). In addition to educational computing courses, it is recommended that preservice teachers need to observe appropriate models of technology usage in the classroom throughout their university coursework (Huang 1994; Hunt, 1994; Gunn, 1991; Novak and Berger, 1991; O'Bannon, Matthew, and Thomas 1998; Strudler, 1991; Wetzel, 1993). Education faculty need to serve as role models. Their uses of and attitudes towards information technology in the college classroom will strongly influence the implementation of technology by preservice teachers in their future practice. (Barker, Helm, and Taylor, 1995; Huang, 1994; Handler and Marshall, 1992). In addition to the educational computing courses and appropriate modeling throughout the university course work, it is also recommended to integrate information technology into the field component of teacher preparation programs (Gunn, 1991; Novak and Berger, 1991; Strudler, 1991; Wetzel, 1993). As Wetzel and McLean (1997) point out, it is important to place preservice teachers in classrooms where information technology use is modeled appropriately. According to Wetzel and McLean, work in the field is a salient way to help preservice teachers experience deep learning of how to effectively use information technology in their future classrooms.

Today's students live in a global, knowledge-based age, and they need teachers whose practices embrace the best that information technology can bring to learning. Recent federal government estimates suggest that as the number of American students and the demand for smaller student-teacher ratios increase, the education system will be forced to replace nearly 67 percent of its workforce over the next ten years. A large proportion of those new teachers will be recent graduates of colleges of education (National Council for Accreditation of Teacher Education

[NCATE], 1997 October). This is the time to investigate to what extent teacher preparation institutions are providing the experiences needed by their preservice cadre to use information technology in their future work.

The Study

This study investigates the perceptions of preservice teachers regarding the extent to which their institutions are providing the experiences needed for them to use integrate information technology in their future practice. The specific questions, which guide this study, include the following: (a) What perceptions do preservice teachers have regarding the extent to which educational computing courses are providing the experiences needed for them to use information technology in the teaching and learning process? (b) What perceptions do preservice teachers have regarding the extent to which education faculty are providing the experiences needed for them to use information technology in the teaching and learning process? (c) What perceptions do preservice teachers have regarding the extent to which field experiences with cooperating teachers are providing the experiences needed for them to use information technology in the teaching and learning process?

This study is an exploratory study. In this study, a College of Education at a major research institution in Southeastern Ohio was selected as the case. The study included three focus groups. As Morgan (1998) describes, the focus group is a qualitative research method for collecting qualitative data through group discussions. There are six to eight participants who come from similar backgrounds. Many other variations are possible, however. In this study, all three groups consisted of participants who were student teachers during the 1998-1999 academic year. Only those student teachers in elementary education participated in this study. Group 1(5) consisted of student teachers in the Fall. Group 2 (7) consisted of student teachers in the Winter. Group 3 (6) consisted of student teachers in the Spring.

In this study, a "maximum variation sampling method" (Schumacher and McMillan, 1993) was used to select the study participants. According to Schumacher and McMillan, maximum variation sampling is a strategy for inclusion within a case that seeks to represent a range of differences of perceptions about a topic among information-rich potential participants. For purposes of this study, the range is being able to use information technology in the teaching and learning process among the participants. To select the study participants with a range of information technology experience, the researcher used an "Information Technology Survey," which was developed based on the ISTE Recommended Foundations in Technology for All Teachers (ISTE, 1998 July). The survey was provided to all potential participants (114) during the 1998-1999 school year. Based on the survey results 18 student teachers were invited to focus group interview participating in three groups. Being a student teacher in different schools and teaching in different grade levels were also considered during the selection of participants. Those who participated in this study were student teachers at 11 different schools throughout the Southeastern Ohio, practicing in K-8 classes.

Data collection and analysis were conducted on a continuous basis throughout the year. The research questions drove the analysis. The researcher analyzed the data question by question, looking for themes within questions and then across questions.

Findings

The findings of the study have been organized into three areas for reporting: (a) educational computing course; (b) education faculty use of technology; and (c) cooperating teachers use of technology.

Educational Computing Course

Only one course--EDCI 203, Technology Applications in Education--had a primary focus of information technology in the undergraduate curriculum. All but two participants took the course as required in their program. Most of the participants strongly felt that the course introduced them to fundamental information technology concepts and skills. However, it was limited to address the task of integrating information technology into the teaching and learning process.

Beth illustrated the feeling of many others as she reflected on her experience:

It was very basic...It pretty much started out with click it twice it's a double click...and really only covered word processing, spreadsheets, database...We viewed some of [educational] software which I think was little bit beneficial just to kind of know what was out there...We did a little bit HyperStudio...[Concerning using it as a teacher in the process of teaching/learning] it made me not be fearful [of technology] as some of the more experienced or older teachers are. Fearful of it. I wasn't fearful to get on the iMac. As soon as it came in I started playing too. But in terms of integrating into the classroom, it didn't teach me how to do that by any means...View the software, create a program, but now how do you implement it at all. I didn't learn any of that.

"My class was the same," said Jane when she reflected on her experience:

This class kind of got me into it a little more. It was good practice on a computer. The thing that teachers can use like basic Internet functions or electronic mail, spreadsheet, database, we just went through that...Well, like it didn't say if there is one computer in your class how do you teach all the students...That is the thing we need to know.

Stephanie shared the same feeling with her colleagues:

It didn't go into like how to apply it. You know how I would go about using the computer in the classroom or how I would use the research that I found on the Internet to apply it to a lesson or something like that...I didn't get like any of that.

Carmen pictured the feeling of many others as she reflected on her experience:

To me, I am still searching how to use, how to integrate...I would like to have strategies how to use three computers in a class of 25. Or like basic troubleshooting stuff. Like if this little problem occurs here what are the things that you can do...I think it would help us if they could break it down into different parts. Like part of it would be practical hands-on. Like here is how you use everything [tools.] And then talk about how you could apply it to the lessons. How you would menage using computers in the classroom.

The need for instructional support addressing the task of implementing information technology in teaching and learning process was an underlying theme. However, the prevalent feeling was that one required technology course was not meeting the needs of preservice teacher to use information technology in their future practice. Most participants were concerned about the conceptual issues covered in the course. They suggested that in addition to teaching certain technology skills, the course should focus on application of those skills in educational settings, and actual classroom management strategies around the idea of having one or few computers with many students.

Education Faculty Use of Technology

The attitude of education faculty towards using information technology in their classroom strongly influences the implementation of technology by preservice teachers in their future practice. However, most participants agreed that they experienced somewhat random exposure to information technology in the teaching and learning process in their content and education classes.

Teresa put it best as she reflected on her experience:

The only class I got anything out of computers was the 203 [technology class.] All my methods, they didn't integrate computers at all. I think it would have been helpful if they would have.

"None of mine were" said Sara when she described her experience:

I think that may be in my science methods he may have said or maybe even in a couple of other ones, you now do to the Internet and find lesson plan. Just print it off and bring it in...It wasn't anything about how to incorporate it into subject area. It was just to check and see if we knew how to get on the Internet. Just go to this, print it and bring it in. That's it. So I didn't have anything.

Mike described that

It's like you are encouraged but you are not really taught what you really need...It was given just like simple ideas like Internet sites for the class.

John described his experience:

> In a couple of my classes I got a list of some good Web sites that I could use. But, my planner had Web sites in it too. I was looking through my planer that other day and I was like oh, Web sites for education.

Bet was concerned experiencing "mixed signal" when she reflected on her experience:

> I had problem with faculty not using e-mail or not even having e-mail account...We were supposed to call them. If they had e-mail it would have been very helpful. Makes you want to use it more, too. If your professor is like oh, no I don't have e-mail, just call me. Then you are like okay. I don't have to. Use technology, but don't have e-mail. Don't even bother me with that; it's kind of mixed signal there. Why should I get it then? It's not that important then I don't need it for my class.

A few participants described that they had different experiences. For example, Adam used his experience to challenge his fellow friends:

> One of the things that I have done in the classroom teaching [student teaching] wise was with the Geometry Sketch program. But I didn't learn that at all in the computer class 203. I learned that in my 330 A & B for my math major. That helped a lot. So I had that and used that a lot in the math [during my student teaching.]

Melissa described her similar experience:

> We used technology in my art class too...We found all the information through the Internet and the library. She [instructor] took us to a class ahead of time to learn how to research, how to e-mail all this kind of things, which was helpful. Then we taught the class. We did some peer teaching with it. We used our lessons that we created. We found the artist and the museum and made a lesson and then we presented it to the class. So it is kind of like you we teaching them and they were learning.

The need for observing technology-using faculty in their curriculum and method courses was a common theme. However, most participants agreed that they have had a few opportunities to observe appropriate models of technology usage in the classroom throughout their university course work.

Cooperating Teachers Use of Technology

Most student teachers found themselves in technology-equipped classrooms/schools during their practicum. However, they strongly felt that they viewed only scattered examples of technology use by practicing teachers.

Jen put it best as she reflected on her experience:

> Kids get 10-15 minutes on the corner...and they play some type of game. They are done. It's the next person. So it's never, I have never seen computers incorporated into the curriculum in any way. It's just go do your time, okay your times up and you are off...

Stephanie was agree with Jen when she described her experience:

> ...Games...They get on computers on free time and play games and stuff. Basically at the elementary school they use shape games and things like that.

Kelly responded to Stephanie's comment when she explained her experience:

> Stephanie actually nailed it for me when she said free time because that is when they used it. When they had a free time. Free time and as a reward. It was definitely used as a reward...If you can do this then you can go use the computer. As an instructional tool in the classroom, no...I mean we did not use and we had 5 [computers.] They weren't hooked up to the Internet but they were all working and could be printed from if necessary. I tried to set it up as a center. I had 29 kids in the room so it was very difficult to try to get them rotated through the center. We also did used like CD-ROM encyclopedia once for a big ocean project they did. So they researched their ocean animal or their ocean creature. But very rarely.

Leslie described her experience intensively:

I am just kind of laughing because I am at East [Elementary school] and we have 2 computers in my classroom and I definitely know that my teacher is not comfortable with them because she is always [asking me] can you type up this rubric for me? You seem to be better at it than I am. Like we have these passwords [to access the computer] and she is messing with them. She has broken them three times this quarter already. The kids play games...I have seen them type up a paper once in a great while.

Some participants expressed their concerned about the attitudes of cooperating teachers as well. "I have a barrier," Maria reflected intensively on her experience:

My cooperating teacher is 69 years old. Computers just really started coming, people really started to know how to use them like maybe when we were seniors in high school or even later...So I think that a lot of teachers in the schools are really uncomfortable using computers because they didn't have a class in college. They are really uncomfortable using them.

I have similar teacher said Susan when she described her experience:

...She is perfectly fine not knowing, not wanting to know. She is ready to get retired, and she feels that she doesn't need to learn that.

Few participants expressed positive feelings about what they observed in their field experience. Leslie, for example, described her experience differently:

Actually each neighboring classrooms are joined by a little computer lab in The Plains [Elementary school.] And then each teacher has one [computer.] There is no designated computer time but she does use the computers to supplement her lesson...[For example,] we are going to do graphing today and we are going to do it in your group when they are finished can enter it into the computer or we are going to write poems today and you can make the word problems on the computer to process it. So may be not as much as she should use the computers but she does.

The need for observing technology-using teachers in the field was common theme. However, most participants agreed that they have had a few opportunities to observe appropriate models of technology usage in the classroom where they participated as student teachers.

Reflections and Conclusion

As the United State enters the 21st Century, teacher preparation programs across the nation are assessing their capacity to adequately prepare new teachers to embrace the use of information technology in the education of young people who will live in a global, information-based society. While investigating the status quo, recent studies have produced somewhat disheartening data. Relatively few teachers (20 percent) report feeling prepared enough to integrate technology into classroom instruction (National Center for Educational Statistics, 1999 January). In general, teacher preparation programs do not provide prospective teachers with the kinds of experience necessary to prepare them to use information technology effectively in their future practice (Milken Exchange on Education Technology, 1999). Findings of this study are consistent with the mounting evidence that preservice teachers are not being adequately prepared to teach with information technology. Only one course has a primary focus of information technology in the undergraduate curriculum. Preservice teachers experience somewhat random exposure to information technology in the teaching and learning process in their content and education classes. Furthermore, in field and student teaching experiences, students view only scattered examples of technology use by practicing teachers and therefore very limited modeling of information technology. In order to prepare technology-proficient teachers, teacher education institutions should increase the level of technology integration in their own program. In particular, the author recommends, increased efforts addressing the task of technology implications in educational computing courses as well as integrating information technology into method courses and field experiences.

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Preliminary investigation of some influences on student teachers' self-efficacy for teaching with computers

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Abstract: Although many teachers now have access to computers for teaching and learning and profess a belief in the value of computers for education the impact on the day to day work in classrooms is still limited. Even where teachers believe in the use of computers and have the necessary technical skills they may be reluctant to implement them in their classrooms. Increasing teachers' self-efficacy beliefs for teaching with computers has been proposed as a means of influencing their behaviour. This paper reports on a preliminary study of some factors that might be associated with self-efficacy for teaching with computers. The absence of significant relationships with factors such as Pupil Control Ideology and Innovativeness suggests that it may be possible to intervene to increase graduating teachers' self-efficacy for teaching with computers.

In Australia, as in the USA, computers are now widely available in schools of all types. The arrangements for access vary. Some schools place the computers in classrooms and others create computer laboratories. Whatever the arrangements in their school, there are now very few teachers who could seriously claim that they have no opportunity to use computers in support of teaching and learning.

There is also widespread support for the increased use of computers among policy makers, educational administrators and the community. In Queensland, the government has provided financial support for Schooling 2001, a policy framework which includes as a goal that "computers should be used in every subject area at every level of education" (Education Queensland 1998).

Despite the levels of opportunity and official encouragement implied by these developments, there continue to be concerns expressed about both the frequency and success with which teachers employ information technology in their classrooms (Cuban 1998). Recent online discussions among students returning from teaching practice have included comments about the limited use being made of computers in many classrooms. However, students observed that even teachers who did not use computers in their teaching expressed belief in the importance of computers in education. Surprisingly, on some accounts the rate of uptake of information technology in classrooms does not appear to be notably higher among beginning teachers than among their more experienced colleagues (Oliver 1993).

Various reasons have been postulated to explain the apparent reluctance of teachers to embrace IT. On the whole teachers appear to share the broader community enthusiasm for IT in education as a "good thing" but they report a lack of confidence in their capacity to use IT effectively for teaching and in many cases attribute this to inadequate preparation (Albion 1996; Handler 1993).

A previous paper (Albion 1999) discussed the importance of teacher beliefs in relation to their adoption of IT for teaching. Self-efficacy for teaching with computers (SETWC) was suggested as an area of belief which was related to teacher behaviour in the longer term, was measurable using existing scales and was capable of being influenced by teacher educators in the context of preservice and inservice courses. Problem-based learning (PBL) has been identified as an instructional design methodology that might offer particular advantages in relation to development of self-efficacy (Albion & Gibson 1998) and a multimedia package using this methodology has been developed (Gibson & Albion 1999).

Factors Influencing Self-efficacy for Teaching with Computers

If self-efficacy for teaching with computers is a significant determinant of teachers' behaviour in respect of teaching with computers and if PBL is an effective instructional design for influencing self-efficacy, then multimedia using PBL as a basis for design warrants investigation as a means of increasing beginning teachers' SETWC. As part of the development of the multimedia package it was proposed to test this hypothesis by measuring students' SETWC before and after the use of the materials.

The Microcomputer Utilization in Teaching Efficacy Beliefs Instrument (MUTEBI) was selected as a measure of SETWC. MUTEBI was initially developed and used in the context of science teaching (Enochs et al. 1993) but it is not specific to that context. It comprises two sub-scales which correspond to the two components of the self-efficacy construct identified by Bandura (1977), namely efficacy expectations, which was labeled by Enochs as self-efficacy (SE), and outcome expectations, labeled as outcome expectancy (OE).

Teachers' beliefs and behaviours in respect of computers do not stand in isolation from their other beliefs. Previous studies have demonstrated that teachers' use of computers may be influenced by, among other things, their beliefs about student centred pedagogy (Honey & Moeller 1990) and their inclinations towards innovativeness (Marcinkiewicz 1994). Moreover, students who reported more custodial orientations on the pupil control ideology (PCI) scale also reported lower self-efficacy for science teaching (Enochs et al. 1995). It is often suggested that the use of computers in teaching leads to more student-centred approaches to teaching. Thus, the possibility of a relationship between PCI and SETWC should be considered.

The effectiveness of the multimedia package in increasing students' SETWC may depend, at least in part, on the existence and relative strength of these other influences on SETWC. Early knowledge of such factors might guide refinement of the materials design. Hence an investigation of the relationships between SETWC and other aspects of student teachers' belief systems is warranted.

Because the multimedia materials were to be developed using an untried design, plans were made to conduct trials of a very early prototype with a small group of students who were representative of those who would use the final product. This group provided a suitable opportunity to trial the instrument that would be used to measure SETWC and to undertake a preliminary investigation of potentially influential factors.

It seems reasonable to assume that positive attitudes towards computers and strong self-efficacy for computer use would be prior conditions for positive self-efficacy for teaching with computers. Scales for the measurement of attitudes towards computers and self-efficacy for computer use have been developed and used with teacher education students (Kinzie et al. 1994). The attitude scale has two sub-scales that relate to comfort/anxiety and usefulness of computers. The self-efficacy scale comprises several sub-scales that relate to categories of computer use including word processing, spreadsheets, databases and so on. Subsequent studies have confirmed the reliability of the attitude scales and of a slightly modified version of the self-efficacy scale comprising seven sub-scales (Albion in press). The scales described in the latter paper were used in this study.

Scales for the measurement of teacher self-efficacy have been developed and used in several published studies. For the purposes of this study the instrument described by Guskey and Passaro (1994) was selected because it was the most recently published validated scale for teacher self-efficacy. It comprises two sub-scales. The internal sub-scale appears to represent perceptions of personal influence in teaching and learning while the external sub-scale represents the influence of elements beyond the direct control of the teacher.

Two other factors were chosen for examination. Pupil control ideology (Graham et al. 1985) is a unidimensional construct which has been found to be related to self-efficacy for science teaching (Enochs et al. 1995). As noted above, PCI could influence SETWC through the relationship between custodial orientation and student-centred classes. It was measured using the instrument published by Graham (1985). Innovativeness has been found to be related to computer use in teaching (Marcinkiewicz 1994). It was measured using the unidimensional instrument published by Hurt et al. (1977).

All instruments used in this study were derived from previously published studies. The body of the questionnaire comprised 134 items representing 15 scales and sub-scales as shown in Table 1. Each item was presented as a

Likert scale item with the extremes of the range identified as Strongly Disagree on the left and Strongly Agree on the right. The number of points on the range for each scale varied from 4 to 7 according to the usage reported by the originators of the scales. Table 2 records the maximum value attainable on each scale.

Results

A total of 31 students (25 females and 6 males) who were completing the final year of their Bachelor of Education degree completed the questionnaire. Ages ranged from 20 to 28 years (mean = 21.7, standard deviation = 1.8) with strong clustering around 21 years implying that most respondents had entered the degree program directly from secondary school. As an indication of relative familiarity with computers, respondents were asked to select a category which represented the number of hours they spent working with a computer in a typical week. These data are summarized in Figure 1.

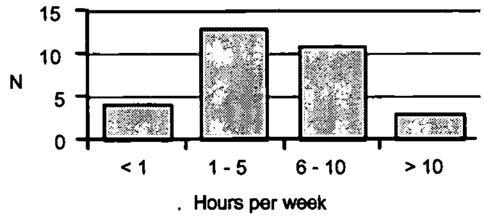

Figure 1: Distribution of computer use in a typical week

The small sample size precluded reliable factor analysis of the scales and they were assumed to exhibit the characteristics described in the published sources. Reliability values were computed and are shown in Table 1.

Instrument & Source(s)	Sub-scale(s)	Items	Alpha
Attitudes towards Computer Technologies (ACT) (Kinzie et al. 1994)			
	Comfort/Anxiety	8	.85
	Usefulness	11	.54
Self-efficacy for Computer Technologies (SCT) (Albion in press; Kinzie et al. 1994)		53	.97
Pupil Control Ideology (PCI) (Graham et al. 1985)		10	.62
Microcomputer Utilization in Teaching Efficacy Beliefs (Enochs et al. 1993)			
	Outcome efficacy	7	.77
	Self efficacy	14	.85
Teacher Efficacy Scale (Guskey & Passaro 1994)			
	External	11	.81
	Internal	10	.82
Innovativeness (Hurt et al. 1977)		10	.71

Table 1: Instruments & sources, sub-scales, number of items, and reliability measures

For each scale, student scores were computed as the mean of the item scores for each student in order to facilitate comparisons. Table 2 shows the means and standard deviations of the results obtained for each scale together with the maximum score possible on the scale as determined by the number of points on the Likert scale.

Instrument	Sub-scale	Scale maximum	Mean	SD
ACT				
	Comfort/Anxiety	4	2.79	.54
	Usefulness	4	3.42	.30
SCT				
	E-mail	4	2.31	1.12
	Internet	4	2.29	1.02
	Word processing	4	3.64	.45
	Operating system	4	3.08	.67
	Spreadsheet	4	3.09	.71
	Database	4	2.96	.79
	CD-ROM	4	2.62	.80
	SCT composite	4	2.90	.61
PCI		5	2.48	.43
MUTEBI				
	Outcome expectancy (OE)	5	3.61	.56
	Self efficacy (SE)	5	3.24	.57
Teacher Efficacy				
	External	6	2.71	.65
	Internal	6	4.37	.58
Innovativeness		7	5.02	.64

Table 2: Mean and SD of scores (N = 31)

Scores obtained for the ACT and SCT instruments were compared with the posttest scores reported for a group of first year students in the same program (Albion in press). The only significant differences were for Usefulness ($t = 3.11$, $df = 117$, $p = .002$) and word processing ($t = 2.45$, $df = 115$, $p = .016$). In each case the final year students returned higher scores indicating stronger belief in the future usefulness of computers and greater confidence in their ability to use a word processor.

Pearson product moment correlation coefficients were computed for pairs of measures. As described previously (Albion in press), scores on the sub-scales of the SCT were combined to form a composite measure of self-efficacy for computer use. Results are shown in Table 3.

	Age	Comf.	Usef.	SCT	PCI	OE	SE	Ext.	Int.
Comfort	.21								
Usefulness	.26	.52**							
SCT	-.13	.59**	.36*						
PCI	-.35	-.03	-.28	-.10					
OE	.03	.56**	.54**	.49**	.06				
SE	-.05	.50**	.33	.75***	-.07	.44*			
External	-.09	-.18	-.21	-.29	.38*	-.20	-.41*		
Internal	-.01	.01	.15	.21	-.28	.31	-.01	-.22	
Innovativeness	.53**	.42*	.30	.10	-.30	.20	.00	-.04	.27

* p < .05 ** p < .01 *** p < .001 (2-tailed)

Table 3: Correlation coefficients for pairs of scales (N = 31)

Discussion

The most significant correlation found was between the SE sub-scale of SETWC and SCT, implying that student teachers who report strong belief in their personal capacity to work with computers are more likely to report

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feelings of self-efficacy for teaching with computers. SE is also very significantly correlated with the comfort/anxiety sub-scale of the ACT, confirming that students who are comfortable with computers feel more positive about their ability to teach with them.

Outcome expectancy (OE) on the SETWC instrument corresponds to student teachers' beliefs that, through good teaching, they could increase the computer competence of pupils in their class. OE is significantly correlated with both sub-scales (comfort/anxiety and usefulness) of the ACT and with the composite SCT score. The implication is that graduates who have strongly positive attitudes towards computers and confidence in their ability to use them are more likely to believe that they can transmit those qualities to their pupils.

A significant correlation was found between age and innovativeness. The implication of this is not clear but it may result from older students (maximum age in this sample was 28) being more confident of their personal priorities and being prepared, at least in theory, to consider variations to common practice.

The remaining highly significant correlations are between the two sub-scales of the ACT and between the comfort/anxiety sub-scale of the ACT and the SCT. These relationships have been reported previously (Albion in press). It is hardly surprising that beliefs in the usefulness of computers, which would probably influence patterns of use, should be correlated with feelings of comfort with the technology. It is equally understandable that comfort with computers should be related to confidence in their use as measured by the SCT.

Contrary to expectations based on the results reported previously (Enochs et al. 1995; Marcinkiewicz 1994), neither innovativeness and pupil control ideology was significantly correlated with either sub-scale of the MUTEBI. A significant correlation was found between innovativeness and the comfort/anxiety sub-scale of the ACT. This might be explained in terms of comfort with new technologies being indicative of preparedness to adopt new approaches. The significant correlation between PCI and the external sub-scale of the Teacher Self-Efficacy instrument may indicate an association between a custodial orientation towards classroom management and a belief in the power of influences beyond the direct control of the teacher.

The implications of these findings for attempts to influence student teachers' self-efficacy for teaching with computers through their interaction with a multimedia package remain to be tested in practice.

The factors most strongly correlated with SETWC are comfort with computers and self-efficacy for computer use. These are among the factors that might be influenced by students' working with a multimedia package that presents examples of effective use of technology in teaching together with opportunities to rehearse relevant patterns of thought.

Factors such as innovativeness and pupil control ideology seem inherently more likely to reflect stable characteristics of students' personalities. If self-efficacy for teaching with computers were strongly related to these factors it might prove more difficult to obtain significant increases through the short term use of a teaching intervention such as a multimedia package. The implication appears to be that the use of the multimedia materials may produce the desired increases in self-efficacy for teaching with computers.

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Preservice Teachers' Beliefs about Effective Uses of Computers in the Classroom: A Content Analysis of Narratives

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Abstract: In this paper, the results of a content analysis are presented of preservice teachers' narratives describing how they would use computers in a classroom to bring about learning. This study is a continuation of an examination of preservice teachers' preconceptions about the role of the computer in the classroom. Each of the 286 narratives was reviewed and categorized by three instructional technology experts. The results indicate that prior to formal instruction, preservice teachers possess naï ve conceptions about effective roles of the computer to support learning.

Introduction

The demand for teachers who can effectively use technology to create meaningful learning environments for students is increasing (U.S. Department of Education, 1999). This fact, coupled with the predicted rate of teacher turnover (Darling-Hammond, 1996), makes the preparation of technology-using teachers among the highest priority for schools of education. Unfortunately, few teacher education institutions adequately prepare teachers to use technology (Quinn & Strudler, 1999; Willis & Mehlinger, 1996; Wetzel & Strudler, 1999).

Effectively preparing teachers who can integrate technology and pedagogy is a complex, arduous task. In part, because preservice teachers often enter instructional technology courses with personal theories about the role of computers in teaching and learning. These theories have evolved from their 12 years of experience as students. When studying about teaching, preservice teachers often use their personal K-12 experiences to understand instructional methods. This perpetuates a cycle in which students who were taught using didactic methods draw on these experiences and personal theories when solving problems in their teacher preparation courses (Niederhauser, Salem, & Fields, 1999; Sadera, 1997).

Preservice teachers' preconceptions can be inaccurate, incomplete, resistant to change, and affect student learning (Posner, Strike, Hewson, & Gertzog, 1982). In addition, if a student's existing theories are strongly held beliefs, the student may reject

conflicting ideas presented via traditional instruction and retain their personal theories (Posner et al., 1982). If preservice teachers are to espouse more comprehensive conceptions about classroom computer use, they will need to engage in conceptual change.

The conceptual change theory describes a process whereby rational beings may alter or abandon existing conceptions for ones that are widely supported by empirical evidence (Posner et al, 1982). Conceptual change occurs in four stages through which individuals need to progress to change their conceptions; they are dissatisfaction, intelligibility, plausibility, and fruitfulness.

Although many researchers have examined preservice teachers' perceptions of computers, few have examined preservice teachers' conceptions and conceptual development about educational computing. At the crux of this research study is the Thomas and Boysen Taxonomy for Instructional Computer Use (1984). This taxonomy categorizes classroom computer use based on the student's experience with the subject matter being taught. The taxonomy consists of five categories: experiencing, informing, reinforcing, integrating, and utilizing (Figure 1). Previous research on preservice teachers' technology preconceptions has shown that preservice teachers tend to possess simplistic views about classroom computer use (Sadera & Hargrave, 1999).

By analyzing the content of participants' narratives, this study describes how preservice teachers believe computers should be used in a classroom to bring about effective learning. This study is a continuation of an examination of preservice teachers' preconceptions about the role of the computer in the classroom (see Sadera & Hargrave, 1999).

Category*	Definition
Experiencing -	student has little knowledge of subject matter; computer is used prior to formal instruction to set stage and serve as catalyst for future learning. Description explicitly states that student uses computer prior to formal instruction
inForming -	student is prepared to receive formal instruction on subject matter; computer is used by learner to acquire information. Description explicitly states that the computer is being used to teach or deliver instruction.
Reinforcing -	student has initial understanding of subject matter; computer helps learner to strengthen knowledge previously acquired. Description explicitly states that student uses computer after formal instruction
inTegrating -	student is linking previously unrelated ideas to form new knowledge; computer is used to link classroom knowledge with real world situations to solve problems.
Utilizing -	computer serves as a tool to eliminate menial tasks allowing the student to concentrate on the subject matter.

*Categories are based on the cognitive state of the student with

respect to subject matter (Thomas and Boysen, 1984)

Figure 1: Thomas and Boysen Taxonomy of Instructional Computer Use

Research Questions

The purpose of this study was to extend our understanding of preservice teachers' preconceptions about the role of the computer in the classroom. Three research questions guided this investigation.

Research Question 1: What categories of Thomas and Boysen Taxonomy are the narratives most consistent with?

Research Question 2: How do preservice teachers describe effective uses of computers to bring about classroom learning?

Research Question 3: What do the data suggest about preservice teachers' preconceptions about the role of the computer in the classroom?

Methods

Procedures To obtain data regarding preservice teachers' preconceptions about effective uses of computers to bring about learning, the study activities were integrated into an introductory instructional technology course. During the first two weeks of the semester, approximately 300 preservice teachers at a large Midwestern university, were asked to write a narrative in response to the following open-ended statement: "Describe how you would use the computer in the your field of study to bring about effective classroom learning". Part of a larger study (see Sadera, 1997), the responses to this question were gathered in the hands-on laboratory sections of the course.

Data Analysis To analyze the students' narratives, a content analysis procedure was used. The purposes of the content analysis were to categorize the narratives according to the Thomas and Boysen Taxonomy of Instructional Computer Use (1984) and to characterize the content of the narratives. To complete this analysis, experts in instructional technology reviewed and rated the narratives.

Ten experts in instructional technology participated in the content analysis. The experts received training on the analysis procedures prior to reviewing the narratives. Using the definitions provided by the researchers, the ten experts were to carefully review the narratives and determine the category of the Thomas and Boysen Taxonomy with which each narrative was most consistent. Each narrative was reviewed and rated by three different experts. Using an eight-point scale (Figure 2), each expert reviewed and rated approximately 90 narratives; for the 286 narratives, the inter-rater reliability = .77.

BACL Rater's Quick Check Sheet

Original item given to respondents:
Beliefs about effective computer use for learning assignment

Select a discipline (i.e., math, science, English) and describe an example of how you would incorporate the computer into a lesson.

Rating Scale

E	= experiencing	DA	= doesn't address the question
F	= informing	0	= blank or no answer
R	= reinforcing	9	= multiple examples of computer use within one answer (not multiple categories)
T	= integrating		
U	= utilizing		

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Figure 2: Narrative Rating Scale used by Instructional Technology Experts

Results

Two hundred eighty six students completed narratives for the study. Of 286 narratives, 32 were eliminated because the study participants didn't complete all parts of the original study. The narratives from 28 participants were eliminated because their responses did not address the question; and 26 narratives were removed from the sample because there was no consensus among the experts in the ratings. The number of narratives used in the following analyses was 200.

Research Question 1: What categories of Thomas and Boysen Taxonomy are the narratives most consistent with?

The data analysis indicated that informing and reinforcing were the two most commonly described uses of the computer for effective classroom learning (Table 1). Nearly 60% of the narratives consisted of examples of using the computer to deliver information to students or reinforce previously taught material. Although using the computer after formal instruction was a common example in the narratives, using the computer before formal instruction to set the stage for learning was not. Only one narrative described using the computer to help students develop an understanding of the materials prior to formal instruction.

Nearly 20% of the respondents indicated that having students use the computer to manipulate the subject matter (e.g. write papers, form budgets, access information) would bring about effective classroom learning. Twenty-one percent of the narratives described multiple uses of the computer in the classroom. (The narratives rated as multiple uses of the computer are not analyzed in this paper.)

Table 1: Ratings of narratives by Thomas and Boysen Taxonomy

Category	N	Valid Percent
Experiencing	1	5
Informing	62	31
Reinforcing	53	26.5
Integrating	3	15
Utilizing	39	19.5
Multiple categories	42	21

Research Question 2: How do preservice teachers describe effective uses of computers to bring about classroom learning?

To move beyond the mere categorization of the narratives, the researchers also studied the documents to ascertain their character. The descriptions of effective classroom computer use provided by the participants are consistent with the uses of computers they experienced as students in K-12 classrooms (Sadera, 1997). These narratives provide a great deal of insight into their preconceptions. Below are narratives written by the study participants. Using simple random sampling procedures, the researchers selected five percent of the narratives as examples to demonstrate the preservice teachers' preconceptions.

Overall, these narratives exhibit rudimentary conceptions of educational computing; furthermore, they tend to be Type I (i.e. using the computer to teach in traditional ways (Maddux, 1984)) uses of computers in the classroom.

In a science lesson, a computer could be quite helpful. I would begin by giving background of the topic (i.e. earthquakes). Then the computer could be used to show earthquakes in a more 3-D way instead of looking at it from a book.

In a math class, I would first teach how to do addition using the chalkboard... Then a couple days later, I would give the students a chance to play a computer game involving addition. This makes learning fun and I think they get more out of it!

English – computers can be used to practice and reinforce what the teacher taught about such things as parts of speech. Students can use computers to publish creative writing stories including graphics.

Math has always been a hard subject for me in high school. I remember in middle school we would always use the computer lab to help us with our math and to introduce us to new things. This always helped me because I am a visual learner and I have to see it being done in front of me at my pace. If I needed to see it being done again, all I would have to do is click a button and I could see it again. This helped me out in a lot of ways and made it seem more like a game than just doing math problems.

To do a math lesson on probability, I might use Power Point. This would help all the students see and figure out the probability of dice being rolled at random. Sometimes seeing things makes it easier to comprehend.

Spanish – perhaps do a matching activity with vocabulary and pictures which keeps a print total for correct answers and rewards the child in the end. Certain games could be used to facilitate the lesson or review for a test.

Science (Anatomy) – You could get a software program that is geared toward scientific learning, and have students explore its features, and have them follow it along with a book.

English writing paper. The kids learn keyboarding skills along with being able to spell. Also they learn and develop skills for good writing

In the history class I plan to teach, I would incorporate the computer by using websites. In history the more resources you have, the easier it is to gain an overall view of a topic. So I would encourage and demand that my students get information for assignments not only from periodicals but from websites as well.

I might create a lesson in English on finding books on the net. I don't think computers should be used much to teach a lesson. Too many teachers are taking out the personal aspects of the classroom and turning it into a technology-based center of learning. I think it is important to know how to use a computer, but that is where computer classes come in. Don't over use them — it's the easy way out.

Research Question 3: What do the data suggest about preservice teachers' preconceptions about the role of the computer in the classroom?

The content analysis of the preservice teachers' narratives indicates that preservice teachers possess naïve conceptions of computer use for effective classroom learning. Fifty-eight percent of the narratives described simplistic uses of the computer (as defined by Hooper & Thomas, 1990). That is, the preservice teachers view the computer as a device to supplement traditional teaching methods. Several of the examples included above describe using the computer to complete tasks that are possible without the computer (e.g. practicing addition skills, sustain vocabulary skills, reinforce basic writing techniques, etc.). In addition, several of the examples described using the computer as a device to teach with (i.e. a presentation device).

Twenty percent of the narratives described using the computer as a tool to manipulate subject matter. For example, several participants depicted writing papers, finding resources, and developing spreadsheets as appropriate ways to use the computer to bring about effective classroom learning.

The researchers were surprised at the number of preservice teachers who described advanced ways of using the computer to support learning. To better understand this result, the researchers compared the data of these 39 preservice teachers with the data from the larger study. Specifically, we examined the following variables: experience with computers in education, attitudes towards computers, computer proficiency, and beliefs about knowledge acquisition. No significant differences were found between the two groups.

Conclusions

The intent of this study was to better understand preservice teachers' preconceptions about the role of the computer in teaching and learning. The content analysis procedure was an effective method to characterize the participants' conceptions.

The results of this study are consistent with the larger study of which this reseach was a part (see Sadera & Hargrave, 1999). Preservice teachers possess naïve conceptions of how the computer can be used to bring about effective classroom learning. Their conceptions are consistent with didactic, objectivist views of teaching and learning and support traditional teaching methods.

Clearly there is an increasing need for teachers who can effectively integrate computer-technology to create meaningful learning environments. Given the results of this study, teacher educators need to devise instructional strategies that will assist preservice teachers in developing more comprehensive views of teaching, learning, and the role technology can play in the classroom.

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Flexible Delivery of Teacher Professional Development for Information Technology in Learning

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Abstract: This paper compares the experiences of undergraduate education students on two university campuses who experienced an introductory information technology subject using different methods of flexible delivery. The paper analyses differences in the perceptions of the students on the two campuses as evidenced by a subject evaluation survey administered in the final week of the subject. Students at this level, express greatest satisfaction with subject delivery when it incorporates adequate human and technological support accompanied by online resource material.

Introduction

Subject delivery is key to student engagement with the subject content. It impacts not only on what students learn but also on their attitudes and beliefs about the subject area. In response to community, commercial, employer and parental pressure, teachers are being required to implement teaching practices that incorporate information technologies. The attitudes and beliefs that teachers have about using information technologies to enhance learning will be influenced by their experiences in their pre-service education degree study. This paper compares the experiences of undergraduate education students on two Australian university campuses who experienced an introductory Information Technology (IT) subject using different methods of flexible learning.

'Flexible learning' is one of those terms that everyone uses but nobody agrees on its exact meaning. For example, Louise Moran (1996) contends that "Flexible learning is multi-dimensional and does not lend itself to a neat, one-line description" while Rachel Hudson et al. (1997) suggest that "There is a confusion in the minds of practitioners between the terms open, distance, flexible and resource-based learning" (p.2). However Peter Taylor and Gordon Joughin (1997) are clear that flexible learning "prioritises learner control over the requirements of institutional practices". They claim that flexible learning "focuses the design of courses and subjects on *how* students will engage in learning activities … and *how* their participation and learning will be supported" (p.2, emphases in original).

Flexible learning in higher education has been a response to a number of factors. Hudson et al. (1997) include the following: pedagogy, cuts in funding, increasing diversity of students, equal opportunities, labour market requirements, and the demand for transferable skills. But most importantly in these factors have been IT improvements making available a range of delivery genre (including traditional print materials, video, audio tapes, Compact Disc based multimedia, and Internet delivery), and the huge increase in home ownership of computers and access to the Internet.

In the University in which this study was carried out, considerable resources were made available to allow all subjects on a new campus to include Internet delivery and it was strongly suggested (but not mandated) that subject convenors avail themselves of this option. Inclusion of Internet delivery for at least some aspects of the course was further encouraged by the ready availability of high-end computers for student use. This made possible the cross campus comparison of student's perceptions within the same subject that is the focus of this study.

While there is a fairly large literature on flexible learning and what it entails (see for example McGinnity et al., 1999 and Niklova & Collis, 1998) there has been less discussion on evaluating programs and subjects that employ flexible delivery methods, particularly where on-line (Internet) genres are used. This is probably because flexible learning using on-line facilities is still in its infancy. Diana Laurillard et al. (1997) suggest that "While perhaps the most judicious reason for evaluating an educational program is

to improve it", there are a number of other reasons for evaluating that might include informing interested parties, encouraging others to adopt similar methods, throwing light on innovative programs, and determining effectiveness. To these I would add determining student satisfaction. Students are becoming increasingly informed consumers of university courses and competition for students between universities is fierce. Therefore we should not be embarrassed to admit that one of our primary goals in educational evaluation is to determine student satisfaction and find ways of enhancing it – along with our usual pedagogical goals of course.

About the Subject

The evaluation that this paper is based on was concerned with the subject *Learning with Information Technology*. This is a first semester, first year subject in an initial teacher education program. The subject is designed to introduce students to aspects of IT relevant to teaching and learning. The subject was conceptualised in three parts – Concepts and Ideas, Applications, and Developing Assignments. The students were supplied with detailed *Subject Profiles* that explained the rationale, concepts, delivery, timetable, requirements and assessment items for the subject. The subject was taken by 350 students at Griffith University, Australia, comprising a cohort of 81 students on the Logan campus and 270 students on the MtGravatt campus. Logan campus is a new campus that specialises in flexible delivery. MtGravatt campus is a traditional campus that has its origins as a College of Advanced Education. On the MtGravatt campus the Concepts and Ideas aspect of the subject was delivered via one-hour lectures in a lecture theatre. In addition a one-hour tutorial in a computer laboratory addressed the Applications and Developing Assignments aspects of the subject. All aspects of the subject were supported with online material. On the Logan campus the students had the same online material available to them plus a two-hour workshop in a computer laboratory but no lecture. The workshop dealt with Applications and Developing Assignments. The Logan students had a *Book of Readings* available for purchase through the campus bookshop. The Concepts and Ideas section of the subject was studied independently by the students using the online material and the *Book of Readings*.

The student populations on both campuses were essentially the same with 86.30% of the Logan population and 90.91% of the MtGravatt population being female. This is in keeping with the highly feminised (and increasingly so) nature of the teaching profession in Australia. 58.44% of Logan students and 57.99% of MtGravatt students are under 21 years of age but there is a significant component of older students in both populations with 22.08% of Logan students and 19.18% of MtGravatt students being 30 years of age or older. The biggest difference between the two populations was in the number of immediate family (parents, siblings, children) who had attended university (see Figure 1). At Logan 70.13% of students had no immediate member of the family who had attended university compared with 46.12% of MtGravatt students.

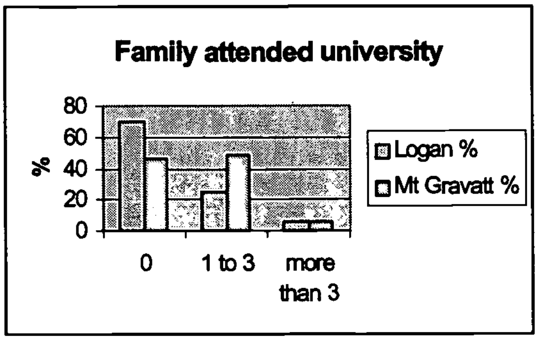

Figure 1: Number of immediate family who had attended university.

The Survey and Results

The perceptions of the students on the two campuses were ascertained from a subject evaluation survey administered in the final week of the subject. The survey consisted of questions concerned with the subject in general, the format of the subject, and about them as students, as well as a rating for the subject and the tutor and open ended questions concerning the strengths and weaknesses of the subject. The surveys administered on the two campuses were essentially similar with minor modifications to allow for the differences in subject delivery on the two campuses.

Subject Satisfaction

The students were asked to rate the subject from 1 (Low) to 7 (High). A result of 7 would indicate that all students rated the subject High. Table 1 shows the differences in the student satisfaction with the subject on the different campuses. At the Logan campus the subject was rated at 4.70 and at the MtGravatt campus the subject was rated at 3.84. It is clear from this result that the Logan students rated the subject more highly than the MtGravatt students yet the content and assessment of the subject on both campuses were identical. The only difference between the campuses was in delivery.

Question (1 Low – 7 High)	**Result**	
	Logan	**MtGravatt**
How would you rate this subject?	4.70	3.84

Table 1: Difference in subject satisfaction between campuses

General Statements about the Subject

On the survey there were four statements about the subject in general. The students were asked to enter a number against each statement from a rank of 1 to 7, where 1 represented 'strongly disagree' and 7 represented 'strongly agree'. Therefore a result of '7' to a question would indicate that all students strongly agreed with the given statement. The comparative results between campuses for general perceptions about the subject are shown in Table 2.

Statement (1 Strongly disagree – 7 Strongly agree)	**Result**		**Difference**
	Logan	**MtGravatt**	**(Logan – MtGravatt)**
This subject is of direct relevance to my professional life as a teacher	5.14	5.12	0.02
The level of the subject was appropriate to my background	3.46	3.73	-0.27
This subject provided a context in which I gained competencies for teaching	4.58	4.05	0.53
The assessment in this subject was an important part of the total learning experiences in this subject	4.73	4.30	0.43

Table 2: Comparative results between campuses for general perceptions about the subject

The first statement was intended to gauge the students' belief in the relevance of a subject about learning with IT to their professional life as a teacher. The results (5.14 at Logan and 5.12 at MtGravatt) show that the students have a clear understanding that the subject *Learning with Information Technology* was relevant to them as future teaching professionals. There was little difference (0.02) between the two campuses. The second statement on the appropriateness of the subject to the students' backgrounds was less positive and the Logan students rated this statement negatively (3.5 being the mid-point). There was also greater difference (0.27) between the campuses. As the students did essentially the same work on both campuses this seems to suggest that the students on the Logan campus came into the subject less well prepared with respect to IT skills. This was borne out in the data collected from a survey conducted with these students at the beginning of the semester where they were required to rate their competencies with a range of applications (email, word processing, Web searching, presentation software, spread sheets, databases, desk top publishing, multimedia development and Web page development). In all applications (except for word processing which they rated equally) the Logan students rated their competency lower than the MtGravatt students. With respect to the third statement concerned with gaining competencies for

teaching within the context of the subject, there was strong support (4.58 at Logan and 4.05 at MtGravatt) with a difference between the campuses of 0.53. When read in conjunction with the previous statement these figures suggest that Logan students were more positive about this statement because they learnt more, possible because they knew less to start with, or because the learning experience was more conducive on the Logan campus.

Statements about Subject Delivery

The format of the statements about subject delivery was the same as for the general questions, that is a score of '7' would indicate that all students 'strongly agreed' with that statement. Because of the differences between the delivery methods on the two campuses there were variations in some statements between campuses. The results are shown in Table 3.

Campus	**Statement** (1 Strongly disagree – 7 Strongly agree)	**Result**
Logan	The online Concepts and Ideas material provided me with stimulating ideas and foundation theories about learning with information technology	4.19
MtGravatt	The lectures provided me with stimulating ideas and foundation theories about learning with information technology	2.82
Logan	The structure of the online Concepts and Ideas material was easy to follow	4.30
MtGravatt	I found the online concepts and Ideas material useful	4.26
Logan	I would prefer to attend face to face lectures rather than have this material presented in online material	4.30
MtGravatt	I prefer to use the online material than attend lectures	5.31
Logan	I would prefer to have both face to face lectures and online material	5.02

Table 3: Results for statements about subject delivery.

One of the major differences between the delivery on the two campuses was in the presentation of lectures concerned with the Concepts and Ideas of the subject on MtGravatt campus while on Logan the students studied this aspect of the course independently using the online material and a *Book of Readings*. It can be seen that the Logan students expressed greater satisfaction (4.19) than the MtGravatt students (2.82) but they also expressed a preference for attending lectures rather than having the online material (4.30) and for having both lectures and online material (5.02). In contrast the MtGravatt students expressed a preference for online materials rather than lectures (5.31) and in fact when they found that the lecture material was available online a large number simply did not attend the lectures.

Statements about Computing Competencies

The statements that related to computing competencies gained as a result of the subject took the same format as those about the subject delivery and the general statements about the subject. Again there were some differences between campuses because of the variation in delivery. The results are shown in Table 4.

Statement (1 Strongly disagree – 7 Strongly agree)	**Result** Logan	**Result** MtGravatt
As a result of this subject I feel more competent and confident to use IT in learning	5.04	4.46
The workshops/tutorials allowed me to experience useful practical aspects of learning with IT	4.24	3.78
I found the online Applications material useful	4.40	4.10
I found the online Webster tutorials (in Excel, Word, Access) useful	3.88	-
The 1 hour tutorial length was adequate for my needs	-	2.34

Table 4: Results of statements about computing competencies.

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The students gained computing competencies during workshops/tutorials and via online tutorials and independent practice. At Logan there was a two hour weekly workshop while at MtGravatt there was a one hour tutorial. It can be seen from Table 4 that the Logan student expressed a greater confidence about using IT in learning. This is important when compared with the lower rating they assigned to their IT competencies when entering the subject. This more positive result is also reflected in their response to the second statement in Table 4 regarding their workshop being a useful experience for learning practical aspects of learning with IT. The negative result (2.34) for the MtGravatt students' satisfaction with their one hour tutorial makes it clear where the source of their dissatisfaction comes from.

Statements about resources

The survey included statements about resources because there were considerable differences between the two campuses in terms of resources. Statements on this topic took the same format as the previous three sub-sections. The results are shown in Table 5.

Campus	**Statement** (1 Strongly disagree – 7 Strongly agree)	**Result**
Logan	I was able to access a computer whenever I needed one	5.37
MtGravatt	I was able to access a computer whenever I needed one	3.69
Logan	I found the *Book of Readings* useful	4.71
MtGravatt	I would have been willing to purchase a Book of Readings if one had been available	5.04
Logan	The library had adequate resources to meet my needs in this subject	3.71
MtGravatt	The sessional/off campus employment conditions of tutors did **not** create problems for my progress in this subject	4.16

Table 5. Results of statements about resources

The Logan students were much more positive about being able to access a computer whenever they wanted to (5.37) compared with MtGravatt students (3.69). The Logan students found *their Book of Readings* useful (4.71). This was made available to the Logan students because the library facilities on their campus were new and did not have the same book and journal resources of the MtGravatt library. However the MtGravatt students expressed a strong desire (5.04) to have a *Book of Readings* made available to them as well. Surprisingly the MtGravatt students did not seem to be concerned about the sessional nature of their tutors that resulted in their not being able to have face-to-face contact with their tutor between tutorials. They did have the compensation that as subject convenor I was available to them on their campus four days a week (the fifth was spent at Logan campus).

Conclusions

Evaluating subjects is always a sobering experience for academics – well it is for me anyway. Preparation for this subject had been enormous and had taken over six months. I had the solo task of preparing the Subject Profiles, the *Book of Readings*, all online material and lectures and then delivered the lectures, took one workshop group and managed four sessional staff on two campuses as well as dealing with all convenorship duties entailed in a subject with 350 students. To say that I was not overjoyed at the outcome would be an understatement, but in some ways I was probably not surprised. For example I was well aware that there would be problems with the lack of computing resources on the MtGravatt campus. This had been the reason that the one-hour tutorials had been scheduled in preference to two-hour tutorials - it had simply been impossible to timetable that number of hours in the available computer laboratories. This of course had the further consequence that there was little available time for students to do independent work in the computer laboratory. This problem is easy to solve by increasing the computer/student ratio and the university has undertaken to do this for the next cohort.

A more difficult question is the value of the flexible delivery. Admittedly, the subject evaluation survey was a fairly shallow attempt to gauge the student preferences with regard to online material compared with more traditional delivery methods such as lectures and tutorials. It did little to gauge the efficacy of the methods with respect to the learning that took place, except in so far as it rated students' beliefs in their own confidence and competence to use IT in their teaching profession. Certainly there was a more positive result in this regard on the Logan campus but this is more likely to have arisen from the

difference in workshop/tutorial time allocated on the two campuses and the availability of computers for independent practice. The university has considerable investment in the online material that included not only my time in developing the materials, but also the services of the Flexible Learning unit of professional Web designers, programmers and technicians that had the responsibility for Web mounting the subject materials, as well as the infrastructure costs in computers and communication technology. The students clearly valued the online material but only as a suite of possible delivery methods of which face-to-face contact with a lecturer or tutor was the most important. What the online material does is provide a backup for the students where they have chosen to miss lectures for whatever reason and to reassure them that they all have available to them the core of the material regardless of differences between tutors. From the staff perspective, it is an advantage to be able to direct students to online material rather than have to provide personal tuition when special circumstances arise but at this stage the investment in my time comes no where near equalising this advantage.

My limited appreciation of online support for this first year undergraduate subject of internal (that is on-campus) students is not replicated however for post graduate external students. I also convene a Graduate Certificate of Computer Education that I made available via the WWW over the last two years. As a delivery method for these students, online materials have been an unqualified success and the course has attracted students from as far afield as New Zealand and Badu Island (a remote island in the Torres Straight to the north of Australia). It also does not apply to interactive components of the online subject delivery. All subjects I have Web mounted include a Forum (also called a threaded discussion or Web Board) where students can contribute comments or questions and read comments or answers from other students or staff. This has been an very useful for remote postgraduate students and was built into the assessment process for the undergraduate students who are the subject of this paper. Students were required to post their initial thoughts on various aspects of their group project on the Forum and their tutor gave them feedback on a weekly basis. This was a valuable developmental exercise for the students and improved the quality of their projects considerably but it is personally costly on tutors' time and needs to be well managed when used by large numbers of students such as a big first year subject.

So where to from here? With respect to the first year subject *Learning with Information Technology*, I have implemented changes that will see both campuses having a two hour workshop and a *Book of Readings*, neither campus will have lectures for the immediate future (a practical decision based on my absence from the university on sabatical) and the computing facilities on MtGravatt campus will be upgraded. With respect to the online material, further developmental work will be directed at improving interactivity as this is where the real power of online material lies. As for research, there is a huge need for in-depth work on the quality of learning that is taking place while students are engaged in interacting with online material, rather than just bowing to student preference or institutional dictates.

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How Can Computer Based Visual Mapping Tools Enhance Learning with Pre-service Teachers?

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Abstract:
Visual mapping tools are computer-based and are essentially two dimension and/or three dimension spatial arrangements of text and diagrams. Research has shown that these cognitive tools help teachers link curriculum content to instructional plans. Traditionally, it has been in the area of language and science education. This study extends this notion to include visual arts education. This paper will present the preliminary findings of a funded research study which used a visual mapping tool package in a visual arts studio setting with students training to be non-specialist teachers. The study highlights the benefits of these cognitive tools in allowing students to conceptualise and map their learning processes, while enhancing their visual learning.

Visual mapping tools are computer based, two dimension and/or three dimension spatial arrangements of text and diagrams. They have been used traditionally to link curriculum content to instructional plans, particularly in the areas of science and language. Research indicates that concept mapping is a reflective strategy to promote efficient and meaningful learning by connecting prior knowledge to new concepts. (Novak & Gowan 1984, White & Gunstone 1992, Ferry 1996a).

Concept maps use labelled nodes to represent concepts and lines or arcs to represent relationships between pairs of concepts. Studies by .Novak & Gowan 1984; Gallard 1994; Ferry, Hedberg & Harper 1998 contend that concept map structures parallel human cognitive structures as they demonstrate how learners organise concepts The use of concept mapping strategies with pre-service teachers has been acknowledged in the area of science education where researchers have reported how subject matter knowledge is organised. (Lederman & Latz 1995; Ferry et al. 1998).

While it has been recognised that concept maps act as tools to help learners organise their cognitive frameworks into more powerful integrated patterns, researchers such as Jegede, Alaiyemola & Okebukola (1990), Lederman & Latz (1995) and Ferry (1996b) contend computer based concept mapping goes further and assists pre-service teachers to organise curriculum content into powerful integrated frameworks. Importantly, Ferry et al (1998:2), argue that the process of concept map construction can stimulate a dialectic between curriculum content and pedagogical practice.

This paper takes the notion further and suggests that concept mapping can be employed by pre-service teachers to other disciplines, namely visual arts education, to actively develop understandings, map ideas and conceptualise meanings.

Creating Concept Maps

Six steps are recommended by Holley and Dansereau (1984) for learners to create concept maps. They are: selecting key concepts which is a recognition process which activates relevant knowledge and helps with topic identification; writing of the key concepts; listing the attributes of a key concept; forming spatial relationships which relate key concepts; rearrangement of the spatial representations; comparison of the representation to the text.

White and Gunstone (1992), suggest that a period of direct instruction is necessary for success before employing the process.

The following instructional steps are recommended by White and Gunstone (1992): use a small number of familiar terms with students so they can concentrate on the learning process; modelling by the instructor of the construction process; encourage students to record all possible links; provide constructive criticism by the instructor as it is unlikely that first attempts will produce successful maps; for first attempts suggested layouts are helpful; inform students that there is no single correct answer to the text.

The Concept Map Tool Used in this Study

The concept mapping tool used in this study was created using Inspiration®, using Apple Macintosh™ computers. These computers are used across the campus at the University of Wollongong. The pre-service teachers in this study had at least one course on the application of information technology to teaching and learning (fourteen two hour tutorials during their pre-service teacher training course).

The concept map tool is defined as a cognitive tool in this study. Jonassen (1991:2) defines cognitive tools as generalizable tools that can facilitate cognitive processing. According to Ferry et al (1998:3), cognitive tools are both 'mental and computational devices that support, guide and extend thinking processes of the user'. These tools are 'external to the learner and engage the learner in meaningful processing of information'.

The cognitive tool Inspiration®, allows the user to create a variety of visual diagrams. The four visual diagrams are: concept maps, ideas maps, webs and story boards.
Inspiration® defines:
1. A *concept map* as a hierarchical diagram used to represent a set of concepts beginning with the most general or most important and then working down to more specific detail. Key concepts are connected with links which may have descriptive words explaining relationships.
2. An *idea map* is a visual brainstorming technique used to generate ideas and develop thoughts. An idea map has the main idea located in the centre of the screen with sub ideas linked and radiating out.
3. A *web* has a main idea or core concept at the centre with different categories of information connected to it. Ideas, facts and information are connected to the categories to support them.
4. A *storyboard* is a visual way to organise projects and displays ideas at the beginning, middle and end.

Method

A number of broad areas for exploration were developed and investigated by the researchers. For the purpose of this paper, the following specific questions are addressed:
1. Do computer based visual mapping tools assist or hinder pre-service teachers to organise curriculum content and knowledge to be effective instructors?
2. When using computer based mapping tools to construct knowledge, do differences exist when applying subject matter knowledge to different subject disciplines, such as Science and Visual Arts?
3. Can the creative process in Visual Arts education be represented and deconstructed as a cognitive framework in the form of a visual map?

During the research study twenty four volunteer pre-service teachers enrolled in their final year of Bachelor of Education (Elementary) training were invited to:
1. compare the use of the visual mapping tool created by Inspiration® to plan instruction in Science and Visual Arts education
2. use the visual mapping tool created by Inspiration® to analyse and deconstruct the creative process

Instruction Provided

Half of the group were given direct instruction in a lecture theatre which contained computer projection facilities, where the program was demonstrated and modelled by an instructor. Half the group were given the User's Manual provided by Inspiration® and worked in pairs to gain knowledge of the package through a self-paced inquiry mode. (Note: the reason for the variation in instructional modes will form the basis for other research outcomes). Each pre-service teacher was allocated a computer but was encouraged to collaborate with their peers when constructing their visual maps.

Data Collection

Data was collected through three main sources, ongoing written personal reflections, analysis of the visual maps produced and interviews. Interview transcripts, written reflections and visual maps were coded and analysed for trends and emerging themes.

In relation to the reflective data, at the conclusion of each stage of the visual mapping process students were required to reflect and comment on their practice.

The reflective practice took three forms:
1. an *open-ended reflection* where students were asked in pairs to discuss and write about their thoughts and initial impressions concerning the use of the package),
2. an *individual reflection* where students commented on the use of the package in two situations
-the visual mapping of prior knowledge of an artist and his/her work
-the development of a personal artwork
3. a *structured reflection* where students were asked a number of specific questions (See Appendix 1 for questions)

Brief Description of the Study

Students were given four specific tasks to perform over an eight week period which involved either/or both Science and Visual Arts education.

They were:
1. to plan a short program of work for a elementary class, using the visual mapping tool package Inspiration®, to conceptualise ideas, organise content and knowledge
2. to research and investigate an artist and artwork, gathering and recording as much information as possible
3. to construct a visual map of the information and knowledge gathered in (2) using the visual mapping tool Inspiration®
4. to plan the development of a personal creative response (artwork) using the visual mapping tool Inspiration® to conceptualise and organise thoughts, ideas, materials and processes

Results

The results are organised by the three research question posed for this study. Part 1 presents and discusses the data and helps to clarify understandings on how pre-service teachers use visual mapping tools to organise content and knowledge. Part 2 presents and discusses data on how pre-service teachers use visual mapping tools to organise ideas and deconstruct existing knowledge in the Visual Arts discipline area. Part 3 presents and discusses data on how pre-service teachers use visual mapping tools to conceptualise, organise thoughts, ideas and materials to develop a personal creative response.

Part 1: Do Computer Based Visual Mapping Tools Assist or Hinder Pre-service Teachers to Organise Curriculum Content and Knowledge to be Effective Instructors?

It was clearly evident that all students agreed that the visual mapping tool package Inspiration® assisted them with their organisation of curriculum content and knowledge. The students were able in a

very short period of time in visually representing their knowledge and conceptualising in both subject disciplines. Many students reflected that it provided a clearer way of thinking and more efficient. It allowed the students choice in changing thoughts, conceptualising and recording their ideas. The students unanimously agreed that they would use the package again to prepare and plan their pre-service university course work. Students made positive comments on the transferability to the teaching context. They believed that the visual mapping tools would enhance their abilities to be more effective instructors. These results are congruent with earlier studies conducted by Ferry (1996, 1997) and White and Gunstone (1992).

Note: a number of criticisms/annoyances were raised by the students about specific actions relating to navigation which occurred when using the package. These points will be discussed in detail later in the paper.

Part 2: When Using Computer Based Mapping Tools to Construct Knowledge, do Differences Exist when Applying Subject Matter Knowledge to Different Subject Disciplines, such as Science and Visual Arts?

After data analysis it could be concluded that the students felt that differences were evident between the two disciplines when using the visual mapping tool package Inspiration®. Students generally commented that at first differences occurred when planning instruction between the two disciplines, but later when attempting to conceptualise knowledge, greater differences were apparent. This could be possibly be attributed to the nature of the task. That is, in the Science activity and the initial Visual Arts activity, the pre-service students had researched the topic area which was to be visually mapped. While, in relation to the Visual Arts activity, the students were required to gather knowledge about an artist/artwork and visually map this. This required the students to make decisions, find categories, explore ideas, gather like concepts and represent them visually.

It is interesting to note that Inspiration® provides two main views or environments: Diagram view and Outline view. When in Outline view the main idea appears as text at the top of the outline while the supporting topics and subtopics follow in hierarchical order, where notes as text can be added. Students used this mode extensively in this study.

Part 3: Can the Creative Process in Visual Arts Education be Represented and Deconstructed as a Cognitive Framework in the Form of a Visual Map?

In this study students were asked to plan and develop an artwork using the visual mapping tool Inspiration® to organise their ideas and thoughts. The New South Wales Visual Arts syllabuses (Years 7-10 and 11-12) broadly organise and describe art practice under the broad headings of three kinds of artworld practice: artmaking, art criticism and art history. For the purpose of this exercise the basic tenets of this syllabus were applied relying on the area of 'artmaking'.

A characteristic identified in the syllabus for the area of artmaking involves an understanding and application of a process. Students are required to utilise actions of exploring, developing and resolving. For this exercise the visual mapping tool was used at the 'exploring' stage of the process.

In this sense, when involved in the process of exploring, students were encouraged to think imaginatively, explore ways of looking, interpreting and responding to subject and forms. Students were required to make decisions about materials they might use or experiment with, the subject matter they might explore and the influences that impact on their 'artworks'. In other words, butcher's paper, scrapbooks and pens or visual process diaries were replaced with a visual mapping tool for students to organise their ideas.

From the visual maps provided by the pre-service students in this study and the analysis of the results it appears that the creative process can be represented and deconstructed as a cognitive framework in the form of a visual map. It is the researchers' belief that the development of and deconstruction/analysis of an artwork is a common practice in art education, but development of and deconstruction/analysis of an artwork using a visual mapping tool is a particularly unique phenomena.

In response to this activity one student stated:
'Inspiration allows the user to think visually, go off in any direction, and follow that idea to its logical conclusion, then come back to a past thought and go off in that direction. This is a great advantage as when someone thinks about a subject or topic they often come up with several ideas to follow, they then go off in one direction, often forgetting about their original thoughts, leaving them with a limited view of their subject. Another advantage is the ability to include notes behind the surface of the concept map allowing thoughts to be explained or expanded upon. Concept maps generally allow people to communicate their ideas to other people, this package helps do this in a very efficient and clear way.'

Other Areas of Investigation/Emerging Themes

This paper has only addressed a small area of the total research project. Other areas presently under investigation and proposed for future research include: the relationship between learning styles and the selection of visual mapping formats; the difficulties experienced in navigation by the pre-service teachers when using the visual mapping package, such as, screen size and printing problems; the problems of visualisation and the need for a package which could import visual or photographic images to enhance the deconstruction process; and the issue of cross-cultural applications when using the packages. In conclusion, further investigation, including the use of hyperbolic trees to present screen data, is being presently explored, as well as research to ascertain whether a particular learner, or learning style is better suited to this method of knowledge mapping.

Conclusion

In conclusion, a number of significant findings have been addressed in this research project. Students all agreed that the visual mapping package has enabled them to:
1. plan more efficiently
2. conceptualise their knowledge and ideas more clearly, allowing them to use the process successfully in two subject disciplines
3. make their thinking processes more explicit.

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Appendix 1

Final Evaluation - Inspiration®

1. Inspiration was developed to help you think and learn visually. The package provides you with the tools to let you create a picture of your ideas or concepts. Comment on the success of the package in light of the above statement.
2. With Inspiration, learning and thinking becomes active rather than passive. Is this statement true? Why/why not?
3. How could you use Inspiration with children?
4. Which of the following maps best describes your thinking processes?

Integrating Technology for Moral Education in the Student Teaching Practicum

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Abstract: Faced with a 23% population increase during the 1998-1999 school year, the faculty of a small rural K-12 Wyoming school realized that major intervention efforts would be needed to facilitate the absorption of the new students. The plan was to adopt a school-wide code of conduct: the law of kindness, and utilize the involvement of a student teacher in the language arts department, with the promotion of multi-media activities which would encourage students to express beliefs and values about interactions with each other in creative and interesting ways. The student teacher was involved in providing instruction in multi-media applications skills development as well as facilitating student project development. Various computer applications utilized in the classrooms provided the students a creative and challenging medium by which they could demonstrate concepts learned in morals and ethics, through multi-media presentations at a bi-annual celebration of the arts: the 15th all-school Drama and Fine Arts Festival.

Introduction

This project took place in Rock River School, in Rock River, Wyoming. This K-12, isolated rural school had a student population of 116 at the end of the 1998 school year. At the start of the 1998-1999 school year, the population rose to 152. The school was enrolling significant numbers, proportionately, of new students from four different locations, who were all choosing to come to RRS for different reasons. The faculty knew they had to assist with the absorption of the new, diverse student population, or serious fragmentation of the student body would take place. At the same time, the school was notified that it had been a grant recipient of a large sum of money that was intended for the development of curriculum to teach morals and ethics. In addition, the school was notified that a student teacher from the University of Wyoming would be placed with Rock River's language arts teacher. The faculty elected to use the grant initiative as well as the services of the student teacher, as two approaches to solving the problem of helping the new students mesh with the old-timers. Representatives from the University of Wyoming College of Education were recruited to help determine if direct instruction in the teaching morals and ethics through multi-media did have an impact on the students. The student teacher, who had already earned a master's degree in American Studies and was just completing his teacher certification, was most intrigued with the concept of

attempting direct instruction in morals and ethics. The purpose of the research was to determine whether or not interventions based on direct instruction in morals and ethics, which were demonstrated through multi-media, had a meaningful impact on a significant number of the students. The basis of the data collected was transcribed student interviews and written commentary from student reflections, primarily taken from the language arts classroom and also from the music classroom. In addition, anecdotal statements from the principal regarding school discipline were solicited. Also, selected teachers offered reflections about the impact of the initiative.

Background

Rock River School, a small, isolated rural school in Wyoming was facing a 22% increase in student population. Large groups of students were choosing to come to RRS for different reasons. One school located to the north of RRS, in a different county, closed down and their secondary students were going to be bused elsewhere. RRS was a viable option for those students. RRS serves as the secondary school for many of the area ranches, and a group of those students matriculated to the 9th grade (i.e., finished with their elementary education on site on the ranches). Also, RRS serves as the destination school for selected K-12 students bused from Laramie, 40 miles to the south, who want the "small, rural school" experience. Working all of those distinct groups into the RRS mainstream was going to be a challenge. At this time, as a part of a grant from Reader's Digest and DeWitt Wallace Corporation, the school agreed to develop a curriculum designed to provide direct instruction in morals and ethics. The initiative in morals and ethics instruction seemed to provide the framework to address the needs. Six classroom teachers elected to participate in the grant activities: Language Arts, Family and Consumer Science, Art, Music, and Health. A student teacher from the University of Wyoming, who was assigned to the language arts classroom, joined the team and participated in all aspects of the grant initiatives. Through work in using various computer applications in the language arts classroom, he assisted students in preparing their mulit-media presentations about what they learned about morals and ethics. In addition, by the time he was done, he used multi-media to prepare his own professional portfolio that is required by the College of Education as a graduation outcome.

Procedure

Six classroom teachers in the RRS secondary addressed morals and ethics in their lessons during the year. In the English room, a literature-based approach to morals and ethics provided numerous examples of stories, plays and essays that raise moral questions. Students were given the chance to reflect (in various ways) about the moral questions raised by the literature. The moral issues raised by student publications were examined. In addition, the students created mini-dramas that reflected the moral and ethical choices and consequences, and then used them as videos in their multi-media presentations. The student teacher was instrumental in helping the student write the mini-scenes, rehearse them, film them, then capture the video to include in their multi-media presentations. In the Business class, morals and ethics in the workplace were examined. A first-ever "mock trial" was staged to examine morals and ethics pertinent to business

law. In the Family and Consumer Science class, students were asked to determine how universal values affect their self-concept and personal feelings of self-worth. In Health class, the morality of the drug culture was examined. In Music, through the vehicle of two country-western songs, students examined and reflected on the impact of music that is designed to teach morals and ethics. The two songs are "Don't Laugh at
Wills and "Random Acts of Senseless Kindness" by South-Sixty Five. In the Art class, various unusual cultures were examined for their unique contributions to the human condition.

School-wide Projects Attempted

At four different times during the school year, the entire K-12 student body was called together for projects designed to apply morals and ethics. The first project was building team work, after an especially long and tiresome discussion of the student handbook on the first day of school. The students were placed in groups by random numbers, and those groups comprised the first sports teams of the school year. The second school-wide project was called "adopt -a –disability- for –a- day- and –rely- on-a-trust-partner- to- help- you- through- the- day." The students were paired, and then each set was given a contrived "disability." Some were partially "blinded" with glasses made from waxed paper. Some lost the use of hands; some were in wheel chairs. Some had ear plugs because they were "deaf," and some had to wear weight vests with an extra 50 pounds in them. The third school-wide project was "I Am a Member of the Seventh Generation." The students heard the Native American myth of White Buffalo-Robbed Woman, who in the past had taught Native Americans how important it was to care about future generations, those seven generations in the future. The students were paired with elementary students, and they were asked to get to know children who they didn't know or who were new to the school. The activity was especially meaningful, because one of the senior boys, the salutatorian of the class of 1999, himself was a member of the Northern Arapaho nation. He presented the myth of the White Buffalo-Robbed Woman to the students. He was an especially well-liked student who practiced daily morals and ethics with his fellow students, as though they were second nature to him, because they were. The students listened when he spoke, and they took his words to heart. The final project was the 15th RRS Drama and Fine Arts Festival, where students showcased much of the learning that went on during the year, through the performing arts. For example, advanced technology taught by the student teacher in the language arts classroom, was used to showcase the 7th and 8th grade examination of health-related issues. The theme of the Drama Festival was "Teen Choices and Consequences." The Drama Festival had K-12 involvement.

Tools Used

In order to create the student mini-scenes that were a part of the 4th quarter Drama Festival presentation for the 7th and 8th graders, the student teacher and students used Microsoft Works and Microsoft Word to write and edit the scripts. One critical piece in this entire project was the ability to edit the scripts down to a manageable size. At first

the students had trouble with the editing, but after they saw the size of their video clips, they understood the reason for the critical, discriminating editing. After filming on to tape from a Sony Panasonic Camcorder, the student teacher used Adobe Premier to edit the small scenes. The presentational vehicle used was Hypercard 2.3. The choice to use Hypercard rather than a more difficult presentational package was a conscious one. The students would have to prepare their presentations on LCII and LCIII computers available to them in the school's one Mac lab. While some applications such as Hyperstudio and Powerpoint were available on some machines, they are not available on all of them. In the next step, the abbreviated, edited videos were added to the Hypercard stacks on the G3 or the Powermac 7500 with a G3 processor, which are located in the English room. The student teacher was able to arrange a workable schedule for each of the 4-member student groups in grades 7 and 8 to get their turn on the two high-powered machines available. While using the tools, the students learned many lessons in group dynamics, collaboration, and team work. The student teacher once told me about some friction among some seventh grade boys, and his response was, "No, you can't quit the tour just two days before the show."

Conclusions

In order to determine the success of the instruction in morals and ethics, several procedures were used. First of all, after every school-wide event, students were randomly placed in "debriefing" groups, and with a teacher-leader, their feelings were aired and examined. A secretary for each group recorded observations. Then those thoughts were shared with the K-12 population of the school. Because of the student teacher's presence in the building, the faculty was able to divide the groups by one additional member, which further allowed the student teacher to be involved in the entire grant initiative. Further, at two times during the school year, Dr. Carol Bryant from the University College of Education came and interviewed a random selection of students about their thoughts on the effort. Those interviews were taped. The six teachers on the grant committee each submitted questions and likely student interview subjects, without collaboration among the members. The interviews revealed that students were really thinking about their actions before they took them, and many commented that they were more aware of kindness and compassion in the school. In English class, end-of-year reflections of the meaning of the initiative became the subject matter for final compositions. The student teacher pre-taught, assisted with the composition, and then evaluated the student written work. During the fourth quarter of the school year, a small contest was organized by the Student Council to determine the students who could demonstrate "random acts of senseless kindness" and be observed by an adult in the building. The senior class won the competition, and then instead of "blowing" the $100.00 cash prize on their senior trip, they elected to host a bar-be-que for the faculty and staff on graduation day. In a closing interview, Principal Charles Cashman commented that serious discipline problems had gone down, and the number of serious suspensions also was significantly reduced from previous years.

During the interviews, students were asked if they thought the emphasis on the Law of Kindness made a difference in the school. Student responses were analyzed for

indicators of change in attitude and responsiveness to the project. Student responses to the questions, as well as personal reflections at the end of the year, were generally positive for the impact of the initiative. Sample comments from the end of the school year included:

SY, 9th Grade: "I also learned to be kinder and to be more patient….but because of this activity, I understand how much the teachers were stressing kindness and I tried harder to be a better person."

MW, 9th Grade: "I have become really comfortable in this school."

BR, 9th Grade: "The grant taught me that kindness is an important element in this day and age. I think almost everyone learned something from it."

However, not all students felt the same.

KL, 8th Grade: "The most important thing I learned this year is that no matter how much teachers preach about kindness, all ages will still be cruel. All year long, the teachers here at RRS have spoken of kindness. Few, if any, have listened."

Further, the integration of multi-media in the English classroom, implemented by the student teacher, created a high level of motivation among students to seriously consider the morals and ethics lessons associated with the grant initiative. When multi-media projects were begun, student discipline incidents diminished, students came in for extra time and assistance, and they were actively engaged in the learning process. The student teacher discovered that the project approach using multi-media was a viable teaching technique that could be managed, even by a pre-service teacher.

Implications of the Entire Initiative

1. The grant monies provided special, unique opportunities for the students and teachers of RRS.
2. The grant initiative did indeed bring diverse faculty members together, out of necessity, to organize the activities. Those who would not normally keep company with each other, found themselves bonding with peers out of their normal group of friends.
3. The student teacher was able to build and maintain relationships with teachers who taught out of his discipline area, who also worked on the grant initiative. The interactions were positive and helped him develop a more global perspective of what the school was trying to accomplish.
4. Direct address of morals and ethics had an impact on many students. However, there is still work to be done.
5. Because of his computer training at the University of Wyoming, the student teacher
6. was able to provide assistance in the classroom with the students with various computer applications in a meaningful way.
7. Student teachers must be trained to integrate various computer applications and technology into daily lessons.
8. Student teachers must be trained in team-building, collaborative learning activities that may be out of the normal range of teacher activities.
9. Student teachers must be trained to use a project approach when appropriate.

10. Student teachers must be able to manage a project approach to various activities and not be threatened by such activities.
11. Student teachers must be willing to spend the time necessary to learn what new information is required of them, regardless of the time it takes.
12. Direct school-wide activities about morals and ethics, including activities to share feelings after an assembly, allow for good interaction among students.
13. Random selection of students for various groups involved with the grant initiative forces students to interact out of their typical groups.
14. The initiative must be continued in future years... students, staff and principal felt that way. Now the education must go on because it is the right thing to do, and not because there is a price tag attached to it.

Selected References

Two distinct sources were used as the foundation for the project. The teachers used these sources as guidance in some of the planned activities with the students

Brooks, David and Frank G. Goble. *The Case for Character Education: The Role of the School in Teaching Values and Virtue.*(1998). Brooks provided an answer to the doubters who question "whose values" are to be taught. Brooks identified values common to humanity, that transcended diverse cultures.

Glickman, Carl D. *Revolutionizing American's Schools/.*(1997) Glickman stressed the importance of fostering democracy in schools and of learning to live productively in society. Glickman advocated that all teachers should examine their practices for democratic overtones.

Preparing Teacher Candidates for the Integration and Implementation of Appropriate Technology: A Triad Approach

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Abstract: This paper is a description of initiatives in one teacher preparation program to prepare its candidates for the integration and implementation of appropriate technology. The paper will include descriptions of specific assignments, projects, and learning experiences designed to engage the teacher candidates in enriching technological experiences to enhance their own learning while at the same time serving as a model for teaching. The technology integration approach implemented focuses on a triad model that identifies three areas of technology infusion: communication, productivity, and research/instruction. This triad model demonstrates one approach for designing curriculum and appropriate experiences in a teacher preparation program that provides hands-on experience.

Introduction

Teacher education programs are faced with the challenge of preparing candidates for a technology-rich teaching profession. With innovations in technology growing exponentially and current research in teaching and learning advancing, the challenge can be quite daunting. Accreditation agencies such as *the National Council for Accreditation of Teacher Education* (NCATE, 1997) and discipline specific organizations such as the *National Council of Teachers of Mathematics* (NCTM, 1989) have proposed guidelines for preparing future teachers in the use of technology for instruction. These guidelines emphasize the importance of the appropriate use of technology for teaching and learning in both content and pedagogical studies for teacher preparation.

The International Society for Technology in Education (ISTE, 1996) proposed educational technology foundation standards in three areas: Basic Computer/Technology Operations and Concepts, Personal and Professional Use of Technology, and Application of Technology in Instruction. ISTE advocates that teacher candidates should be able to use a variety of software and technology tools to communicate, solve problems, and support instruction in their grade levels and subject areas. These guidelines provide a framework for teacher preparation programs and higher education faculty to build exemplary certification programs to prepare future teachers for the appropriate use of technology.

In 1996 President Clinton and Vice President Gore unveiled the Technology Literacy Challenge (U.S. Department of Education) that advocated a 21st century where all students in the United States would be technologically literate. The challenge outlined four goals to address an aggressive technology vision. The goals focused on teacher training and support, computer access, internet accessibility, and appropriate integration of instructional software. Woven into those goals were strong implications for teacher preparation programs to provide innovative technology instructional experiences for its candidates.

At present most preservice teachers know little about how to use technology effectively for instruction (Willis & Mehlinger, 1996). A recent survey of teacher-preparation institutions conducted by the International Society for Technology in Education, commissioned by the Milken Exchange on Education Technology (Moursun & Bielfeldt, 1999) revealed that teacher preparation programs do not provide their candidates with sufficient experiences to prepare them to use technology effectively in their classrooms. The greatest problem lies not in the availability of technology, nor in the actual technical use of the

technology, but in the integration of technology in curriculum and instruction. The survey further found that most preservice teachers do not ordinarily use technology during field experiences and that university faculty do not model the use of technology routinely. The report proposes a more integrated model for the effective use of technology in instruction with both student teachers and faculty applying integrated technology.

The University of Georgia's efforts to integrate technology into their teacher education program (Schrum & Dehoney, 1998) demonstrate that with support, modeling, and proper training preservice teachers can experience success in using technology. They found that attitudes toward the use of technology improved and confidence in their own abilities to use technology increased. The preservice teachers also were able to articulate potential uses of technology for their future classrooms. Efforts such as this indicate that teacher education programs must move to a level of integration of technology for their candidates to be prepared to use technology effectively for instruction.

This paper will describe initiatives in a university teacher preparation program to prepare its candidates for the integration and implementation of appropriate technology. Descriptions of specific assignments, projects, and learning experiences designed to engage the teacher candidates in enriching technological experiences to enhance their own learning while at the same time serving as a model for teaching will be included.

The Triad Model

The technology integration approach implemented focuses on a triad model that identifies three areas of technology infusion. The triad categorizes the three areas as communication, productivity, and research/instruction. The triad model (Fig. 1) applies to discipline specific methodology courses, general curriculum courses, and practicum experiences such as student teaching. Over the past four years modifications and revisions based on ongoing research in classroom practice have provided an experiential foundation for the integration of technology in both coursework and field experiences of teacher candidates.

The teacher candidates engage in authentic learning experiences where technology is a tool among many other resources that is provided as a venue for learning. The triad model is used to illustrate that the three components of communication, productivity, and research/instruction are interrelated. Linkages between the triad components are essential for the understanding of the model and the true integration of technology in instruction.

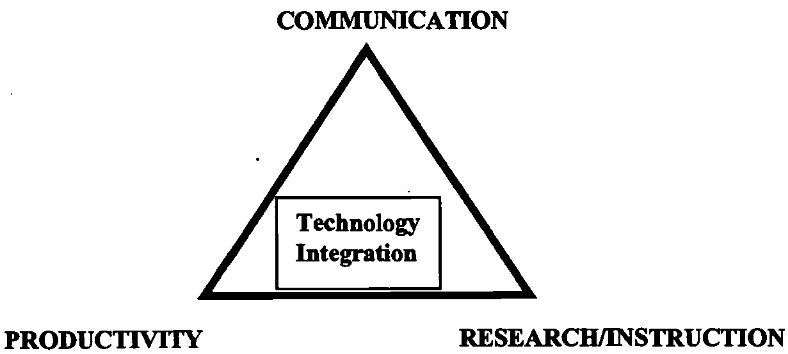

Figure 1. TRIAD MODEL: INTEGRATION OF TECHNOLOGY IN A TEACHER PREPARATION PROGRAM

Communication Component

Appropriate use of technology can facilitate communication between and among various groups involved in teacher preparation programs. Both e-mail and video conferencing were used as tools for communication between preservice teachers, university instructors, and curriculum experts. Preservice teachers at the university used e-mail as an avenue for communicating with their peers located at the same university, as well as with other students involved in teacher preparation at universities in other states. These experiences began with direction from the instructor with various guidelines for implementation. The students began to branch out on their own and use the e-mail vehicle for continued collaboration and support. Results showed that the students continued the dialogue more within their own university than across states. Future collaboration with teacher preparation candidates in other locations needs to be more structured with sufficient time given for the communication.

The use of e-mail also facilitated communication between the preservice teachers and the university instructor. Not only were there required assignments such as reflective journaling while completing field experiences, utilizing e-mail communication but the e-mail vehicle continued to be used by the preservice teachers as a means of support for both course work and field experiences. It was found that this means provided immediate feedback for timely communication. After the field experiences and course work many students continued to make the connection with the instructor through the use of e-mail. This has given them useful support and feedback.

At the university a video conferencing session was held with one class of preservice teachers enrolled in a secondary mathematics methods course. The group participated in a discussion with the author of the text used by the students in the course. The class prepared for the experience by developing questions and topics to engage the guest curriculum expert dealing with issues related to the text and course. The guest author made a brief presentation, addressed various questions from the students, and engaged the students in a discussion of current topics in the field of mathematics education. The students noted that this experience not only gave them an opportunity to interact with an expert in the field whom they might otherwise not encounter personally, but also modeled a use of technology that they may use in their own classrooms in the future. The preservice students were able to relate both technical and curriculum issues in utilizing such technology.

Both the experiences of e-mailing and video conferencing provided a wide range of opportunities for the preservice teachers to engage in professional dialogue with colleagues. They were able to identify benefits and issues related to the use and implementation of such technology for their own future use as teachers. Communication was modeled through an integrated approach.

Productivity Component

According to Forcier (1996) the computer can be seen as a"multifaceted tool" (p. 2) and serve both teacher and student as a productivity tool. His reference includes both personal and instructional productivity for the user. In the Triad Model productivity refers to personal productivity and support of instruction. Actual classroom instruction is addressed in the third component of the Triad Model - research/instruction. Computer technology was used by the preservice teachers at the university for personal productivity in the form of word processing, e-mailing, and presentation software packages. While word processing is possibly the most common form of productivity software, the preservice teachers were required and encouraged to combine it with the use of digital camera images and scanned images to enhance their documents. The preservice teachers began to find creative uses that saved them time and produced more professional materials. As they became more comfortable using the technology, they were able to initiate its use as needed without an actual assignment by the instructor.

Other examples of student use of technology for productivity were through the selection of multimedia presentation software packages such as *Power Point* and *HyperStudio* when given assignments such as personal literacy portfolios or group project assignments. As an example, preservice teachers enrolled in a graduate curriculum course were given an assignment to develop a personal literacy portfolio addressing multiple literacies. They were instructed to use a presentation medium of their choice. Many produced

effective presentations utilizing a wide range of technology tools. When assignments such as this were given so that an option of type of presentation was allocated, many students in the teacher education programs chose to use computer technology. The students cited as reasons for their choice ease of use and more appropriate format for their content or topic.

Research/Instruction Component

A third component of the Triad Model addresses the use of technology for research and instructional purposes. As preservice teachers begin to integrate university course work and field experiences it is important for them to explore the role of technology in this capacity. Opportunities to use internet resources and educational instructional software are essential for their development as effective teachers. Preservice teachers at the university participated in a Web Quest as a model for integrating internet resources, curriculum content, and research. The results of their experience were presented through multimedia presentations. Others were able to implement particular instructional software packages in their classrooms as student teachers. One such student teacher was able to have extensive experience using *Geometer's Sketchpad* with students. This experience was very successful in part because the student teacher had worked with the software in the university courses and then had it modeled by her supervising teacher with students. This multiple, integrated approach provided a strong foundation for effective use of the instructional software.

In a secondary mathematics methods course students were assigned a project based on the book *G is for Googol* (Schwartz, 1998). The project required the use of a *Power Point* presentation that would relate appropriate mathematical content to secondary students based on the information in the book along with other sources and activities. Students connected literature, technology, and mathematics content addressing both research and instructional ideas.

Preservice teachers became more critical users of instructional technology through these experiences. They also expressed renewed interest in applications of various technology resources that they had experienced in their course work at the university. Some preservice teachers expressed frustration when appropriate technology was not available in their field experiences. More importantly, they were disappointed when the technology was available, but was not utilized and modeled by their supervising teachers.

Conclusion

Teacher education programs must meet the challenge of preparing teacher candidates for the effective use of technology for instruction. The three areas of communication, productivity, and research/instruction addressed in this model provide a foundation for such a program. All three areas are essential and are interrelated in their use.

It is critical that teacher candidates actively participate in an engaging technology model that prepares them for their future as innovative, effective classroom teachers. In establishing expectations for accredited schools of education, NCATE (1997) advocates that teacher candidates complete experiences that use technology in their content areas along with experiences in the use of technology in instruction, assessment, and professional productivity. The triad model described in this paper is built on such expectations. This triad model demonstrates one approach for designing curriculum and appropriate experiences in a teacher preparation program that provides hands-on experience.

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Electronic Portfolios for Learning and Assessment

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Abstract: Two innovations, performance assessment and information technology advancements, provide the prospect for wide-scale use of electronic portfolios as an assessment tool. In a time where national and state standards are recognizing and incorporating technology literacy requirements into preservice teacher education, electronic portfolios offer benefits beyond their ability to easily manage and store data. There is evidence that using hypertext and multimedia tools to create a presentation of one's competency involves a range of higher order complex thinking skills. Putting the process of assessment in the hands of the student, portfolios produce tangible evidence of a preservice student's ability to connect theory to practice to create meaningful learning experiences for their students. As technology tools and skills become more commonplace, and the expectation of technology literacy more universal, electronic portfolios can serve as authentic assessment tools that provide a rich repository of information about teaching and learning.

Introduction

Portfolios represent the next logical step in applying performance assessment to constructivistic learning theory (Boulware & Hold, 1998; Richards, 1998; Barrett, 1999; Read & Cafolla, 1999; Tichnor & Sipek, 1999). According to constructivism, the learner plays an active role in knowledge building leading to deeper understanding and retention of this knowledge (Bruner, 1986; O'Neil, 1992, Leeman-Conley, 1999). Portfolio assessment models rely on the learner as an active player in representing what they have learned through a purposeful collection and explanation of their work (Wiedmer, 1998). Portfolios offer an on-going and summative documentation of a person's knowledge, creativity, and personal perspectives.

In 1991-1992, Vermont became the first state to use portfolios on a state-wide basis for assessment of math and writing ability of 4th and 8th graders (O'Neil, 1993). In 1995 this was extended to a results-orientated program approval process for teacher certification, evaluation by portfolio, placing this evaluation in the hands of the institutions of higher education that serve those pre-service students (VISMT, 1995).

As states, districts, and schools are adapting portfolio assessment strategies, corresponding problems associated with issues of storage, organization, dissemination, and inter-rater reliability are emerging (O'Neil, 1992; Barrett, 1998). How do we manage all this new information? How do we allow a personalized representation of knowledge yet develop uniform criteria to fairly assess it? How can we facilitate connections and reflections between theory and field experiences and how can we be assured the learner can present their knowledge to an array of audiences?

Some solutions to these problems seem intertwined with our struggle to define and implement technology literacy standards for pre and inservice educators. (National Council for Accreditation of Teacher Education, 1997; International Society for Technology in Education, 1999). There is added value in using new technology to document pedagogical competency through electronic portfolios. Electronic models streamline storage, facilitate dissemination, organization, and easy updating of documentation (Wiedmer, 1998). Portfolios can be easily shared for feedback, models distributed to students, and the electronic nature facilitates documentation for research about patterns of what creates a good educator. There is evidence that electronic portfolio construction helps students focus more on the content and connections of theory and practice than traditional paper-based models. Hyperlinking

allows the student to connect course work, applications, ideas, and themes through a network of designed nodes, assisting them in reflection and enlightenment (Jonassen, 1996). Multimedia features support multi-intelligence theory allowing expression in text, video, animation, and sound (Moersch and Fisher III, 1995). Student's portfolios can be richer, sharing work otherwise not possible and presenting what they've learned and who they are as a teacher in a creative, personal representation. Finally, there is no better way for students to document their technological competence than to create their final assessment using a hyperlinked, multimedia based instrument.

The Portfolio Process

To respond to the 1995 Vermont State requirement for teacher certification, the Elementary Education Program at the University of Vermont encourages students to use the power of multimedia to construct electronic portfolios. Beginning in their first year, students enroll for a required technology course: Computers in the Elementary Education Classroom. In this class students learn basic computer skills and applications, and discuss technology-related issues. One third of the class is dedicated to teaching HyperStudio, the software used for building portfolios. At this stage, students are taught how to use the program's multimedia and hypertext tools to allow documentation of their work with children, coursework, with artifacts from their first year as a preservice student. They are encouraged to select particular products that showcase their learning, and in a caption, provide the context of their document and justify their selection with a reflective statement. They are taught how to design their presentations to include easy navigation, facilitate the reading of large text fields, scan, and work with digital photographs. They learn how to plan their presentation through story boarding and how to organize their information with sensitivity to layout techniques, color, and design.

Barrett (1998) has developed a matrix to help educators decide which portfolio tool meets their needs. These include a range of HTML and multimedia solutions corresponding to the level of technology proficiency and student-teacher control. Our interests were in creating a student-centered model and after exploring a number of programs, we selected HyperStudio. The program is popular in our neighboring schools, easy to use and yet provides sophisticated features that offer flexibility for students to control what and how they represent their learning. The program is self-sufficient with built in multimedia tools and a player readily available on the Internet in Mac and Window platforms to permit final products to be seen on almost any computer. The program allows for easy importation of text and sound and graphic files from many formats. QuickTime video and slide shows can be brought in, animations constructed, and final products uploaded to the internet, saved to a variety of media, or mailed via FTP (file transfer protocol).

Students' electronic portfolios are maintained on the College of Education and Social Service's server for easy access throughout the students' academic and professional course work. All residence hall rooms are networked with access to the College's server and a computer facility, The Technology for Teaching Lab. This is a college-based lab supervised by a full time technology coordinator and staffed by workstudy students who support faculty and students working on computer based assignments or projects or exploring technology tools. Most of the workstudy students are pre-service educators and have completed the required computer course and are thus familiar with the applications and student assignments. The lab has scanners, a writeable CD-ROM, and computer with the capacity to convert video movies into digital ones for incorporation into electronic presentations.

The use of HyperStudio to develop teaching materials is a new assignment recently introduced into a third year elementary education course in the inquiry block, an interdisciplinary based methodology course in science, social studies and art. In this assignment students develop a multimedia stack as one activity in a student constructed science center. Students build these around science content, set them up and leave them in their field placement classrooms for two weeks. Science Centers must be self-sufficient with activities and assessments about science content and processes. Creating a multimedia based resource helps preservice students demonstrate their ability to develop grade-appropriate content, organize information in a logical interesting way, and use technology tools to present this to an elementary audience. It also reestablishes student's familiarity with HyperStudio, preparing them for their senior portfolio experience.

While students complete their internship in their final year of our program, they participate in a one-credit portfolio course where they are given specific direction and skills related to assembling their final professional portfolio. At the University of Vermont, professional portfolios must be organized as a text, via themes of practice with student selected documentation that describes them as an emerging teacher. State and Program criteria are located in appendices and cross-referenced to the documentation. Students collect, select, and connect the artifacts. Documentation is captioned to explain the context and relevance of the evidence and invites the pre-service student to reflect about how it translates to a meaningful learning experience for their students. Pre-service students are

expected to relate educational theory to practice drawing upon their coursework, fieldwork, and community experiences to create personal profiles.

Portfolios showcase learning and demonstrate professional competency and electronic portfolios facilitate this process and scope of expression. Evidence includes a rich assortment of artifacts: papers, homework, video, pictures, projects, diagrams, notes, animation, student voices, and music. In constructing their portfolios, students learn from the process and product as well as demonstrate their ability to use integrated technology. Beginning portfolios electronically in their first year ensures students possess the technology skills they need to succeed as undergraduate students at the university, in their field placements, and as prospective teachers. This serves as a vehicle for infusing technology throughout their college and field placements and begins their documentation of their education and professional competence.

Advantages

Teachers and administrators who have used electronic portfolio documentation have reported they make it possible to portray one's educational philosophy by helping them summarize their beliefs and attitudes into a compact multidimensional product (Wiedmer, 1998). Electronic portfolios demonstrate organization and presentation skills, facilitate the ability to make cognitive connections between themes, and offer multimedia for a rich choice of expressive modes. There is also evidence that in creating multimedia-based hypertext presentations, students practice complex thinking and express creativity (Jonassen, 1996).

Management

Electronic portfolio construction offers several advantages over traditional paper-based models. Distribution of portfolios to faculty and potential employers becomes simple with the ability to save to disk, CD-ROMS, and Zip and super disks in both Macintosh and Windows formats. Products can also be uploaded to an Internet site or e-mailed to facilitate the ability for graduating students to seek employment in diverse and distant communities. In a study of school administrators' reactions to electronic portfolios, portfolios were found to be powerful marketing tools during the interview process demonstrating technology expertise, presentational organization, content and pedagogy (Giuliano, 1997). Numerous copies can be easily and inexpensively duplicated, offsetting the risk of loss of the singular paper based format. They are easier to share making it possible for students to see a variety of exemplars and helping students "stand on the shoulders of giants" so they see other perspectives of teaching and learning and challenge their own practices and beliefs. Electronic portfolios are easy to edit permitting a continuity of documentation of growth with the control of distribution in the hands of the student. Yates (1999) reports that substantial revisions involve reflection on course content encompassing processes like reordering and reevaluating, resulting in new insights. If left on a server, assessment can be formative with a stream of faculty-student and student-student interactions that fine-tune the portfolio. Electronic documentation also provides a reservoir of data about the teaching learning process that with analysis and organization offers an opportunity to understand what constitutes a good teacher and good teaching.

Interactive Multimedia

Multimedia refers to communication from more than one media source such as text, audio, graphics, animated graphics and full motion video. (Sharp, 1999). In the past we have made presentations using different media but we had to combine slide projectors, cassette players, video players, and overhead projectors to achieve these effects. The change lies in a combination of all these different media handled by just one machine, the computer. The computer injects a level of interactivity into multimedia permitting an element of input via keyboard, mouse, and voice. Multimedia features allow students to include sound, graphic, and video components, in addition to traditional textual data. According to multiple intelligence theory, not only do all individuals possess numerous mental representations and intellectual languages, but individuals also differ from one another in the forms of these representations, their relative strengths, and the ways in which (and ease with which) these representations can be changed. (Veenema and Gardner, 1996). Multimedia encourages a richer and more accurate presentation and interpretation of what one has learned. Multimedia presentations are more engaging because they stimulate many senses at a time something many believe is essential when working with today's video and net generations (Jonassen, 1996). Preservice teachers have included video clips that demonstrate portfolio criteria, scanned copies

of student work, and voices of children reading. In constructing multimedia portfolios, students are actively engaged in creating representations of their understandings and have a variety of tools to use to make that representation accurate and unique (Jonassen, 1996). Educators who compiled their own portfolios noted growth in their self-confidence, collegiality, and sense of personal empowerment (Wiedmer, 1998). Portfolios materialize as creative personal products that represent a formative and summative assessment of progress as well as a clear picture of creativity, organizational ability, and pedagogical knowledge.

Hypertext and Hypermedia

Normal text is linear, proceeding from beginning to end. Hypertext presents information in a nonlinear fashion, without a predetermined sequence. Barnes (p. 29, 1994) describes it as "interactive reading" because students experience the text as part of a network of navigable relations instead of a linear sequence of ideas. The reader finds the experience more personally meaningful because they have greater control over what is read and the sequence in which it is read. Its organization is not imposed by the author (Jonassen, 1996). Hypertext is more closely related to how the human mind operates, by association, snapping from one item to another creating trails of information, suggested by the association of these thoughts (Bush, 1945). Hypertext usually refers to an environment limited to textual jumps from one chunk of information to another. Hypermedia extends this concept to include additional forms of media that may be linked as well so that text may link to a bird's song or hear a student read. It may link to a video of a student teaching a lesson or a scanned image of a science test. The hypermedia component fosters connections between course work, concepts, and applications because it allows the individual to designate links between ideas and themes. It cultivates the development of association of content, theory, and practice helping students become thoughtful problem-solvers. Because the architecture of hypertext is open, the same set of data can be organized in many different ways to reflect different conceptual perspectives and orientations that facilitate the production of personalized products. One of the notable initiatives of the 1990's is the development of the World Wide Web. To those not familiar with a hypertext retrieval system, this may present a barrier (Barnes, 1994). As authors of a Hypermedia product, students become proficient hypermedia users in "a new kind of literacy prompted by jumps of intuition and association" (Heim, 1993, p.30) and a kind of literacy imperative for an educator to understand and demonstrate.

As a Mindtool

Jonassen (1996) describes mindtools as applications of computers in schools as tools for engaging learners in constructive, higher order thinking activities that help them become self-directed critical thinkers. In designing Hypermedia presentations, students are engaged in complex thinking skills and decision making: evaluating, analyzing, connecting, elaborating, synthesizing and imagining as they conceptualize and design their presentation. Adding hypertext capabilities creates another dimension of organization and interactivity, creativity, and complexity. Electronic Portfolios represent a challenging assignment that engages students in management, research skills, organization, presentation skills, and reflection. They select the multimedia tools they will use and essentially have *carte blanche* in representing what they know about teaching to faculty and potential employers. They must make numerous decisions about what to include, synthesize themes and help the viewer see their constructions. They use the technology to create: diversity and coherence, visual and textual balance, and stillness with movement. Learners are more mentally engaged in developing materials than by studying materials and the diversity of tools enables the student to express abstract concepts with concrete representations. According to Jonassen (1996, p.209), "...Hypermedia is the most compelling and potentially effective of all Mindtools" because of richness of representational forms available in designing with multimedia. The process of using this tool augments portfolio assessment by presenting a learning experience in itself.

Computer Literacy

In using electronic portfolios, students are demonstrating their ability to manage their information with a computer, and use some complex applications and sophisticated techniques to prepare their products. They work with different graphic file formats, import data from a variety of applications, perform screen dumps, scan and crop photos, digitize video, create slide shows, and insert sound. HyperStudio has built in hyperlogo scripting capabilities allowing students to include fairly sophisticated programming techniques. Students learn to correctly name and connect their files, save them to a server, disk, or CD-ROM, or e-mail as an attachment or upload them to the Internet. They use graphic tools, Internet resources, peripheral devices and constantly problem-solve using

technology tools to produce tangible evidence of their ability to teach in twenty-first century classrooms.

Obstacles

There are some obstacles associated with electronic portfolio assessment to consider. Constructing any portfolio is a time-consuming process. Students begin with collecting and labeling artifacts, looking for patterns that express their educational philosophy and then need time to process these into coherent themes. It also takes time to translate all into an electronic format. Photos need to be scanned, videos digitized, and there is a limited amount of equipment available. Students attend to this assignment at the end of the semesters resulting in wait time for some equipment. Portfolios are also time consuming to grade and faculty have to know how to access these presentations and use hypermedia tools to understand the student's theme development and documentation. Although using a network can facilitate communication and exchange of documents, it can represent some interesting challenges in running software and saving files. Files get corrupted, the system crashes, and data is lost and retrieving and reconstructing it is not always possible.

One must have hardware capable of handling multimedia software with the ability to input and record sound and video. Lots of storage space is also advisable. Although students begin portfolios in their first year, they forget details and many need to work on them in a supported atmosphere and finally, although this is becoming less of an issue, there are still some schools that do not have the technology to view electronic portfolios.

Conclusion

New technologies have historically helped us do things better, and to do things not possible before. The printing press allowed books to reach the masses and cars enabled easier travel. Technology advancements in terms of the multimedia computer offer an assessment tool more aligned to accepted educational learning theory. Electronic portfolios can serve as an authentic assessment tool that provides a rich repository of information about teaching and learning. Electronic portfolio documentation using hypermedia software offers better management, storage, and distribution with the added value of providing a tool that promotes higher order thinking and creativity. Electronic portfolios offer a formative and summative assessment tool that simultaneously demonstrates technology skill. Putting the process of assessment in the hands of the student, portfolios produce tangible evidence of a student's ability to connect theory to practice and use new technology tools in the process.

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Development of a Personal Electronic Profile for Pre-service Teachers

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Abstract: As part of the pre-service teacher education program for the elementary and secondary education program at Northern State University, students were required to develop an electronic personal profile. The purpose of the project allowed pre-service teachers to become more proficient in the use of technology and also to communicate a personal profile to their future mentor teachers, K-12 students, and future employers using an electronic medium. The product they developed may also be included as part of their professional electronic portfolio.

Goals of the Project

During the past two years education faculty at Northern State University have emphasized the use of technology in the courses they teach and through the activities and projects required of pre-service teachers in completion of their program. With this project implemented as one part of their Instructional Technology class, students developed a personal profile of themselves using Microsoft PowerPoint as the software for producing the product. Microsoft PowerPoint was selected since it was most readily available for use by students in our computer labs and by the school districts in the regions they will practice teach.

The goals of the project were to:
1) Develop skills in the use of Microsoft PowerPoint in order to create classroom and professional presentations for their students and colleagues.
2) Create a presentation, which profiles information about their personal lives that reflect their interests, achievements, family, and community.
3) Enhance collaboration between pre-service teachers at Northern State University and K-12 teachers, students, and administrators.

Content Criteria of the Project

In order to communicate the requirements of the assignment, it was decided we would model them by creating a personal profile of ourselves for demonstration in our classes. We decided that even though each profile would be unique it should include minimum criteria and components.

The criteria we decided on should include:
1) A recent personal picture.
2) A favorite elementary or secondary school experience.
3) A memorable childhood experience.
4) A teacher or experience that inspired them to become a teacher.
5) A hobby or pet.

6) A unique or interesting fact about their community.
7) A personal achievement.
8) An interesting fact people would be surprised to learn about them.

Technology Components of the Project

Technology components and skills we wanted to have our students demonstrate through the creation of the portfolio included:

1. Producing an organized and motivating personal profile demonstrating appropriate visual, oral and written communication skills.
2. Utilizing a digital camera, computer scanner, and "Internet", to import and transfer pictures, music, sound effects, and graphics into their personal profile.
3. Creating "Internet Links" which will enhance the information presented in their profile.
4. Demonstration of equitable, ethical, and legal use of technology resources by following copyright regulations related to the use of electronic media.
5. Demonstration of these on Microsoft PowerPoint, which allows the use of a variety of texts, fonts, colors, layouts, sounds, images and special effects to create motivating and unique presentations.

Teaching the Lesson

Anticipatory Set

We introduced the lesson by stating the purpose, goals, and components of the project. It was suggested they create a storyboard which includes the texts, pictures, and special effects for each frame prior to creating the presentation. An example of the instructor's storyboard was distributed to the students.

Modeling the Lesson

We loaded our personal profiles and presented it to the class discussing various aspects included for each frame. This seemed to motivate the students and generated many questions.

Instructional Input and Guided Practice

We had each student load PowerPoint and they began to develop example frames using a variety of formats, texts, colors, sound and special effects as they were being demonstrated. A Microsoft PowerPoint Tutorial was distributed to students and reviewed to assist students in solving problems they might have while creating their portfolio.

Checking for Understanding of the Lesson

We had students practice by creating several frames implementing different presentation strategies. We answered their questions and demonstrated things that were confusing to the entire class or we had forgotten to cover during the instructional input stage.

Assessment of the Lesson

In order to assess the project we decided that we would create a rubric, which would include the criteria and the project technology components. The only additional requirements was that each student would also showcase the personal profile to the entire class during our *showcase day* and create a printout of the frames to be submitted with their CD ROM for grading purposes, see [Table 1].

Evaluation of the Project

Informal interviews with the students indicated the project was a very enjoyable and positive experience. Students were anxious to show them to their cooperating teachers and students during their field experiences. They also stated they planned to incorporate the electronic version in their professional electronic portfolio or the printout version in their paper professional portfolio. The only negative responses pertained to the significant amount of time required to locate personal pictures and Internet sites for pictures, music, and sound effects to create their

presentations. As instructors, we found this to be a very successful and useful project for our pre-service teachers and plan to continue and refine the project during future semesters.

Personal Electronic Profile Rubric
❑ Introduction and conclusion frames with a recently scanned photo and e-mail address. (15 pts.)
❑ Elementary or secondary education experience that inspired you to become a teacher. (15 pts.)
❑ Enjoyable childhood experience with your family or friends. (15 pts.)
❑ Past or present hobby or pet. (15 pts.)
❑ A personal or professional achievement. (15 pts.)
❑ Experience which reflects your local community or home. (15 pts.)
❑ Internet links to sites, which enhance the information presented. (15 pts.)
❑ Use of sound, music, or animation. (15 pts.)
❑ Creative design, unique details, or interesting facts about you. (15 pts.)
❑ Presentation utilized correct grammar and is appropriate for your goals for your grade level audience. Includes a printout with rubric attached. (15 pts.)
❑ Total Points (150 pts. possible)

Table 1: Rubric distributed to students and utilized to evaluate their personal profile.

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Default User.com: Preparing Preservice Teachers for Constructivist Classrooms

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Abstract

The purpose of this article is to present a model for integration of technology into teacher preparation. A four-course block of elementary teacher certification courses serves as the context for this study, as well as a university-based summer camp for the requisite field experience component. Investigators analyzed purposes for technology integration into the curriculum of the methods courses and the students' use of technology in the field experience as they worked with children ages 6-11.

In his 1997 State of the Union Address, President Clinton issued a "Call to Action" that included as a priority improvement of the quality of teachers in every American classroom. President Clinton's speech reflects the rhetoric of concern over the condition of education and the nation's need for excellent teachers. The nation requires teachers with the knowledge, information, and skills necessary to prepare students to live and compete in a complex international marketplace. This means, students must be knowledgeable in a broad base of disciplines, technologically literate, and autonomous learners.

Definitions of good teaching range from those that focus on what should be taught and how knowledge should be imparted to the kinds of knowledge and training teachers should possess. Two broad elements emerge as characterizations of teacher quality: (1) teacher preparation and qualifications, and (2) teaching practices. The first refers to preservice learning and continued learning. The second refers to the actual behaviors and practices that teachers exhibit in their classrooms (U.S. Department of Education, 1996a). These elements of teacher quality are not independent; excellent teacher preparation and qualifications should lead to exemplary teaching behaviors and practices.

Using a nationally representative survey of full-time public school teachers of core subjects or self-contained classroom, the National Center of Educational Statistics (NCES) (1999) included indicators of preservice and continued learning (e.g., degrees held, certification, teaching assignment, professional development opportunities, and collaboration with other teachers). The survey indicated that currently less than half of American teachers report feeling "very well prepared" to meet some classroom challenges, specifically feeling 'very well equipped' to integrate technology into classroom instruction (20 percent). White (1996) advocates that technology can facilitate preservice teacher understanding of and engagement with problem solving and critical thinking skills facilitating their development of desired teaching behaviors and practices.

We teach how we're taught. In this era of constructivism, preservice teachers continue to enter teacher education with the belief that teaching is all about the transmission of knowledge rather than interaction and construction of knowledge (Brazee & Kristo, 1986, Shor & Friere, 1987). As undergraduates, they attend 'lectures' and respond to tests about these lectures in their core requirement classes. They encourage their teacher training supervisors to observe them on days when they're really 'teaching' (lecturing) rather than those days where students are actively involved with activities of a constructivist nature. They don't perceive these strategies as teaching, limiting their ability to spark fresh insights in their own students (Holt-Reynolds, 1991). Field experience is carefully guarded as a special event rather than an integral component of teacher preparation. Use of technology is covered via stand

alone courses that are taken out of the context of teaching and with the leap of faith that it will be accommodated into the daily life of the student. Is there any reason to believe that preservice teachers can be prepared to create constructivist classrooms that prepare their students to live in a complex international marketplace carrying with them this nonconstructivist experience?

To develop technology-using teachers, preservice teachers must experience demonstrations by their professors, integration of technology into daily activities, and application of technology into their class projects and field experiences. Technology also supports the reflective practice essential to the development of a constructivist teacher (White, 1996). Camp Paw Print was developed as a constructivist field experience requiring the use of daily interactions with technology through the preservice teachers' own instructional experience, as well as their planning and preparation for the camp.

Methodology

This paper reports the outcomes of the preservice elementary methods students taking a block of courses that were richly infused with technology as tools of instruction and communication and integrated into the context of science, mathematics, social studies, and language arts content and pedagogy. The culminating field experience gave rise to observations, measurements, and analyses of these preservice students as to their abilities to use various types of technology. The role that technology took in their of instruction of children ages 6 to 11 years and the way that they learned to use technology in instruction was significantly increased from the limited impact of the stand-alone course previously taken as a core requirement.

Observational data was recorded through anecdotal record by preservice teachers regarding each child's interactions with the instructional materials, other children, and the ability of each child to meet instructional objectives. Graduate students collected observational data through the course of the summer semester about preservice teacher level of technological literacy. Professors of the methods courses collected observational data on preservice teachers during the camp regarding their planning of integrated, content-rich and technologically supported experiences and implementation of instructional plans, their interactions with the children, and their ability to problem solve events and situations that emerged. The graduate students and one of the professors kept Field Notes of the camp that were analyzed for significant patterns in technology use and implementation and authenticity of application.

Interview data were collected by the graduate students from SHSU methods' students regarding their understanding of the events of the camp/field experience and their beliefs about the use of technology. Student products were collected daily by the children and reviewed with the children by the preservice teachers for evidence of the child's having met the instructional objectives.

Methods students and campers participated in pre and post test technology attitude surveys that were analyzed by the graduate students.

Each preservice instructional team prepared daily assignments for themselves regarding who would carry out instructional duties, who would provide support, who would be taking the camper kid-watching notes for the day, and who would record through digital video or still pictures the events at the center and/or computer laboratory.

Graduate students and professors analyzed the threaded message boards used by preservice teachers and children for type of response, reflective nature, and cognitive connections between instruction and life experience. Follow-up data regarding use of technology during student teaching, feeling of preparedness to student teach, and unfulfilled plans for instructional strategies in their first position as teacher were collected from preservice teachers during a Camp Paw Print reunion during their student teaching semester.

Findings

Modeling Technology Use for Instruction

Integrating technology into the day to day instruction of the methods courses was important in the overall modeling of technology as an instructional tool. Threaded message boards were used by students to

respond to their reading assignments. Each student was required to respond to the reading assignment with a question about the reading, a quote from the reading, and a comment about the thrust of the chapter. They were required to respond to at least two of their colleagues' postings and to everyone who responded to them. Other uses of the threaded message boards included the posting of responses to current issues in education or demonstration video-tape/video disc of classrooms. Posting of products, such as lesson plans or unit outlines, allowed all students in the class to review each students work and their approach to a given topic. Students commented that they took greater care with the content and composition of their responses when realized that the other students and their professors would be regularly reviewing their work and responding to what ideas they had put forward.

Other uses of technology were the use of web pages that were developed to support daily lessons and the course. Daily lesson pages included links to threaded message boards that students would respond to after participating in a class activity, links to web sites that offered supporting material to the lesson, and links to common pages that contained planning in progress for the field experience camp, Camp Paw Print. Course support web pages included the syllabus, e-mail links to all members of the class, an announcements page, links to support to the course (e.g., lesson plan pages, professional organizations, Texas Education Agency, State Board of Educator Certification). These web sites contained a schedule for each day and the topics of discussion, including the reading assignments. Students could access the course support pages from their homes if they were absent from class and work on the materials that would be due when they returned or to see what changes might have been arranged. In addition the sites included links to questions for discussion and instructions for classroom activities. Sites also included links to children's books on line or reader's theatre scripts. These sites were used as sources of children's literature for classroom study. In addition, literacy events were constructed around web sites that contained content related to the upcoming field-based thematic-unit of study—Hawaii.

E-mail was the official method of contact between students and professors, and all students in the course were required to correspond with their professors and their team members in this way. Each student had a campus computer system address, but could use their home e-mail address if they desired. Professors accessed e-mail often and were able to respond to messages frequently. This approach was much more consistent and responsive than telephone calls.

Integration of Technology into Preservice Teachers Field Experience Lessons

During the field-based learning experience, Camp Paw Print, preservice teachers were required to integrate technology into their lesson plans. Before their participation in technology-enhanced methods, students greeted this requirement less than enthusiastically and in some case with hostility. They felt underprepared and overburdened for this requirement. However, as the short, summer semester progressed, and students became more adjusted to responding to their reading assignments on threaded message boards, reading and responding to their classmates' work, checking the course web site for the daily schedule and related resources and activities, they became less vociferous in their complaints. By the time, they began teaching, they had put up web pages for their teaching teams with links to their own lessons and resources. They were comfortable and proud of this technology-resources, and many students voiced their opinion that they would not want to teach without access to the 'net.

Preservice teachers integrated technology into their lessons for the following purposes:

- Building Community and Getting Acquainted
- Creating Environment
- Investigation
- Activating Existing Schema and Creating Prior Knowledge
- Inquiry
- Applying Concepts
- Connecting to Culture
- Modeling
- Responding to Literature
- Dialoguing with Experts or a Virtual Community of Learners

Building Community and Getting Acquainted

Preservice teachers used technology to get acquainted with students and build a sense of classroom community. A graduate student intern set up threaded message boards, and preservice teachers created questionnaires for campers to respond to on-line. Campers typed out the answers to the questions—sometimes on their own, or with the help of the preservice teachers, and mini biographies of each students' background and interest became available to campers, preservice teachers' and professors. In this way, technology was used as a literacy event, a team building activity, and as a way to create community.

Creating Environment

Technology was also integrated into the classroom environment to set mood and tone and contribute to a cultural understanding of the environment being studied. Pictures of Hawaii were projected through a computer-enhanced projection unit to give a display Hawaiian land, sea, and beach landscapes and create a scenic effect of being in Hawaii. In addition, digital pictures from Hawaii were captured from the web and put in a Power Point slide show presentation which was then used in a "look out the window" flight simulation for campers' who participating in a flight simulation from the mainland to Hawaii. Once again, the pictures helped support an understanding of what the journey would be like as well as what the experience of flight was.

Investigation

The science center became the focus of several technologically enhanced lessons. One lesson in particular used the web as a resource of information for the scientific principles that support flight. Preservice teachers created a web site that utilized the nonlinear nature of hypertext to allow a camper to create an investigation of flight. Campers were to select an icon of an airplane to learn about flight, then could select one of several entry points to learn about the kinds of flight and principles of flight. Students then created their own objects to fly and experimented first hands with the principles of flight by trying to fly their objects.

Activating Schema and Creating Prior Knowledge

For a literacy event, preservice teachers used the web as a resource for students to learn about volcanoes prior to campers reading the book Dear Katie, The Volcano is a Girl by Jean Craighead George. To prepare for the reading, campers filled out KWL charts, listing what they knew about volcanoes prior to viewing the web site and what they wanted to know about volcanoes. Campers then viewed http://volcano.und.nodak.edu/, a web-based volcano site. They returned to their KWL charts to write what they learned about volcanoes after viewing the web site and then with their prior schema activated and/or new schema created, they read the story, Dear Katie, The Volcano is a Girl.

Inquiry

Preservice teachers developed an Internet-based inquiry lesson on Hawaiian animals. Campers worked with partners and/or a preservice teacher to explore the site to finding information on the kinds of animals that live in Hawaii, where they live in Hawaii, what foods they eat, and the classification to which they belong/ (mammal, bird, reptile, etc. and why) This information was charted by teams and brought back to group discussion and hands-on activities.

Applying Concepts

Preservice teachers developed a problems-based math lesson in which campers would use hands on activities and web sites in order to understand the relationships between shapes and mathematical language. Preservice teachers displayed various triangular figures and elicited camper response about the properties of these shapes (3 sides, 3 corners, angle, straight rather than curved.) Then distributed pattern blocks to each students. Then had students explore ways to make triangles with the pattern blocks. Then students went to the Internet to "build triangles" on a tessellation site (http://www.forum.swarthmore.edu/sum95/suzanne/active.html)

Connecting to the Culture

In order to relate to the sounds and rhythm of the Hawaiian language, students went to a web site and entered their name. The site contained a translator program that translated the American names into the Hawaiian equivalent. Students then displayed their Hawaiian names beneath their American names on their name tags.

Modeling

After studying and Internet-based lesson on states and their flags, preservice teachers used the Internet to have campers research information about symbols in general. After some discussion, each camper chose a flower as their symbol, and then they printed pictures of flowers and then took them back to the Social Studies center and drew their own rendition of the flowers. In addition, students viewed Hawaiian children hula dancing from video and then followed the video teacher's instructions and learned to hula along with the video.

Responding/Dialoguing

Threaded message boards were used for campers to write responses to literature they studied. In addition, they used e-mail to contact experts in areas they were researching.

Conclusions and Implications

Preservice teachers arrived in the summer methods block with varied computer skill and lukewarm attitudes about the use of technology. Most of them had experienced the use of e-mail. A number of students knew they had e-mail addresses, but couldn't remember the predictable username or password that they had been assigned when they had taken the required computer science course. Some were known only as default user.edu when they could not recall how to set the preferences for their account. And, a few students were quite fluent with e-mail and Internet use. It was evident that the knowledge and application of the requisite stand-alone computer science course had not developed expected schema for the preservice teachers.

None of the students had experience in developing web-based instructional materials or participating in threaded-message boards as an integral part of class. The preservice teachers were able to develop their own threaded message boards to review student writing and explanations at the literacy center. While type of technology to be used during the camp was not defined, the preservice teaching teams were all able to incorporate instructional technology on a daily basis. A problem that developed early in the camp program was the need to schedule specific times for various computer stations for each center so that all teams and children could have the access they desired. The types of technology that the preservice teachers wrote into their plans was the technology that had been modeled and used consistently during the methods courses.

Children typically wrote more on the threaded message boards and expressed greater interest in the reading of responses of their peers in this medium. The parents of the children requested URL's for the writing sites to view their child's writings and responses. The campers' interviews and attitude surveys revealed high interest in working with technology and increased time on task for content projects enhanced with technology. In addition, critical thinking was regularly employed in the context of problem solving, and the use of technology was a significant factor in providing information resources for analysis, and a means of graphically organizing their products. Campers and students reported an appreciation for being able to print out resources for home use, and an appreciation for the aesthetics of their own final products which were printed or displayed through a light projection unit.

Preservice teacher development was significantly more learner-centered than in those field experiences where the preservice teacher worked in an established classroom. The preservice teachers had to work collaboratively to develop much more of the operating procedures, curriculum, and supervision infrastructure than the traditional field experience students. This group of preservice teachers than in typical sections of methods block expressed a stronger camaraderie.

Seven of the twenty-five preservice teachers gathered for a reunion in October of 1999, the fall semester following their field experience. They expressed a strong appreciation for their methods and field experiences, particularly in the areas of collaboration, classroom management, and integration of technology in curriculum The seven students were teaching in four different school districts, and each reported that technology was not typically being integrated into classroom curriculum. All seven of the preservice teachers indicated their mentor teachers had expressed interest in learning technical skills from them with software and basic computer skills. Two of the preservice teachers had mentors that used a computer inside the classroom for record keeping. The preservice teachers reported that their own technology expertise had increased as a result of the constant integration of technology into their methods' block, and that after using it in field experience, it was an easy transition to use it in their student teacher placement. They felt disappointed that more technology equipment was not accessible to them in public schools.

Implications

Technology-enhanced instruction should be regularly integrated into preservice teachers coursework, both in the College of Education and the College of Arts and Sciences.

Technology-enhanced instruction should incorporate the same features that make technology useful into today's world—collaboration, rapid access to information, ability to input information and disseminate quickly, global connectedness.

Field experiences must offer an opportunity for preservice teachers to integrate technology as well as pedagogy which is consistent with current real world experience.

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Computer-Mediated Communication, The Infosphere and the Virtual Learning Community

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Abstract: The Infosphere represents a global resource that can be applied to the teaching/learning environment and utilizes the computer as a mediator of communication. How can such resources be incorporated into the classroom? What are the effects of computer-mediated communication on the teaching and learning processes. How do students and teachers react to computer-mediated communication. This paper begins the process of understanding the effects of technology on communication by examining student and pre-service teachers reactions to the use of computer-mediated communication.

Problem/Concept

Presently myriad opportunities exist for educators to utilize technology to support teaching and learning. Typically these opportunities are presented as pieces in a puzzle and not integrated into the whole school/curricula culture. Yet, schools exist within an increasingly global culture--one that is united by new technologies, transported by the Internet and the World Wide Web. Computer-mediated communication through its ability to access global information makes possible a new and potentially more unified culture. Dr. Boris Berenfield, metaphorically describes this culture as the Infosphere "[implying] the growing unity, interdependence, and accessibility of information produced by humankind" (Berenfeld, 1996) and encompassing technological and informational resources. How does the Infosphere change the nature of how students find, access, analyze process and exchange information? How can the Infosphere change the nature of how we teach and learn? How does the Infosphere change what we understand about teaching and learning?

This paper describes a beginning, the application of Infosphere resources to the teaching/learning process and the way in which students and pre-service teachers react to the process. The project was concerned with:

- Determining the impact of educational-oriented computer-mediated communication on student attitudes toward technology?
- Determining the impact of computer-mediated communication on student attitudes towards communication and collaboration?

Theoretical Basis

Vygotsky believes that "culture is the product of social life and human social activity" (1986, p.168). Michel Foucault addresses this issue of culture in the context of discourse. He believes that learners create knowledge with language, and, while solving open-ended problems, they are created as thinkers by the language they use within a particular discourse (1971). Traditionally education has been representative of its geographic social, political and cultural environs. Also traditionally education has assumed there is a fixed body of knowledge which can be transmitted from educators to learners. But in Infosphere, knowledge is transmitted, analyzed, and in many cases, transmuted so quickly that it is continually evolving. No longer, can knowledge be

thought to be a static entity dispensed by educators. Instead now, many educators believe that thinking takes place in communication, in an act of knowing in which the learner assumes the role of knowing subject in dialogue with the educator" (Freire, 1988, p.403-404).

With computer-mediated communication, an opportunity exists to open the boundaries of classroom communities whose discourse is not limited by time or space, or by the tradition of a fixed body of knowledge. Words become tools, in this medium, and this helps accomplish the work of learning—mobilization of thinking. Furthermore, Banks posits that when thinking takes place in communication, and that when learners' home cultures are honored and validated, a dialogue will open up fixed boundaries so that "students can freely examine different types of knowledge in a democratic classroom where they can freely examine their perspectives and moral commitments" (Banks, 1993, p.6).

Educators using CMC have an opportunity to situate their curriculums in the context of real life problems. They use collaboration between students, educators, and professionals in a variety of disciplines, and they utilize a wealth of informational resources, none of which are limited by geographical time/space boundaries. Educators who use language to mediate problem solving through the Infosphere have the ability to not only supply information through technological means but also the potential to impact the culture-- the values, ideologies and social context of the populations they serve. The Infosphere resides in and informs that social context.

Methodology

In the summer of 1999, 24 students enrolled in a block of elementary methods' courses. The students were involved in a five-week project designing and implementing Camp Pawprint, a summer camp for elementary school children. The project consisted of the development of curriculum, lesson plans and teaching materials centered on a Hawaiian theme. The students were expected to integrate technology into the curriculum design and also utilize technology as a management and development tool. Much of the material was developed using standard office applications. The worldwide web was utilized as a major data and image resource and both email and threaded message boards were used to communicate among students and between faculty facilitators and the methods students.

Once the curriculum and materials were prepared, the students acted as facilitators in the summer camp. During the methods course and the summer camp both quantitative and qualitative data was gathered, including:

1. Computer-mediated communication, primarily in the form of threaded message boards used as a medium for discourse in the learning/teaching process. The threaded message board provided the opportunity for sequenced multimedia communication in both asynchronous and semi-synchronous modes. The content and structure of communication through the threaded message boards was be analyzed to ascertain how the process impacts both learning and teaching. The threaded message boards provided data from both the methods course pre-service teachers and the Camp Pawprint attendees.
2. Pre-post surveys of methods student and camper participant attitudes toward technology. The analysis of these surveys was used to identify changes in attitudes as a result of exposure to learning-oriented, computer-mediated communication. Pre-post surveys of methods student and camper participant attitudes toward technology were used to identify changes in attitudes as a result of exposure to learning-oriented, computer-mediated communication. The results were discussed in the evaluative narrative and then the resulting attitude data was mapped to the perception data.

Analysis

Data was collected from 12 students enrolled in EED 560, elementary teaching methods and SED 560, secondary teaching methods. In addition data was collected from 24 elementary school students enrolled in Camp Pawprint. The generation of 1747 messages in 29 message boards used by 38 users. The average length of message was approximately 67 words with the longest messages being initial postings (new questions of items for discussion) and responses being somewhat shorted. The graph below illustrates the distribution of message length.

The messages boards used by the methods students had a life of about eight weeks, those used by camp Pawprint, about two weeks. Threads within each message board had duration of about 5 days with an average 8 hours between postings.

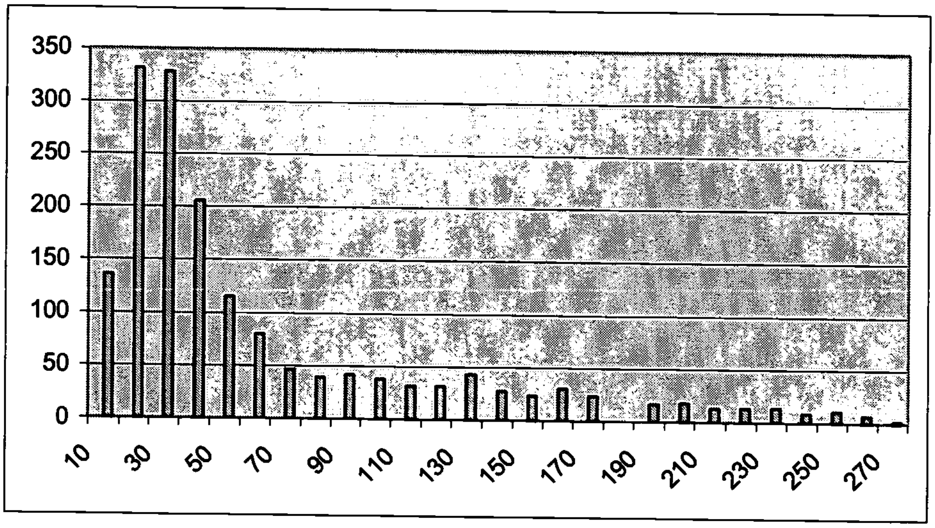

Figure 1: Distribution of message lengths

<u>**Message Board Content Analysis**</u>

Threaded message boards served multiple instructional purposes in the Spring 1999 Secondary Methods Block which was taught as a Distance Education Course via the web. They provided a mechanism for the professors and students to:

- Organize information about the structure and content of lessons
- Post expository assignments discussing the application of theory to classroom practice
- Report primary data collected
- Post lesson plans and construct instructional strategies
- Summarize and reflect upon assigned readings from texts and journals
- Evaluate textbooks & class assignments
- Participate in book club discussions
- Present persuasive arguments on educational issues
- Analyze educational issues and current events
- Simulate classroom practices through role-play, etc.

The professors for the methods-on-line class published web pages to deliver information about the structure and content of the course, but the threaded message boards became the forum for students to interact with the professors and other students in the class. In a typical lesson, a professor posted:

- General information, which consisted of the dates and times the assignments were due for any particular class meeting
- Questions which guided student inquiry into the lesson
- Introduction into the topic, which provided a basis for linking student prior knowledge to the topic to be studied
- Threaded message boards for students to respond to the readings and discuss their responses with each other or post other instructional activities

Attitudinal Analysis

An instrument designed to measure attitudes toward computing (Cooper, 1997) was administered to the students enrolled in the Elementary and Secondary methods courses at the beginning of the course and at the end of camp Pawprint. The instrument evaluated student responses within the framework of Bloom's (1956) taxonomy of educational objectives (Affective Domain). The instrument provided data on five aspects of affective response:

- Receiving (items 6, 19, 25, 26)
- Responding (items 13, 19, 22, 27)
- Valuing (items 2, 5, 8, 12,21, 24, 25)
- Organizing (items 3, 7, 8, 10, 11, 14, 16, 18, 20)
- Personal (items 1, 4, 6, 8, 16, 13)

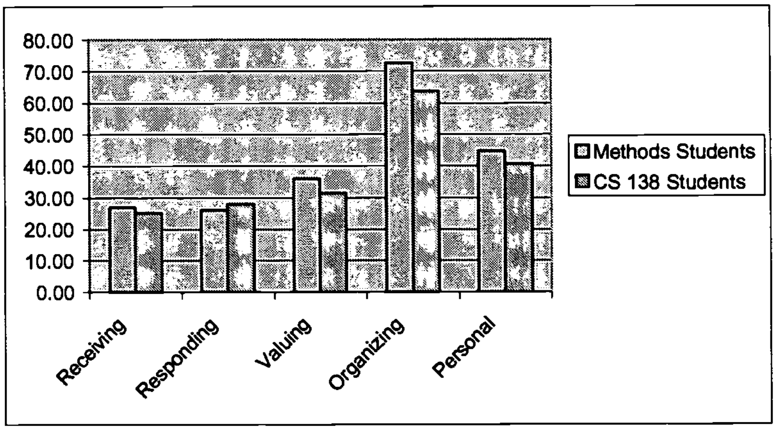

Figure 2: Methods Students Attitudes toward Computing

With only 12 respondents in the sample, it was not possible to perform a statistical comparison between the pre and past data. However there did not appear to be any major differences between the pre and post scores. A comparison was made between the post scores for the Methods course students and data previously collected for CS 138 students, students enrolled in the freshman general education computing course. While no statistical results could be obtained due to the nature of the instrument, it does appear that the Methods students had a more positive attitude toward computing as measured on four of the five subscales.

An instrument measuring affective response to computers was administered to the camp Pawprint students before and after the camp. The instrument measured positive and negative attitudes. Comparison of pre (top bar) and post (lower bar) responses are shown below.

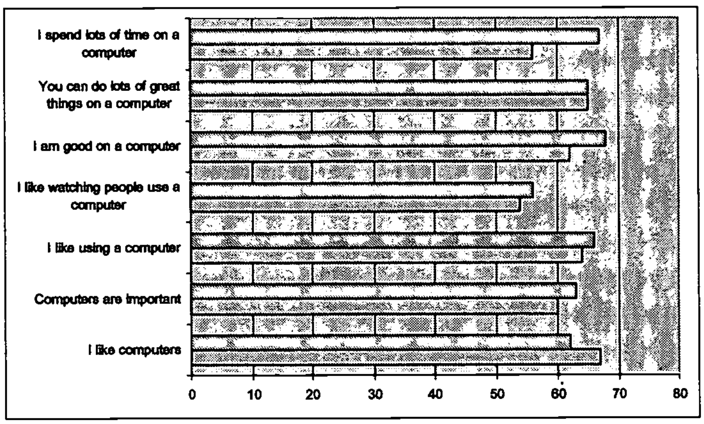

Figure 3: Pawprint Students, positive attitudes

Again, while no statistical analysis can be performed it appears that while the positive attitudes were somewhat lower after the camp, there were more marked reductions in the negative attitudes displayed by camp Pawprint students.

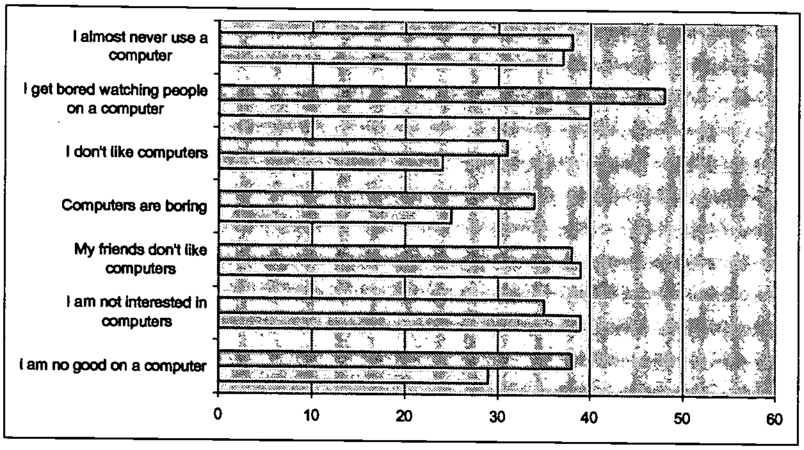

Figure 4: Camp Pawprint. Negative attitudes

Conclusions and Implications

How does the Infosphere change the nature of how students find, access, analyze process and exchange information? How can the Infosphere change the nature of how we teah and learn? How does the Infosphere change what we understand about teaching and learning?

The Infosphere can be the nexus of thought and language that teaching and learning occurs. Threaded message boards offer these points of connection in public space. In this setting of the Infosphere students find, access, analyze, process, and exchange information.

Teaching and learning is changed by the way students and professors participate in a cyber class. Students can not sit passively and observe discussion, but rather must be active participants in the discussion. They must be ready to defend their work with logical and rational reason, and they are exposed to ways educators react to a given problem in multiple educational contexts:

- Professors must design and organize the course around real problems that connect course content to student schema in a meaningful ways. The professors' roles should be that of orchestra director and facilitator—participating in the on-line community's conversations by questioning, extending, and challenging.
- Students engagement in the course is enhanced through interaction with the text and lesson assignments and responding electronically to what colleagues and the professors post on the threaded message boards.

Threaded message boards provide public space for students' publishing their understandings of educational theory and practice. Their work is not limited to being acted on by the instructor; rather, they must be ready to defend their work to their colleagues. Primary research can be disseminated more rapidly by being published on the threaded message boards thus increasing the impact of the research.

Threaded message boards provide a public forum to publish lesson plans to an audience of their peers. The public nature of this forum increases student accountability extending it beyond the scope of classroom practice and the evaluations of their instructors. Cyber book club discussions posted on the threaded message boards open boundaries of traditional teacher-directed assignments, allowing students to discuss books an pertinent issues in a manner consistent with real world dialogue. Threaded message boards offered a public space for analysis of events in popular culture, which affect education and society. Students can offer reasons and pose solutions to current dilemmas and reality check them against their peers' understanding of society and the values. Threaded message boards offered a medium for role play and simulation. In this medium, students could enact how they would respond to an educational problem and then view how their colleagues might respond.

Preliminary results indicate that a majority of students' attitudes toward technology were positively influenced over the course of the semester after a period of initial resistance. Communication and collaboration between university students, university students and professors, and campers increased beyond the traditional classroom boundaries as a result of participation in computer-mediated communication.

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Cold Computers and Warm Hearts: Using Group Process Techniques to Facilitate the Development of Educational Technology Skills While Conducting Pre-Service and In-service Training

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Abstract: Individuals who select teaching as a profession tend to be high on the scale of incorporating personal interaction into learning situations. They are usually people-focused with less interest in machines. Computers, on the other hand, offer an isolated, somewhat sterile environment in which the individual is learning techniques that are quite different from his/her educational experiences in the past. It seems, therefore, an oxymoron to expect teachers to work alone as they attempt to learn how to use teaching technology tools. Integrating a group process-oriented pre-service or in-service experience with mastering computer technology skills builds upon the very strength most teachers bring to the profession.

Introduction

According to a study published in 1999 by the U.S. Department of Education, only 20% of teachers considered themselves well prepared to integrate technology and learning in the classroom. Ellsworth in a 1997 publication suggested that universities are failing to provide adequate technology training, particularly in the area of using the internet, for students who plan to become teachers. The need for experienced teachers to keep up with advances in technology through in-service training has also been discussed by authors such as Melheim (1997)..

The complications involved, however, in increasing the percentage of teachers who feel prepared to use technology in the classrooms are many. Of major importance in determining in-service training needs is the assessment of skill and knowledge levels, either through asking the teacher to complete a needs assessment, or via another variety assessment such as a discussion group meeting with faculty and the prospective group facilitators.

Levels of Technology Skills and Knowledge

Differences in understanding and skill levels vary greatly among faculty, ranging from never having touched a computer to sophisticated knowledge of the use of complicated multimedia systems. Levels of accomplishment, however, may be grouped according to the following system:

Teacher understands computers, how they work, basic operating systems, and peripherals.

Teacher knows about other learning experiences available through computer technology and software including the internet, distance learning, using a PDA, as well as other technological information systems.

The teacher is able to match the learning needs of the students to available technology.

Teacher knows how to use software, knows what is available in their area of teaching, is able to integrate material seamlessly into classroom teaching in a manner that supports and enriches the curriculum.

Teacher is aware of the student's role in using technology in a creative way as part of both their group and individual learning projects.

Basic computer skills including understanding the computer operating system, how to use folders and files, word processing, spread sheets and data basis are generally taught in most educational institutions. These competencies are expected of beginning teachers. Knowledge and skills in these areas are often an important criteria for hiring in many school systems. Teachers who have been part of the system for several years, however, may not have had the same educational opportunities provided in most colleges and universities today, and therefore may need to catch up with their younger cohorts regarding basic computer use and even more sophisticated skills.

The expectation that experienced teachers learn advanced skills implies the anticipation for changes in instructional strategies developed throughout years of teaching experience. The resistance to learning computer technology may well be partly due to this realistic concern.

For other teachers who have mastered the basics of computer technology, the added pressure of in-service training in more complex areas, particularly those having to do with the successful integration of technology with curriculum and student needs, may be threatening as well.

Finally, the time needed to carry a full time teaching workload along with the expectation that the teacher acquire or refine computer or other technological skills may be overwhelming to the busy teacher.

It seems reasonable, therefore, that various incentives be available to those who are willing to update their technology skills. These might include bonus pay, an extra hour per week of prep time, paid in-service workshop opportunities either within the system or in the community, and of course ESUs needed for teacher certification.

The Value of Group Process in the Learning Situation

Teaching skills or specific informational areas in groups is the cornerstone of most school systems. Whether called classes, seminars, workshops, or any other name that implies people getting together to accomplish a specific task, groups of students are generally brought together to engage in the learning exercise. When a teacher or facilitator receives training in a certain area, he or she is much more likely to feel prepared to use the information and skills acquired during the training. If properly done, the teacher may even feel a sense of excitement regarding a new strategy for instruction. Kelly, in a 1999 article, described how a teacher training session on Microsoft's PowerPoint was instrumental in her developing an approach to teaching students to use a presentation program for their own work.

The group process, however, is often devaluated or ignored in learning situations. Content rather than process is stressed, thereby losing the advantage of one of the most productive aspects of partnership in groups. It is my contention, therefore, that the integration of group process theory with content by a facilitator with experience in dealing with group dynamics, would enrich the learning experience for most participants. Johnson et al., (1987), while discussing the research of Lewin , (1951) states: "His research demonstrated that learning is achieved more productively in groups whose members can interact and then reflect on their mutual experiences." Such emphasis on group process during the course of a computer technology workshop or seminar has the potential to improve the group's learning experience by:

Openly addressing resistance to learning
Developing a trusting, helping atmosphere in the learning situation,
Forming bonds that would continue to provide a source of help, even after the seminar is over.
Extending leadership opportunities to all group members according to their knowledge and skills related to the subject at hand.

With these advantages in mind, the logistics of group process as integrated into this specific learning experience will be explored.

The Pre-Group Planning Stage

The concept of group stages or phases and the group processes involved in each stage has been embraced by many writers and researchers. The pre-group phase, group planning and formation, is devoted to the development of goals and objectives and their integration with the skill levels of the participants for whom the group is planned. As Toseland et al., (1997) suggest, during the planning stage, the group leader focuses on both the task to be accomplished and the level of knowledge and skills of the potential participants. Is the workshop to be devoted to learning basic computer skills, more complex technological strategies, or something in between? The answer to these questions lies both in the targeted membership population as well as the knowledge and skills of the facilitator of the workshop or seminar.

The next step is acquiring information regarding the targeted audience. Is there a need for teachers who have been in the system for many years to catch up or even begin learning basic computer skills? Does the school system have several new teachers who have mastered the basics of computer use, software, and internet use, but who are unsure as to how to assimilate these areas of knowledge and skills into the curriculum they are expected to teach? Or would the school system administrators rather group the participants according to curriculum areas rather than skill attainment? Answers to these questions having to do with group formation will determine the number of groups needed as well as the information and practice that should be provided. As was stated previously, information may be obtained though needs assessment questionnaires returned by faculty members several weeks prior to an in-service training session, or, when possible, through meetings of the faculty of a specific school or district.

Preplanning has been completed when: the workshops have been organized during times convenient to a sufficient number of participants; the grouping of appropriate skill levels concluded; an appropriate number in each group has been selected; and the availability of adequate technology teaching resources has been assessed.

Group Stages and the Learning Process

When a group actually begins, the first stage of group process is an orientation to the purpose and goals of the group as well as a "getting to know you" opportunity. During this early stage in the process of a short term group, it is common for participants to be uncertain as to what will be expected of them, what kind of behavior they will experience from other group members as well as the paradox of impatience and hesitance (Corey et al., 1997). The activities of group members as they become acquainted and learn to trust each other, although somewhat time consuming and often disparaged by group members themselves, pays off later when the need arises for trust and cooperation rather than competition or judgmental behavior. This is particularly true when one of the goals of the group is to help the members work together both inside and outside of the group to improve their skills and share their experiences in building technology strategies for their classes. One group activity usually found to be successful in helping members get to know each other consists of asking the group members to form dyads with someone they do not know well, with the purpose of interviewing the person regarding their technology skills, and then introducing them to the rest of the group members. Another exercise that also works well involves each group participant standing behind his or her own chair, playing the role of a relative or close friend who would relate details about themselves (the group member) that would be important to the task at hand. These activities work best when the group facilitator starts the exercise, illustrating both the logistics and the information about the participant that would be most helpful in the learning situation.

During this initial stage, and also during a second stage sometimes classified as a stage where differences are worked out, the group considers whether the goals of the group fit their needs, and interests. These considerations often have to do with inclusion/exclusion, that is, each member contemplates whether or not this group will meet his or her needs. As this occurs, care must be taken by the learning group facilitator to help those who feel they must exclude themselves to either find a more suitable group, or to reassess their abilities to learn the material to be presented. A clear understanding of the skills that will be taught and the expectations in terms of time and achievement will often help those who feel initially overwhelmed by the experience to

stay with the group. On the other hand, understanding the purpose and scope of group goals will be helpful to the potential participant for whom the information would not be useful, or would be redundant because of the technology knowledge and skills group the member already possesses.

Once the member configuration of the group is established, the goals and expectations clearly explained, and the participants relatively comfortable with each other, the group is ready to work. At this point, it is helpful to attempt to match those who seem to catch on more quickly or have more beginning skills with those who are more hesitant to try something new or ask questions of the facilitator. Hopefully, the setting for the workshop would be a computer lab with availability of a well-maintained computer for all participants. As the workshop continues and the facilitator gets to know the abilities of the participants more fully, the buddy system suggested above can easily be inaugurated with a change of seating arrangements. In an ideal situation, several facilitators per workshop would be available so that questions and problems could be solved more quickly, consequently keeping the group together in their skill development as well.

As the learning group moves toward a more trusting and cohesive level, each member will be more willing to ask questions, even those that may seem "stupid" or embarrassing. Since members have learned to know each other well enough to be aware that they are each nearly the same stage in the learning process, much less competition or threat of being seen as inadequate will be present in the group. The group members will have had an opportunity to observe the leader's behavior as well. As they experience the technical skill of the leader as well as his\her warmth and interest in each participant, the group members will be more likely to ask questions of the facilitator, no matter how simplistic or elementary the questions may seem to the participant.

As the workshop is drawing to a close, emphasis on the future will be part of the natural progression toward group termination. A review of the material covered and how it might be used by the participant either personally or in the classroom would be indicated. The need to practice that which was learned should also be accentuated. Facilitators must emphasize that practice should begin as soon as possible, since new ideas and skills may quickly be forgotten as the participants focus on other aspects of teaching when the workshop experience is over.

The possibility of getting together informally with the group or several members of the group after the workshop for socialization is often a pleasant ending to the experience. Group members being available to each other, and the availability of the facilitators through offering continued aid for questions or problem resolution (particularly if they are part of the staff of the school system of the participants) could provide an excellent continuing resource for those who attended the workshop. The possibility of another in-service training opportunity might be discussed as well, focusing on perceived needs in the present, or more complex issues anticipated in the future. Finally, a questionnaire, assessing the value of various areas of the experience should be distributed and completed by participants as part of the workshop.

Using the group process as a teaching tool to "warm up" the technology experience requires that the group facilitators be trained in the knowledge and skills needed to lead small groups as well as the technology skills needed to fulfill the goals of the workshop. Even though these facilitating skills may require extensive knowledge and training in various domains, some of which may seem unrelated, the enrichment provided by the technology learning experience combined with the relationships developed during the group experience has the potential to provide major rewards for both participants and group facilitators.

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Enriching Preservice Field Experience Through Email Mentoring

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Abstract: This study focuses on ways to connect field experiences to academic theory and reflection through email correspondence. The assignments given by the university instructor were designed to facilitate the students' reflections on observations in the classroom. The instructor hoped that her responses would mentor the students to be reflective about their observations.

Introduction

Feiman-Nemser and Buchmann (1989) report that students come to their education courses with the belief that academic theory and reflection have no relevance to becoming a teacher, and that experience in the classroom will be the primary source of growth in becoming a teacher. Research clearly documents that beginning teachers are seeking "recipes" that will tell them exactly which action to pursue and in what manner they ought to do that to be seen as the "effective" teacher. Additionally preservice teachers tend to believe that there is not much to teaching (Britzman 1991). Preservice teachers have been watching teachers for years and they believe they know what their teachers will do before they do it. Preservice teachers may think they have seen all there is to see and know most of what there is to know about teaching. Further, according to Britzman, most preservice teachers feel disrespect toward university instruction that attempts to teach them about teaching. They feel that "practice" alone is what they need.

The irony is that preservice students' frustration with university coursework in teacher education is gaining strength just at a time when the evidence clearly indicates that the difficulty of being a good teacher is increasing (Bullough & Gitlin 1995). Preservice teacher beliefs about the complexity of teaching need to be exposed. When field experiences are linked to academic theory and reflection,

students begin to question their previously held beliefs about teaching and rethink their practice (Wentworth & Hansen 1999). Reflection and the linking of field experiences to theory require a lengthy time commitment of both faculty and students. Field visits are difficult to arrange and do not accomplish the important goals of reflection or linking of theory and practice. Even when students are seen in the field by their university instructor, conversations are often short and deal with a specific event of that day. These constraints are not conducive to serious reflection on the practice of teaching.

Research evidence in educational change theory (Fullan 1993, 1999) suggests that doing things the way they have "always" been done by the majority of teachers will not help solve the problems of education. A model of teacher education that has students learning to teach primarily from already practicing teachers, or learning practice from practice, is a model of simply reproducing education as it currently exists. Teachers need to learn from their experiences and transform both their own practice and serve as leaders in helping their colleagues transform their practice as well. Thus, as teacher educators we are in a quandary. How do we mentor preservice teachers to be reflective about their practice while they struggle to succeed initially in the classroom? Email correspondence may facilitate reflection on practice.

Email correspondence has been cited as an important contributor to educational practice, allowing participants to share reflection with others. Several research studies focus on electronic networks in university settings and report that motivation and comfort level with computer networking are factors that influence students' use of email networking (Feenverg & Gellman 1990, Kimsky 1991). Grandgenett & Harris (1994) reported that number of years of teaching influenced university faculty members' use of computer networking. Gender, age, and previous computer experience are factors in the preservice teachers' use of electronic communication (Downes 1993). Norton & Sprague (1997) report that on-line mentoring for lesson planning was equal to that of face-to-face mentoring with a peer. This study endeavors to analyze the value of email correspondence as a mentoring tool for university advisors of preservice teachers during an early preservice field experience. The assignments given by the university instructor were designed to facilitate the students' reflections on observations in the classroom. The instructor hoped that her responses would mentor the students to be reflective about their observations.

Methodology

The university instructor began an 8-week "exploration of teaching" course with discussions of student beliefs about teaching and what the preservice teachers might observe as they spent several weeks working in the schools. The students were then assigned to a school where they would act as a teacher's aid for four weeks. They were required to email the university professor once each week. Four topics, lesson planning, evaluation, NCTM questioning, and difficult students, were suggested for email topics. The topics were defined and discussed during the opening weeks of the course. The students were also required to collect data for a mini research project while in the schools. The email messages could discuss any problems with the collection of this data.

The university professor set a goal to reply to each email message within a 24-hour period. She attempted to encourage the students when they seemed frustrated, respond to questions in the emails, and ask questions that would spark further reflection from the students. She also reminded them of their data collection responsibilities and of future campus meetings. Following the field experiences the preservice teachers returned to the university for several seminars. The first day was one of unpacking the field experiences. The university professor used the emails as a beginning point to discuss several of the topics initiated in the first two weeks of class. Then the students were assigned to groups to present the data collected in the field. These groups were used for further data collection on the value of the email mentoring.

Each group participated in a focus group interview (Glesne & Peshkin 1992, Connaway 1996) within the week that they returned from the schools. Each focus group consisted of 4 to 7 students. Interviews lasted from 30 to 40 minutes and were audiotaped. Seated around a conference room table, students responded to questions posed by a moderator. Questions for the interview were formulated by the authors in an attempt to gather data concerning the following: 1) the quality of communication and connectedness between student and professor via email during field time, and 2) to what extent the weekly

email helped the students to connect with what they learned in the university classroom with what they learned in the field. During the interviews, the moderator augmented the questions to produce more in depth student response.

Results

The 24 students in the class sent a total of 81 email messages. Two students sent five emails messages; nine students sent four; nine students sent three; and four students sent two messages. Forty percent of the email messages were answered by the instructor within 24 hours of when they were sent; 11% within two days; 20% within three days; 1% within four days; and 15% within five days. (The majority of the responses sent five days after they were received were sent to first email messages that were received very early in the first week of the field experience. The instructor had not expected email to come that early so she did not begin responding until the end of the week.) Fourteen percent of the emails were not answered at all. All of the emails were coded for the topics suggested by the instructor during the first weeks of the course, lesson planning, evaluation, NCTM questioning, and difficult students. Almost every student sent an email discussing classroom questioning (25% of all emails) but not all of these focused specifically on the NCTM questioning. Evaluation was also covered by most students (24% of all emails focused on evaluation). Twenty-one percent of emails were listed by the students as dealing with lesson planning. Only 15% of the email messages were focused on difficult students. The other 15% of emails were on other topics. Each of these topics will be discussed to see if the emails help the students connect discussions in class with field experience. Selected email comments and replies will be included.

Questions

Connection to the importance of NCTM questions provided the most thoughtful responses in the emails of the students. During the focus group interviews many students commented that they remembered discussing questioning during university seminars and then seeing questioning in the classroom. The university professor discussed the point of the ineffective and often-posed question to students, "Do you have any questions?" Due to the class discussion prior to the field experience, the majority of the students noticed a "red light" when the cooperative teacher posed this question followed by the lack of classroom response.

In the emails, students commented about the importance of posing questions to students that helped them focus on understand the instruction. They also saw questions as a tool for helping students in the classroom remain focused:

"She will occasionally ask the 'Does anyone have any questions?' question, but it is after she has covered all the preliminary questions. If she doesn't have any response, she will call one of the students names, usually one of them with a perplexed look. She asks the students to explain a certain concept. This seems like a great approach, because she can see if they are understanding." (C. E. 17 September 1999, 16:29:18)

"I noticed that one specific teacher always asks the question 'Any questions?' Not once in the three days that I went to that class has any student ever answered that question." (T. P. 20 September 1999, 13:45:37)

"The hardest thing that I found while taking questions from the students was figuring out how much to tell them in my answer and how much I needed to leave for them to figure out. I found it was good to use an example similar to the problem they are struggling with but that wasn't the exact one in the assignment one." (N. F. 20 September 1999, 15:01:25)

Evaluation

In their emails to the professor, students seemed to define "evaluation" as quizzes, tests, grading homework, and assigning grades. Typical emails about evaluation detailed breakdown of points per quiz/test and percentage assigned to in-class participation. The following email from a student about his cooperating teacher's breakdown for a final grade is a typical example of what student email about evaluation stated: "The final grade in her class is due to 20% homework, 20% quizes [sic], 10% partisapation [sic], and 50% tests." (J. R., Report on Evaluation, 1 October 1999, 19:18:36)

Emails on evaluation tended to be qualitatively superficial, focusing on procedure rather than their own point of view or their cooperating teacher's philosophy. Occasionally, students would reflect that they were thinking about more than just grading procedures, such as this students' comments about her cooperating teacher's use of a test written by text book publishers:

"Also, the test was one of those tests that comes from the book and the questions were pretty confusing. A lot of kids didn't read the directions very carefully and so they lost a lot of points. I don't think that the test accurately represented how well they could do that math, it just showed who could read the directions the best. I think that when I teach I will try to avoid using standard book tests as much as possible." (J. G. Re: Evaluation, 24 September 1999, 2:42 PM)

One student did have a notable exception. She discussed the use of alternative assessment even though she did not use that term: "I also like how instead of tests, for some sections, she gives them projects that test their skills." (J. H., Week #3, 1 October 1999, 14:48:30)

Difficult Student

Emails about a difficult students varied from describing groups of students that were challenging to teach to details about one student with whom preservice teachers tried to establish good rapport. Some emails described the willing student having difficulties with the complexities of mathematics; others talked about rebellious youth that were resistant to learning. These emails tended to be more qualitatively thoughtful. Emails about "the difficult student" often contained realizations about teaching, "all the students aren't easy to teach, even in the advanced classes. Some really require extra time and attention." (L. T., Re: Difficult Student, 4 October 1999, 4:29:12)

Communication about "the difficult student" also tended to be more story oriented, student oriented, and contained emotion as they reflected on *who* they were teaching. Often they also expressed aspirations like this email:

"It's really a challenge to love these kids despite their actions. I've gained a ton more appreciation for my junior high/high school teachers. Teaching is really a thankless job. Kids go on and graduate and leave, sometimes saying nothing to you about your influence. . . I really hope to be a good teacher. One who inspires, looks for the best, is respected and loves her students no matter how they do in math." (B. M. Re: Weekly Report, no date).

Lesson Planning

Many of the email messages about lesson planning were more about classroom instruction than actual planning. An idealized view of lesson planning widely held by college professors is that of the classroom teacher intently at work at her or his desk during planning period, surrounded by resources from which to glean ideas for instruction. Add to this picture several teacher colleagues with whom to discuss both the content and the pedagogy for previous and upcoming lessons, and one has the reality of planning for mathematics instruction in China as reported by Ma in her recently heralded book, *Knowing and Teaching Elementary Mathematics* (1999).

Neither version of lesson planning appears to be the reality for the secondary teachers to whom the students were assigned during the course under study. No students reported collaborative planning among mathematics teachers. Further, no student reported on the actual planning process. Rather, students appeared to infer from classroom instruction the nature of the teacher's planning for that instruction. For example one student reported the following:

"I feel that my teacher, . . . , does a very good job of lesson planning. Each class starts with a warm-up. Which [sic] is a review of the day before. They go over the warm-up and then go into the next days [sic] lesson. She gives the class the objective before she starts the lesson. She introduces new ideas and has the kids help her in developing the idea. Then she has the students either go to the board and work problems, or just work out of the book as a class." (A. D. 24 September 1999, 3:49:29)

Other students mentioned similar lesson routines, and most reported that the teachers they observed relied heavily on the mathematics textbook:

"I got to talk with the teacher about how she does her lesson planning . . . . She does her lesson planning just from the book mostly. She doesnt [sic] write anything down, but just from observing her I can tell that her objective is internally set to help the students understand and have a concrete view of the math." (A. L. 24 September 1999, 4:17:43)

In at least one instance, the student inferred from a discussion with the classroom teacher that that teacher viewed lesson planning as unnecessary:

"When I asked my teacher about lesson planning he did not have a very specific answer. He more or less just comes to class and decides that day what to have the kids do. He does have a set routine the students follow and sticks to it well. Most days the students are just given a lecture and then given an assignment from the book." (J. C. 23 September 1999, 8:36:26)

In summary, little information was included in students' email reports regarding the actual process of lesson planning. Students appeared to infer the planning process from the lessons they saw implemented, and most lessons reported were described as routine and highly textbook dependent.

Conclusions

The email correspondence seem to keep the students connected to the instructor during the weeks they were in the field and facilitate the connection of field experience and university coursework. Many of the students were surprised that the instructor responded to the first email. They were pleased to have feedback from their university instructor. Their emails seem to be more thoughtful the next week, perhaps because they knew the instructor would respond to them. Almost every student reported on three or more of the suggested topics. Very few asked questions or discussed problems with the data collection responsibilities. The university instructor commented that very few of her questions to the students were answered directly the next week. Instead the student reported on a different topic.

Email correspondence seemed to facilitate the connection of field experience and university coursework. Students seemed to reflect about the practice they observed in the classroom. However some reflection seemed to be more focused than others. Some topics seemed to be more clearly defined in the early weeks of the course so the preservice teachers were able to discuss them more deeply in their email messages. In this course evaluation and difficult students were fairly well understood by the students. Many of the email messages focused on procedural issues of evaluation, lesson planning, questioning and not theoretical issues. The instructor tried to ask questions to the preservice teachers to help them reflect about their observations, but few of these questions were answered the next week. The preservice teacher just went on to the next topic. Lesson planning and questioning were less clearly understood so the email

messages were less reflective. The instructor needs to be aware that careful discussions about topics for email messages will aid in the depth of reflection of the students as they work in the field.

Further research on the use of email correspondence will be useful in learning how to have preservice teacher reflect on theory and practice as they begin their work as a teacher. While this study focused on the connection of students to instructors, others could look at reflection when students communicate with each other. Additional work could consider allowing students to select their own topics to discuss. Email correspondence does show promise as a way for university work to connect with field experience.

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New Meets New Year Two: Integrating Technology into Inquiry-Based Teacher Education

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ABSTRACT: What happens when an inquiry-based teacher education program encounters a province-mandated Information and Communications Technology (ICT) curriculum? This paper reports on the second year of technology integration efforts in an inquiry-based teacher preparation program. The first three sections provide the context for this endeavor and review strategies employed in the first year of targeting technology professional development in the new Master of Teaching program at the University of Calgary. The final section describes current integration strategies, professional development, and integration projects that are underway for year two of new meets new. *Keywords*: pre-service teacher education, technology integration, problem-based learning, needs assessment, program development.

TEACHER EDUCATION TRANSFORMED

Teacher education programs in this century have generally been organized around an applied science model within which discrete courses are framed by philosophical and theoretical content, and these in turn are followed by short-term "practice teaching" in schools. Beginning in 1996, the University of Calgary embarked on a course of action to discontinue its teacher education programs formed in the conventional mould, and to replace them with a program in which the elements of the professional degree program are integrated, the learners are treated as professionals-in-the-making, the richness of pedagogical knowledge is acknowledged, and cooperative problem-solving is valued. In this new Master of Teaching (MT) program, "courses" in the traditional sense have disappeared to be replaced with professional, case, and field seminars, independent studies, and extensive field experience. The scope of "field" has been extended beyond schools to include a requirements that every student spend a block of time in some alternate educational setting, e.g., zoo, art gallery, museum, prison, special needs facility, social agency, human resources department. Students spend approximately equal amounts of time on campus and in the field from the first day in the program, and the one experience is expected to inform the other.

The campus elements of the program include case, professional, and field seminars. Much of the "academic" content of the program is carried by a series of cases with which students must wrestle, research, take positions toward, and defend their stands. There is a logical progression of series of cases encompassing learners and learning, teachers and teaching, curriculum contexts and issues, living cases from the field during their most intensive field experience, and ethical cases (broadly defined). Each case encompasses far more knowledge than any one student can deal with in the time given—hence the incentive for cooperative endeavors. Team work and collaborative inquiry and problem solving is encouraged, valued, and rewarded. Field seminars provide a forum for the exchange of ideas and experiences gleaned from the variety of educational settings in which a group of students find themselves, not to mention dealing with many of the pragmatic issues which characterize the lives of teachers and students. Professional seminars offer students an opportunity to critically reflect on themselves as teachers-in-the-making, to pursue topics and skills of particular interest, and to engage in the many debates that surround the nature of education and teaching. Now in its fourth year, the MT program has clearly demonstrated its capability to prepare teachers who are energetic, reflective, cooperative practitioners capable of solving problems, confronting new challenges, and taking and defending

positions on complex issues. The move away from courses taught by specialists has not been without its challenges, however, and one of the first to rear its head was how to re-examine the integration of technology.

THE MT PROGRAM MEETS NEW PROVINCIAL TECHNOLOGY CURRICULA

Concurrent with the changes in teacher education at the University of Calgary is the introduction of a new curriculum by Alberta Learning (the provincial department of education), *Information and Communication Technology, Kindergarten to Grade 12: Interim Program of Studies* (Alberta Education, 1998). Best described as a requirement to teach technology across the curriculum, this approach emphasizes the seamless relationship between technology and the subject disciplines, the process nature of technology itself, and the co-existence of knowledge, skills, and attitudes (KSAs) for technology alongside those for subject areas. The emergence of this new technology curriculum follows in the wake of technology competencies that have been published for beginning and experienced teachers.

Our efforts to design professional development for technology integration are further motivated by a specific requirement that teachers develop competency using communications technology in order to qualify for teacher interim certification. Provincial legislation, in form of the Alberta School Act and specifically the Ministerial Order #016/97 Policy 4.2.1., defines the following technology requirement for teacher interim certification:

> Teachers who hold an Interim Professional Certificate are expected to demonstrate consistently that they understand: j) the functions of traditional and electronic teaching/learning technologies. They know how to use and how to engage students in using these technologies to present and deliver content, communicate effectively with others, find and secure information, research, word process, manage information, and keep records (Alberta Education, 1998b).

From the point of view of teacher education in Alberta, it is not only *desirable* that our students become familiar with the content of the new technology curriculum, *it is the law.*

A considerable amount of research and careful thought went into transforming teacher education at the University of Calgary. What now needs to be considered carefully as this new program evolves is how to address the needs of students to gain the technology competencies and thinking skills required for interim certification. The Master of Teaching program accepts 400 students per year, which translates into approximately 800 students in progress each year. The MT program must address technology in education BUT it must do so within the structure of the new program—the reintroduction of courses is not an option.

TECHNOLOGY INTEGRATION STRATEGIES: YEAR ONE

The authors were charged with the task of developing a framework that dovetails technology with the MT program. We determined it necessary to conduct a needs assessment to identify present technology skill levels and areas of highest need. To this end, we distilled the required

learning outcomes of the Alberta curriculum into a competency set that served as the basis for an online survey of students in program. Survey information was used to identify areas upon which we should concentrate our professional development efforts. A complete set of survey results has been published on the World Wide Web (Clark & Jacobsen, 1998). Comparison of 1998 survey findings with Ott's (1996) findings from education students in 1995 permitted us to draw some conclusions about the differences in clientele and entry level skills. For example, more MT students have a computer at home than did students in 1995 (i.e., 84% versus 67%), all of our students hold at least one prior degree (i.e., compared to 20% in 1995), and students entering our program have a higher degree of prior experience with word processing, email and spreadsheets. In brief, our needs assessment told us that with regards to previous computer experience, our students reported the most expertise with word processing, e-mail and WWW browsing and searching. However, a percentage of students also reported having "none" or "a little" word processing experience (9.5%), electronic mail experience (25.5%), and WWW browsing and searching experience (33.3%). Skill areas we targeted for immediate professional development support were those with which a majority of students reported having "none" to "a little" expertise. The high need areas included: accessing library resources using the WWW, spreadsheets, database creation, presentation software, and WWW page creation and editing.

Technology professional development was provided for students in three areas of the MT Program: weekly lecture, a technology skill and integration workshop series, and in professional seminar. As part of their campus experience, MT students attend a weekly lecture series on topics identified with each thematic unit. In order to focus on the integration, communication, decision making, and problem solving aspects of educational technology, the authors prepared and presented two of the winter session lectures for first year MT students on integrating technology. We organized a series of technology workshops to provide skill and integration training in four "high need" application areas: (1) presentation software, (2) web page design, (3) spreadsheets, charts & graphs, and (4) databases for social science. Upon completion of the workshop and a project, such as a web page with internal and external links and graphics, students are presented with a certificate for their teacher portfolio.

INTEGRATING TECHNOLOGY INTO PROFESSIONAL SEMINAR

The first author experimented with integrating authentic technology requirements into the full year Professional Seminar (prosem) she taught with 21 students. The basic intent of prosem is to promote self-conscious learners and teachers. More specifically, prosem opens a space in which students become aware of the differing, sometimes competing sets of values and beliefs that support and frame different kinds of educational practice. Students are encouraged to see teaching and learning from multiple viewpoints-- to understand the complexity and contradiction inherent in these perspectives, to be able to choose and generate multiple possibilities for action, and to see what one's choices both allow (legitimate), or disallow (suppress). The instructor structured prosem using the following five components: (1) Weekly readings with required written interpretive and critical responses, (2) Group discussion/debate, and individual and group presentations, (3) Generative discussion periods for articulating and examining lived experience, (4) Biography of Learning / Independent Inquiry / Scholarly Writing workshop sessions, and (5) Individual consultation / feedback sessions. Student assessment was narrative, and was based

upon participation and contribution to weekly seminar, responses to required readings, creative writing and narratives, two independent inquiries, and three biographies of learning.

Given the goal of creating a collaborative on-line community of scholars, students took on the task of learning how to publish and exchange the results of their written coursework and investigations using individual World Wide Web homepages. Students met with the instructor for additional hands-on instruction both before and after scheduled seminar time, and on alternate days, in order to develop their skills in HTML and web publishing. Eventually, all students learned how to find resources on the web, create new HTML documents, convert existing word processed documents into web pages, incorporate graphics and links, and upload their web pages to a public web server. Some students learned how to convert and upload PowerPoint presentations to their web sites, to construct animations, and incorporate sound and video into their web documents.

This experiment with integrated technology requirements in professional seminar worked. We created images of how students in the MT Program can work with technology and web-based environments to create scholarly electronic communities. The integration of technology into prosem also assisted us in better defining the challenges ahead as we work to integrate technology across the Master of Teaching program. The additional time required to prepare for and to integrate technology in this one course, and the ability and skill levels required of the instructor, lead us to conclude that issues of faculty workload and professional development requirements will be primary considerations in drafting plans for faculty-wide integration. Several additional hours per week over an entire semester, for both faculty and students, is a significant commitment to ask of people. Therefore, we will have to focus carefully on the learner outcomes the faculty plans to target and realize that any and all integration efforts will require that individuals invest time in their own professional development and instructional planning in order to yield the expected returns. Even with years of educational technology experience and bushels of enthusiasm and commitment, the lived curriculum with regard to technology integration can be anything but neat and tidy! Computers freeze, network connections are busy or go down, the projector bulb burns out, floppy disks and hard drives die, and students ask questions that cannot be answered on the spot. However, in the midst of all of this apparent chaos, students create amazing and extensive projects, develop remarkable technology skills, discover the fallibility of technology, overcome some of their technology-related fears, and invent neat ideas for technology integration in their future classrooms. The challenge will be to convince our colleagues to persevere in spite of these expected, and often inevitable, technology glitches and failures, and provide the necessary support and just-in-time training as they work toward meaningful integration of technology into learning goals and processes.

NEW MEETS NEW IN YEAR TWO

A number of recommendations, in the form of goal statements, were made to the Faculty of Education Curriculum Planning Committee as a result of our first year technology integration efforts and literature on technology integration, professional development, and ICT leadership (Jacobsen, 1998; Stein, Smith & Silver, 1999; Yee, 1999): (1) take steps toward the ubiquitous integration of technology into the MT program, (2) plan for and support faculty members'

professional development for technology integration, (3) create an electronic communication medium for all MT students and faculty, (4) disseminate instructional materials about technology access and requirements, and (5) offer an extended MT technology workshop series in 1999/2000.

TECHNOLOGY INTEGRATION COMMITTEE

The first recommendation was to reconceptualize the end goal of "ubiquitous integration of technology for learning" from being a sole responsibility of the "educational technology folks", and repositioning it as a faculty-wide vision and commitment. The new provincial curriculum requires *all* teachers to integrate technology across the K-12 curriculum. Technology as process is every teacher's responsibility. Therefore, technology integration efforts on campus should be undertaken by faculty across all curricular specializations, rather than relegating it to the technology specialists. To this end, one of us has formed and now chairs a Faculty of Education Information and Communications Technology (ICT) Integration Committee. When selecting potential committee members, careful consideration was given to appropriate representation and diverse membership. A goal was to promote a faculty culture that explored fundamental teaching and learning issues, rather than emphasizing the adoption of technology for technology sake, so it was important to solicit and include views from both adopters and non-adopters in the faculty, in schools, business, and government about the relative advantages of technology for teaching and learning. Therefore, the committee includes Faculty of Education colleagues with expertise in areas other than educational technology, colleagues with expertise in educational technology, the Director of the Doucette Resource Centre, individuals from Calgary-area school boards, a member from the Galileo Educational Network, an individual representing Alberta Learning and the leading author of the new Information and Communication Technology Interim Program of Studies for Alberta, and an individual from industry with technology expertise.

The committee's goal is to create a shared vision by working to establish a Faculty Wide Technology Integration Plan. This document will provide a flexible and responsive plan that will guide rather than constrain integration efforts that are in alignment with the University Technology Integration Plan and the teacher certification requirements of Alberta Learning. An outcome of this Technology Integration Plan will be to address the second goal, that of determining the technology professional development requirements of faculty members, and developing appropriate strategies access to technology, training, and support. In order to realize the potential benefits from technology, the faculty as a whole needs to find ways to encourage and assist faculty members with the adoption of technology for a variety of teaching, administrative, and research tasks. Without attention to the human infrastructure, nothing of value will be achieved with the technological infrastructure (Jacobsen, 1998).

SPECIAL TOPICS SEMINAR FOR SECOND YEAR STUDENTS

An opportunity for advanced technology infusion in the MT Program has presented itself in the form of the second year special topics seminar. In their final semester, second year students enroll in a special topics seminar which allows them to extend and deepen their understanding about a particular aspect of education. A list of diverse topics for special seminar is made available to students in semester three, and students indicate their preferred topics. A special

topics seminar entitled "Integrating Technology Across the Curriculum" has attracted 45 second year students for the Winter 2000 semester. The normal class size for special topics seminar is 15 students. Instead of offering 3 separate seminars, the first author and two colleagues with expertise in educational technology have been afforded the innovative opportunity to team teach a combined seminar with all 45 students. Goals of this seminar include: (1) investigating fundamental teaching and learning issues that surround the use of information and communications technology in educational settings, (2) examining both the potential and the limitations of educational technology use, (3) providing a forum for discussion of conceptual issues related to educational technology and the Alberta Learning Technology Outcomes, (4) participating in a collaborative, electronic community to publish, exchange and consider emerging ideas, (5) engaging in practical exercises that have classroom application for student learning, and (6) acquiring some proficiency in the use of various computer applications. A component of the seminar will be to critically analyze, build and extend upon innovative professional development strategies described by Stein, Smith & Silver (1999) with regard to technology integration, and approaches to ICT leadership outlined by Yee (1999). Students will be responsible for producing a portfolio demonstrating advanced technology understandings and skills. Portfolios will be assessed by the seminar leaders, along with student-selected peers, public school and university faculty members.

EGALLERY: ELECTRONIC PUBLICATION OF EXEMPLARY STUDENT WORK - http://www.ucalgary.ca/~egallery

The third goal, to create an electronic communication medium for faculty and students, has opened a space for an innovative publication medium for student work. A number of faculty members, teachers, and two second year MT students have formed an editorial team and have created the EGallery, a web-based peer-reviewed publication of exemplary student scholarship. EGallery's mission is to provide an electronic medium for international publication and consideration of exemplary scholarly work produced by Master of Teaching students in the Faculty of Education. The editorial team seeks submissions of critical essays, independent inquiries, and biographies of learning from first and second year Master of Teaching students. All submissions are subject to a peer review process.

To get to the stage of a full-scale launch of the EGallery, a number of different development tasks needed to be undertaken by the editorial team. We needed to: (1) discuss and develop a mission statement, (2) define our intended audience, (3) outline our purpose, (4) establish publication and submission guidelines, (5) establish a review process and criteria, (6) consider how we might involve others, (7) consider who might become reviewers, (8) design advertising and promotion strategies, (9) canvas for academic and financial support, (10) establish an e-mail account and web page directory on the University of Calgary server, and (11) design and develop the website.

Development work has also included, not exclusively: (1) designing HTML documents and graphics for the core website, (2) designing and publishing paper-based promotional materials, (3) formatting and publishing the first two submissions for review, (4) creating a review form that will e-mail results to the editors, (5) inviting others to become part of the editorial team, (6) inviting peers and students to become reviewers, (7) fielding numerous questions from peers and

students, (8) recording and discussing suggestions and advice from others, and (9) editing, refining, and maintaining the web site.

There are some technological and infrastructure requirements to consider when launching an online publication of this type. The EGallery website is hosted on a University of Calgary public web server, and linked to the official Faculty of Education website. The editorial team considered it crucial to have both the Dean and the Associate Dean's public support of the EGallery, and sought their advice and advocacy. The Department of Teacher Preparation in the Faculty of Education has generously supported EGallery by providing photocopying for promotional materials.

We have published a prototype issue of the EGallery with two exemplary independent inquiries about teaching mathematics. Our immediate goal is to publish the first issue of EGallery in January 2000 with six exemplary pieces of student scholarship. Our future plans are to fully explore how EGallery can become an active and inviting space for critical discussion among experienced educators, faculty members, and student teachers about educational issues and topics. We plan to investigate how the editorial team might facilitate ongoing and sustained conversations that build and extend upon issues raised in the published work.

TECHNOLOGY HANDBOOK

The fourth recommendation was based upon an observed need for instruction, access, and support materials that students could access for individual training and support needs. Plans are underway for the creation of a technology handbook for faculty members and students. This document will be available on the Faculty of Education web site as both HTML and PDF documents, and will provide useful information about technology integration activities, professional development, and resources. A preliminary list of topics and resources that will be addressed in the Technology Handbook are: 1) requirements and expectations for technology integration by Alberta teachers for Interim Certification by Alberta Learning, 2) where to access and how to print Alberta Education online resources (PDF files) and curricular documents, 3) how to get e-mail account and how/why to use it (i.e., communication with faculty, peers, cooperating teachers), 4) how and why to sign-up for list server, and 5) the URL for Faculty of Education web site and description of relevant online resources.

MT TECHNOLOGY WORKSHOP SERIES

We have organized an extended MT Technology Workshop Series for the 1999/2000 instructional year that includes instruction in getting started with technology, personal writing, communication and research skills, creating computer-based slide presentations, and graphics creation and integration. A fundamental goal for all of the workshops is to provide images of how the new ICT curriculum might be lived out in the classroom with students.

The first workshop was designed for beginners who wanted to develop a better understanding of computer terminology and components, to navigate basic operating system features, to word process, save to disk, and print a basic document, to access technology resources in the faculty, and to set up an email account with the university. The second workshop was developed for

beginners who wanted to refine their writing, communication and research skills using a computer. The workshop was designed to help students to develop general word processing skills (i.e., new, open, save, print, page numbers, double spacing, formatting, insert clip art, and so on) for their major writing assignments, to use email to communicate with others (i.e., instructors, partner teachers, and peers) and to exchange attached files, to use various search engines to locate research information on the World Wide Web using a browser, to download and open Curricular documents, such as the Technology Outcomes document, from the Alberta Learning Website (Alberta Education, 1998). The third workshop was designed to provide instruction on developing computer-based slide presentations. Students learned how to create PowerPoint presentations using the Wizard feature, design a new presentation from blank slides, develop a new presentation using the color templates, add graphics and special effects, and most importantly, explore how presentation software can be used for writing and research in the classroom with/by students. The fourth workshop built upon skills learned in the first three workshops. Students learned how to integrate graphics into word processing and presentation documents, to create graphics using a flatbed scanner to digitize photographs, drawings, and other media, to use a spreadsheet to create simple charts and graphs, and to create drawings and figures using draw tools. Students also learned how to download images from the World Wide Web for use in word, presentation, and web documents.

Three additional workshops will be offered in the Winter 2000 instructional session: database design and integration, manipulating numerical data using spreadsheets, and web design and HTML.

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Teachers Learning about Software Implementation

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Abstract Knowing how to integrate computer resources into curriculum is far more important than finding what resources are available, where the former requires the knowledge and skills of evaluating, planning, designing, and enforcing. Most teachers today, however, lack knowledge of and experiences with software implementation. This paper describes an experience of 23 teacher education sophomore students observing school children exploring the Magic School Bus CD-ROMs and discusses several related issues, including students' perception, children's performance, the usefulness of the software programs, and other issues.

Introduction

Throughout many years of working with teachers, I have heard many teachers ask, "What computer resources or software are available for my teaching?" Surprisingly, very few teachers have asked, "How can I best use the existing computer resources for my teaching?" Although most teachers are eager to know what resources are good for their class to use, it would be improper to assume that teachers already know how to integrate existing resources in their curriculum and they only need to know what resources are available and how to acquire them. By talking with school teachers on various occasions, I found that many teachers have faith in computers and believe computers can enhance content teaching and learning although these teachers did not have experiences using computers in teaching, nor did they know exactly how students would react toward the computer resources being used in any given situation.

Knowing how to integrate computer resources into curriculum is far more important than finding what resources are available, where the former requires the knowledge and skills of evaluating, planning, designing, and enforcing. As Dias (1999) indicated, although electronic resources are widely available, how software may be best integrated into curriculum still remains a puzzle among most teachers. Oftentimes, teachers are unaware of the students' needs when assigning computer-related learning tasks for students to complete.

To help preservice teachers better understand the actual use of computer programs for teaching and to help some local elementary school children gain a better understanding about what it is like when learning in a college computer lab, a special arrangement was made to invite local elementary students to the College of New Jersey campus. Forty-five children in grades 1 through 5 from a professional development school in Trenton, NJ, came to the college. The sophomores in the Analysis of Teaching class met with these elementary school students in a campus computer cluster. The children were given an opportunity to explore the Microsoft Magic School Bus CD-ROMs, and the college preservice teachers observed and helped them with this experience. The preservice teachers gained more sophisticated understandings of how

children approach software as they observed and documented this experience. After elementary students had a good time learning while playing on computers, they were asked to share how they felt about the software and what they enjoyed most about such an experience.

Based on the results of the children's visit and exploration on the software, this paper explores various issues with reference to the following questions:

1. How did elementary students react toward the Magic School Bus software?
2. Are there changes in preservice teachers' perceptions about how elementary students would perform or benefit from using the software program before and after this experience?
3. Do elementary students prefer the use of the Magic School Bus software for learning to the traditional classroom instructional approach?
4. Do elementary students' attitudes change after they explore the software?
5. Do college students perceive the use of such a program superior to the traditional approach of instruction?
6. Are there any differences in performance between the younger students and the older students?
7. How well do the preservice and inservice teachers know about software implementation?
8. Under what circumstance will elementary students benefit from the software?
9. What did the preservice teachers learn from this experience?

Magic School Bus Series

The Magic School Bus (MSB) CD-ROM programs, designed and developed jointly by Scholastic and Microsoft, are based on a series of books and video tapes that center on science explorations in various topics, including exploring the ocean, inside the earth, the human body, the rainforest, and the Solar System.. This highly interactive program series features Ms. Frizzle, a teacher who, with the help of a magic school bus that can go anywhere and do anything, provides her students with outrageous field-based science experiences. The CD-ROMs attempt to simulate journeys presented in the books and tapes and to engage children actively in science through various activities. The design of the series is based on Ms. Frizzle's teaching approach: exploring, getting messy, and finding solutions to problems encountered by students. The CD-ROM programs are intended for teaching and learning with the constructivist's approach.

The visit of school children

Forty-five children in grades 1 through 5 from Christopher Columbus School, a member school from the Professional Development School Network, in Trenton, came to The College of New Jersey. Twenty-three college sophomores in the Analysis of Teaching class met with these elementary school students in a campus computer cluster. The children were given an opportunity to explore MSB CD-ROMs, while the college students observed and documented them as they did so. These children later shared how they felt about this trip and what they have learned from using the Magic School Bus CD-ROMs.

The procedure

Prior to the children's visit, the sophomore students rated the MSB software based on their own observations and perception. During the visit, each sophomore student observed two pairs of school children who explored the software together for two one-half hour periods. The children were randomly assigned to work in pairs on one of the MSB CD-ROM titles for a half hour, then worked on a different MSB CD-ROM title for another half hour. After the observation, the sophomore students rated the MSB software again and wrote reports describing their observations. In addition, before and after the elementary students' visit, sophomore students were surveyed about their perceptions and attitudes concerning the usefulness of using the MSB programs for teaching and learning. The sophomores were encouraged to answer the question, "Did the children succeed in using and learning with the Magic School Bus software?" The Columbus School children were also asked to share what they perceived about their Magic School Bus experience. The data collected are primarily from the sophomore students' pre- and post-survey as well as their reports about their perceptions and findings from observing children using the software.

Results

This paper addresses some key issues related to appropriate software implementation. Derived from careful observations of how college students interacted with the elementary school children on the computer tasks, how sophomore students interpreted their observations, and gathered from the pre- and post-surveys conducted with all participating preservice teachers, some interesting findings are worth noting. Many preservice teachers didn't actually learn how to integrate software into instruction until they had a chance to interact with both the software and students. As a result of this experience, many preservice teachers developed a different perspective about the best way to implement software in teaching. Through an informal discussion with the two teachers of the students in this study, it was determined that they had an incorrect notion about how their students would react toward the software and how the software may be best used to enhance teaching and learning. Like many others, these two teachers assumed that having students learn with software would automatically result in positive learning outcomes. A further report of the findings is presented below.

Sophomore students' attitudes

In general, students held good faith in software and advocated the usefulness of the software. Although a few sophomore students expressed different concerns of the software implementation after they observed these children exploring the software, there were no significant changes in their general attitude toward this particular software or toward the general use of educational software for instruction. This may be partially due to the insufficient amount of time allocated for children to use the software for learning, and partially because there are no lesson plans or other activities to go along with the software; it became impractical to assess the value of the software when it is irrelevant from the intended learning contents.

Sophomore students' beliefs

As evident in their observation reports, most sophomore students believed it was worthwhile to use software in instruction because:

- it has information value
- it can give the teacher instructional ideas
- it expands children's horizons
- it allows children to explore new concepts
- it engages children in learning in an exciting way
- it allows students to have fun while they learn
- it stimulates the senses and allows children to express their creativity
- it provides physical participation that keeps children focused
- it provides a relief from lecture-style teaching
- It is a reprieve from traditional learning methods
- it gives children a choice and allows them to take control of their own learning
- it is valuable because children like it
- it builds confidence
- it inspires children to use computers, and children need computer skills for their futures

Learning with CD-ROMs vs. learning with Ms. Frizzle

It is interesting to compare a regular classroom setting with Ms. Frizzle's class. Many sophomores can easily identify some major differences, including the language used by Ms. Frizzle, the efforts for the class preparations, the concept of student safety, the flexibility of class time and activities, and the passion for new knowledge. Students were also encouraged to compare learning with CD-ROMs with learning with Ms. Frizzle. Most students considered the similarity between the two, while some students pointed out some differences. These comparisons are listed below.

- "Ms. Frizzle rarely answers the children's questions directly; she allows them to learn hands-on. Similarly, the software gave little instruction; the children have to figure out how to use it."
- "The CD-ROM offers an independent learning experience for children, in which they are free to explore and learn on their own. This is similar to Ms. Frizzle's methods in the cartoon classroom. She is not concerned with telling children things; rather, she favors a method where children discover things for themselves, with very little direction from their teacher."
- "The teaching that is embodied in the CD-ROM is *different* from that of Ms. Frizzle. Although it encourages independent learning and allows children to explore different areas, it keeps them in a controlled environment and constantly spits out facts. Ms. Frizzle's mantra is 'take chances, get messy, make mistakes.' When interacting with the CD-ROM, I realized

Sophomores' observations about children using the MSB software

- The CD-ROM offered little direction. Some children could navigate with ease, but others required extensive guidance. Most observers felt this impaired learning.
- Younger children generally liked the software more than did older ones and were excited by the sights and sounds they were able to create.
- Children were engaged with the video game-like activities and had little interest in the facts.

- Only a few children took an interest in the game around which the software was organized.
- There was little knowledge embedded in the games, and few children could identify anything they had learned. While some activities had more learning than others, all had some educational value.
- Children were generally good at sharing the mouse and working together.
- Children tended to click around, avoiding difficult activities or those that involved a lot of information.
- A half hour was not enough time for children to become engaged with the software.

How would sophomore students use the software for their future teaching?

Elementary students were frequently carried away by the bells and whistles presented in the software and ignored the intended learning content. Simply putting students to work on a computer program does not necessarily guarantee learning success. Sophomore students suggest implementing the software for teaching:

- as the primary source of instruction for older children.
- as an introduction to a unit.
- as a supplement to a unit once children knew the basics.

Children's reaction toward the visit

The children shared their perceptions with us and almost all of them gave positive feedback regarding their experience. Most children were excited to have an opportunity to visit the college computer lab and work with college students. They were strongly motivated to explore the CD-ROM programs and thought this experience was fun. Although most children had encountered some difficulties in figuring out what to do in the program at various stages, they did not seem frustrated. In fact, many children seemed to pay more attention to running the MSG programs rather than focusing on the learning contents.

Implications

- Software integration is complex. Know it well, pilot it on children, and use it appropriately.
- Time pressures may make it difficult to use software effectively.
- Preservice teachers believe that learning should be fun.
- Preservice teachers equate constructivism with hands-on learning and don't see a difference between Miss Frizzle and the CD-ROM.
- Preservice teachers like the idea of software but are afraid of its random quality.
- Preservice teachers are technophilic.

What did the sophomores learn?

- They found that children are fast in catching up with new computer applications. It took adults longer to figure out something in the program than children.
- It is important to find appropriate software to supplement teaching. Not all the materials are good for instructional needs.

- Putting students in the computer lab to explore the Web or software applications will not automatically help students learn better. Lesson planning is essential to ensure the success of the software implementation. To maximize the learning, teachers should relate the learning contents with the computer programs as well as with students' prior experience.
- When applying software in the school, there may not be sufficient hardware or software resources. The cooperative or collaborative learning setting is beneficial to engage students in learning from each other.
- Software implementation requires time. It will take plenty of time for teachers to prepare the lessons. It will also require much time for students to explore the programs. Not until they can manage the program well enough will they be able to engage in active learning through activities.

Summary

Knowing how to integrate computer resources into curriculum is far more important than finding what resources are available, however, most teachers lack knowledge of and experience with software implementation. By inviting some elementary school children to The College of New Jersey to explore the Magic School Bus series, sophomore students developed a better sense of software implementation while observing children using the software. They also developed a better understanding about some other related issues which are essential for software implementation in the classroom.

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Implementing Mandated Information Technology Infusion into Teacher Education: California Cases

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Abstract: California legislation recently mandated that credential candidates meet specified technological competencies before being recommended for a California State Teaching Credential. This paper describes how a large teacher preparation institution and an innovative alternative to certification offered by the California State University system are responding to this legislation. Faculty involved in the implementation efforts discuss issues and challenges faced and share examples of information technology infusion in a variety of teacher education courses.

Technology Infusion in the Credential Program at CSUF–Roy M. Bohlin

As a result of recent legislation in California, the faculty at California State University, Fresno were faced with a dilemma of how to make sure that our credential graduates met specified computer competencies. There are several ways in which technology competencies can be implemented into a teacher credential program, but some of these were not an option for us. Because our current credential program doesn't allow room for additional courses or credit hours, we had to find a way to infuse technology into the overall program. For us the greatest barriers to the infusion of computer experiences include the following:

- Many part-timers teach many sections of our core courses on a rotating basis.
- In spite of a new technology enhanced building with four complete computer labs, many sections are assigned outside of our building and many classrooms do not have a computer and/or an internet connection.
- Many of our faculty were not comfortable with moderately high levels of computer usage.

To address these problems, the Dean and Department Chairs first identified several key courses to be the focus of the infusion efforts. These courses in which the major infusion responsibility would be placed were:

- Curriculum and Instruction
- Mathematics in the Elementary School
- Psychological Foundations
- Teaching Reading.

I was asked to coordinate the effort to infuse technology into our credential program, while focussing on these courses. The process of getting faculty onboard was begun by holding a meeting in which key faculty were asked to help make decisions about content and timing for a weeklong workshop during the summer of 1999.

Because the reading faculty were already saddled with their own competencies, the reading course was done separately. Their infusion was coordinated by a member of that department, who had previously worked on Web-enhancements in several courses.

A weeklong workshop was scheduled in June and 12 faculty were able to participate. They all had some familiarity with both word-processing and e-mail. During this week faculty were:

- Introduced to the new labs, computers, and network
- Familiarized with several applications (e.g., PowerPoint, Netscape Navigator and Composer, HyperStudio) and search engines (e.g., Metacrawler, HotBot, Sherlock)
- Shown model examples of how technology can be used in student-centered higher-order thinking lessons
- Provided with the opportunity to meet with exemplary technology using teachers, technology coordinators, and other resource people to discuss what students need to know and how we might better prepare future teachers to use technology
- Given time to thoroughly examine and discuss the content of their courses to make decisions about how technology might be best used to achieve their curricular goals.

Stipends were provided to the participating faculty. The feedback from the participants was very positive. They enjoyed the opportunity to learn about infusing technology into teaching and they also enjoyed the opportunity to meet with other faculty and discuss many different issues related to their courses.

Two matrices were developed during the week, one for the Multiple Subject and one for the Single Subject programs. Faculty selected those competencies that fit the needs of their students and the content of their courses. The selected competencies were identified as being either primary or secondary responsibility in each course. Actually, very little negotiation was needed to cover nearly all of the competencies with these selected courses. The few that did remain "unclaimed" were added to either the general curriculum classes or as part of the field experience courses.

Individuals from each of the four courses volunteered to serve as leaders in the fall, to pilot the full infusion plans developed by the teams. The others agreed to try infusing one or two of the new assignments or lessons. I met with the course leaders and talked with their team members late in the semester to discuss progress and to help participants move through a formative evaluation process. The revised plans are being implemented in Spring 2000 semester. Additional stipends were not available for this continued planning and work, so the effectiveness of this part of the process was very limited.

Also during the 1999-2000 academic year, I am planning several follow-up workshops and professional development experiences aimed at helping faculty to gain more knowledge and confidence of computer use. Some of these experiences will be coordinated with a grant that will provide some support and small stipends for faculty. Additionally to help provide technical support while faculty are teaching, a lab support person is scheduled to be available to help with hardware and software problems three evening a week. He has also helped faculty by teaching some of the technical skills to students in some of the classes.

Designing Meaningful Activities for the Elementary Curriculum and Instruction Course–Robin T. Chiero

The newly adopted technology standard mandated by California states that credential candidates must "demonstrate knowledge and use of computer-based technology to enhance and support teaching and learning". There are a number of competencies that indicate that this standard has been met. One of the courses designated to address a number of the competencies was the course titled "Curriculum and Instructional Methods in the Elementary School." In this course students explore a variety of topics, issues, and instructional strategies related to curriculum theories and practices in the elementary school (K-8), and learn how to plan lessons and create instructional units.

One section of the course was selected to serve as a pilot to integrate activities that would enable students to meet the competencies. The students in the course were in a cohort program designed for "re-entry" students (students going in to teaching from another career). Consequently, the students were, for the most part, older than students going directly into a credential program after completing their undergraduate work. There were 24 students in the course, sixteen females and eight males. Results of the pilot will be used to provide information necessary to revise activities and ensure that they can be consistently met across all sections.

There are, in a sense, two perspectives of technology integration in such an effort. First is the use of technology in the curriculum course so that students see the advantages technology can have for their own learning. Second is the issue of providing them the knowledge and skills for using technology in their classrooms. A group of professors who teach the course met to determine what activities would be. Table 1 shows the competency and the corresponding activity.

Competency	*Activity*
Uses computers to communicate through printed media	Combine text and graphics to create a newsletter for parents that introduces the instructional unit
Uses computer applications to manage records	Use a spreadsheet or grading program to manage student records Explore the use of electronic portfolios as a means of assessment
Chooses software for its relevance, effectiveness, alignment with content standards, & value added to student learning	Use the California Instructional Technology Clearinghouse database on the Internet to investigate potential educational software to be used in the classroom
Selects appropriate technological resources to support teaching and learning	Locate web-based resources for instructional unit and evaluate using specified criteria
Is familiar with a variety of computer-based collaborative tools	Use Web-based course materials for course information and communication
Demonstrates knowledge & understanding of the appropriate use of computer-based technology in teaching & learning. Analyzes best practices & research findings on the use of technology & designs lessons accordingly. Considers the content to be taught & selects the best technological resources to support, manage, & enhance learning	Incorporate technology activities into an instructional unit

Table 1. State-mandated Competency and Corresponding Activity

Goals of Designing Course Activities

Three major goals in designing the activities were to (1) provide opportunities for students to demonstrate their competency; (2) design activities that are relevant to course content; and (3) model appropriate use of computer-based technology in the classroom. To meet the first goal, students had opportunities to demonstrate their competency in a number of areas. For example, a major assignment in the course is to create a two-week interdisciplinary instructional unit. Included in the requirements for the unit were to use a spreadsheet as part of the assessment component, to incorporate text and graphics into a letter to parents describing the unit, and to incorporate technology into unit lessons. Although students did not have hands-on practice, electronic portfolios as a means of assessment were discussed. In addition, the course web site supported a Bulletin Board in where students could discuss topics covered in the text and pose additional questions. Also available at the course web site was the syllabus and course materials based on lectures and class activities.

Challenges and Opportunities

One major challenge encountered was one that has historically been a major obstacle to computer integration–that of access. The cohort program is a site-based program and all classes are held in a portable classroom at an elementary school site. This was the first year at this site, and for the first several weeks there were no computers in the classroom. Eventually three computers were made available for the portable, but without Internet access and without a projection device. The logistics of borrowing a projector from the School of Education and taking it out to the site were difficult. Another access challenge was access to software. The computers supplied had limited productivity software installed, but had no educational software for students to examine and evaluate. These circumstances limited the amount of modeling that could be done in the course.

Another, and perhaps more important challenge was to design activities that demonstrated the true power of the computer to support teaching and learning, not merely activities that added to the demands of the course. In this pilot, although activities provided students the opportunity to demonstrate their competence in a number of areas, the activities need to be revised somewhat to show how computers can support the teaching and learning process.

An unanticipated opportunity arose as a result of the coming accreditation visit the School of Education and Human Development will have next spring. Each program is to create a visual display that describes the program. The program coordinator and I decided that this would be a good opportunity to model the use of a multimedia program to convey information. One assignment was adjusted to allow additional time to create the project. As a whole group we decided what major topics we wanted to include. I presented a brief introduction to PowerPoint. Students then were divided into groups with each group taking a topic. Groups designed their slides on index cards before going to the computers. Then they entered the information on slides. Due to time constraints, we didn't have time to complete the final product during class time. An indication of their interest was that many students requested they be able to finish the project, as they had a particular vision of what they wanted to convey. We have set aside a date during the winter session where they will be able to complete the project.

Conclusion

Despite the challenges encountered during the pilot course, students indicated positive attitudes regarding the importance of incorporating computer-based activities used in the course. Early in the semester, one class session was held in a computer lab on the University campus so students could practice accessing the course web site and other Internet sites and so they could explore some of the educational software programs available in the labs. The bulletin board was widely used throughout the semester, not only to respond to questions posed about text material, but also to discuss student teaching experiences, ask questions, and share ideas and resources. With the access to computers problem solved from the start of the semester, other more sophisticated issues could be more satisfactorily addressed. Activities incorporated in to the pilot need to be revisited to ensure that they not only address the competencies, but that they model the strengths of technology in supporting student learning.

Technology Infusion in an Elementary Mathematics Methods Course–
Carol Fry Bohlin

At California State University, Fresno, all Multiple Subject Credential Students are required to take CTET 121, a three-unit course in mathematics teaching methodology for the elementary school classroom. Following the one-week Technology Infusion Workshop described above, I completely restructured my assignments to provide multiple opportunities for my students to become comfortable using technology as a resource for their current and continued professional development in mathematics education. Eleven assignments were developed that incorporated the following technology competencies: the student (a) is familiar with a variety of computer-based collaborative tools (e.g., threaded discussion groups, newsgroups, list servers, online chat, and audio/video conferences); (b) demonstrates competence in the use of electronic research tools (e.g., access the Internet to search for and retrieve information); (c) interacts with others using email, and (d) demonstrates knowledge and understanding of the appropriate use of computer-based technology in teaching and learning. A number of other competencies were also addressed to a lesser extent in the assignments or by the guest speakers–elementary teachers who provided an inspiring vision of the range of possibilities for technology's effective use in the K-6 mathematics classroom.

All students were required to have an email account Those who did not already have an account were provided with a free University account prior to the second day of class, at which time the class met in a computer lab for hands-on experience with e-mail, Web browsers, spreadsheets, databases, and word processing programs. A discussion was held about attaching files, hot links, characteristics of various e-mail programs, Netiquette, and various differences between Macintosh and MS-DOS computers. During this first class session, the assignments were discussed in depth, and I demonstrated how to join a listserv. The class met in a computer lab the following week and was given a handout of "Must-See Web Sites for K-12 Mathematics Teachers." They explored sites such as the National Council of Teachers of Mathematics, the California Mathematics Council, the California Department of Education (with links to the California Mathematics Content Standards, to the California Mathematics Framework, to the list of recently-approved mathematics textbooks, and to schools' scores on the Stanford Achievement Test (SAT 9), Eisenhower National Clearinghouse, EducationNews.com, and The Math Forum.

The students were also added to my personal distribution list–"OMEN" (Online Mathematics Education News) to help keep them apprised of the latest developments in mathematics education at the local, state, and national levels. They will remain on this list following the completion of the course.

Assignments

All course assignments were submitted to me via email; one assignment had to also be distributed electronically to all students in the class. Each assignment was required to contain a concluding paragraph where students reflected on the assignment (e.g., its value, what they learned, ease of completion), their feelings about using e-mail and other computer applications, their thoughts about the class, and anything else they wanted to express. Below are very brief descriptions of the assignments:
(1) **Statewide Test Results**–Students looked up the SAT 9 (Math) and Math Augmentation test scores for a selected school at the STAR Web site (http://star.cde.ca.gov). They then interviewed teachers and administrators at the school about steps that were being taken to address student performance on these tests.
(2) **Report on Classroom Technology Use**–Students interviewed a teacher from each of three different grade levels at an elementary school to see how these teachers infuse technology into their mathematics curriculum. Students are given a number of issues to address in their paper.
(3-5) **Online Article Reviews**–Students went to the National Council of Teachers of Mathematics (NCTM) Web site for three months (September, October, and November) and selecedt an online article from one of the four NCTM publications to discuss and critique.
(6) **Listserv Membership** –Students joined a mathematics education-related listserv (e.g., math-teach, TIMSS-Forum, AMTE, or NCSM) and wrote a report summarizing their experience (discussions, etc.). They were encouraged to participate in the discussions, and over half of the students elected to do so.

(7) **ENC Web Site**–Students became familiar with all aspects of the Eisenhower National Clearinghouse (ENC) Web site (http://www.enc.org/). ENC publishes an outstanding magazine, *ENC Focus: A Magazine for Classroom Innovators*. Students signed up for a free subscription at http://www.enc.org/focus/ . They also wrote a critique of an articls in each of several issues of ENC Focus.
(8) **"Ask Dr. Math"**–Students submitted a math-related question to "Dr. Math" at the Math Forum site (http://forum.swarthmore.edu/) and reported "Dr. Math's" response.
(9) **Search Engine Exploration**–Students picked a math-related topic (e.g., Fibonacci numbers, pentominoes, tessellations, division of fractions, Platonic solids, etc.), and used MetaCrawler, Ask Jeeves, HotBot, and AltaVista search engines to investigate sites related to their topic. They wrote a report comparing and contrasting each of these search engines.
(10) **Web-based Lesson Plan**– Students went to the "lessons" portion of the SCORE-Math Web site (http://score.kings.k12.ca.us/). The site contains teacher-developed, Web-based lessons that are linked to the California Mathematics Content Standards and the NCTM Standards. The students developed their own Web-based, standards-based lessons and shared them in class. Students were also invited to submit their lessons to the SCORE-Math site, and received $200 if their lesson was accepted.
(11) **"What I'll Remember Five Years From Now"**–Students mentally projected themselves into the future to reflect upon what they will recall from CTET 121. I have found this assignment to be one of the most valuable for me as an instructor, and the students appreciate the opportunity to reflect on the semester and see what aspects of the class stood out in their mind and what knowledge and meaning they constructed from the class.

Reflections

The reaction to the assignments and the focus on technology has been overwhelmingly positive. Having assignments submitted electronically allowed me as an instructor to hold an ongoing dialogue with my students; to develop a more interactive, personal relationship with them; to provide feedback to them as they completed their assignments; and to mentor them on various matters. Virtual office hours were thus "24-7," which students greatly appreciated. Throughout the semester, the students' comments on the assignments indicated an increasing confidence in their computer skills and their excitement over the power of the Internet for information-gathering. Their assignment reflections included the following:

- This assignment inspired me to think about how to include technology into my classroom. I think it is easier for me as a student teacher because I can start thinking of ways to integrate the Web, computer software, and email into my curriculum before I have my own students. By reviewing the math standards now, I can look for innovative ways to teach this information. For teachers that haven't incorporated technology into their curriculum, it is more difficult for them to either enhance or replace their existing materials. I'm excited about all the possibilities for using various technologies in the classroom. It is not only a more visually stimulating way to learn but it is also a necessity to be successful in this society.
- I am becoming more confident in myself in using the computer, and found that I don't have a feeling of dread in using technology in my classroom.
- I cannot believe the amount of useful information that is available through the Internet. The unlimited amount of resources have given me a sense of empowerment in teaching math in innovative ways.
- I would like to thank you for these interesting assignments you have given us. I don't know where else I would have found out all of these things that you can do on the computer
- I thought this lesson was a lot of fun to create. I didn't realize how useful the Internet could be for making math lessons, or any other lessons. I searched the Internet for different sites to incorporate into my lesson and I found these to be the most useful and easy to use for the lesson I created. After doing this lesson and all of the previous assignments, I am feeling much more comfortable using the Internet and e-mail. I look forward to trying to implement it into my classroom when I teach.

Postscript

This is the first semester that technology has been infused into CTET 121 in any significant way. Prior to this semester, I only had students surf the Web for Web sites that they felt would be useful for K-6 teachers. (They also gained experience with using calculator technology, using the TI Math Explorer to help develop mathematics concepts.) Hence, the planning and implementation was time-consuming and involved much experimentation. In addition, organizing and responding in a timely fashion to all of the students' comments and

papers electronically was quite a challenge! However, the many benefits to the students and the close relationships that were developed made the efforts worthwhile.
In the future, I plan to develop a course that incorporates more math-related software and one that is Web-enhanced, as many of my colleagues have done. Such a course will include threaded discussions, online calendars, chat rooms, online resources and lessons, and other elements of an interactive, vitual learning environment that helps students see the possibilities of how technology can, as David Thornburg has said, "prepare our students for their future, not for our past."

Sparkles and Blemishes: Integrating California's New Technology Competencies into a Fifth Year Secondary Credential Program–Susan Harris

Educational decision-makers in California are anxious to equip beginning teachers with all the skills and competencies necessary to be "successful" teachers. They need opportunities to learn about the social and psychological foundations of education and the generic teaching skills related to instructional planning and management. They need content knowledge as well as knowledge of content-appropriate pedagogical strategies. They need opportunities to apply what they are learning during an extended student teaching experience. Because they need specialized training to meet the needs of California's ethnically and linguistically diverse student population CLAD (Cross-cultural Language and Academic Development) competencies were added to the mix. Now we are asked to ensure that "candidates are able to use appropriate computer-based technology to facilitate the teaching and learning process" as well. Required competencies have been defined in a developmental sequence which assumes that some basic skills would be acquired prior to admission, and that other more sophisticated competencies would be developed after initial credentialing. Nevertheless, at the basic credential level we are left with a very substantial number of competencies which are to be integrated into a teacher preparation curriculum which is already bursting at the seams.

This case describes my attempt to pilot integration of selected competencies (*general* or *specific*) in a secondary general methods course taken prior currently with initial student teaching. To organize this discussion, I have provided the competency, followed by piloted strategies for implementation. The case concludes with a discussion of "sparkles and blemishes" I encountered during this effort

Guidelines require that, prior to issuance of the Preliminary Credential, *each candidate demonstrates knowledge and understanding of the appropriate use of computer-based technology in teaching and learning*. To document achievement of this *general* competency my students developed: (a) web-based lessons which stressed higher-order thinking skills and caused students to use information not easily available from other sources; (b) lessons to teach secondary students to evaluate web resources; and (c) lessons which required middle or high school students to use HyperStudio to demonstrate their learning. They completed and reflected upon an Internet tutorial on Visual Literacy and used related principle when developing student handouts, transparencies, and other course materials. They used computer-based technologies to prepare all course assignments including a professional portfolio. While they all successfully completed the technical requirements for these assignments, few were able to actually teach and reflect upon the success of the lesson so questions of "appropriate use" remained unanswered. Would it work with "real" kids? Would students achieve the desired learning outcomes? Important issues were also raised: What reality should they design lessons for, the ideal or the real? Is it appropriate to design lessons for students which will not be taught either because the necessary hardware/software does not exist or because the school/department priorities dictate otherwise? Should a cooperating teacher be excluded from having a student teacher because s/he has few, if any, technology resources for teaching, or is lacking the skill to model effective use of what does exist, even though s/he is an excellent model in other respects? Clearly these are important questions which need answers.

This first "specific" competency addressed requires that *each candidate uses computers to communicate through printed media*. This was a fairly easy competency to achieve, as students were already required to prepare assignments using wordprocessing or other appropriate computer programs. Specific assignments included computer generation of a student handout and preparation of an overhead transparency (or PowerPoint slide) which incorporated text and supporting graphics. Scanners, digital cameras, and the Internet were used to "capture" images for inclusion in curriculum materials. They created an AUP (Acceptable Use Policy) to guide

student Internet use in their classrooms. Finally, students used Excel to chart, analyze and present student test data. While students found the content of some assignments to be challenging, student valued the utility of application programs and most were sufficiently skilled so that actual preparation was fairly easy.

The third specific competency, *each candidate examines a variety of current educational digital media and uses established selection criteria to evaluate materials*, was also easy to address but addressing a related standard, *each candidate chooses software for its relevance, effectiveness, alignment with content standards, and value added to student learning*, was much more challenging. To demonstrate these competencies, students evaluated selected digital media, including web sites, and reflected upon appropriate criteria for evaluating different media. While I could and did require students to include an annotated bibliography of technology resources in interdisciplinary units, there was no assurance these materials would be available to teach the unit. In most, if not all cases, good content/topic specific software at an appropriate academic level was not available for my students to review or to use in their student teaching. Another thing disturbed me as well. Too many students maintained that real teachers would not go to such trouble in evaluating curriculum materials. This belief apparently was supported by many cooperating teachers. It is true that many teachers do not really evaluate materials they order. It is also true that thousands of dollars are wasted because they later discover that these materials do not meet their needs, or that they lack the proper hardware to use the media ordered. Again, there is a good bit of tension between the real and the ideal in terms of student and teacher perceptions.

Integrating the next standard, *each candidate is familiar with a variety of computer-based collaborative tools*, was also a challenge for me. I required that all students obtain e-mail accounts and many students did communicate by e-mail with each other or with me but their willingness to do so was dependent upon having access at home. While some did, many did not. As a class we participated in an "on line" video conference with a local superintendent of schools. Students were thrilled to have their questions answered "on line" but most felt the conference was slow and somewhat boring. While they saw the potential in having virtual guest speakers visit their classes they tended to believe that maintaining student attention would be problematic. They did recognize, however, that involving their students in such a conference might be a useful strategy for encouraging them to read and write. The examples and opportunities I provided were not sufficient to convince my students that these tools would be particularly valuable in helping their students learn. I need to try some new strategies. *I* need to see it work in a real classroom.

Integration of the last two standards, *each candidate demonstrates an ability to create and maintain effective learning environments when using computer-based technology*, and *each candidate analyzes best practices and research findings on the use of technology and designs lessons accordingly*, was also problematic. I could not require that student implement lessons using technology in their student teaching assignments (although ultimately this seems the only way to demonstrate achievement of this standard). I did, however, model lessons with them that required cooperative and collaborative strategies while using technology applications. We also explored how technology could/should be used for supporting the learning of Second Language Learners and considered how technology could support implementation of SDAIE (Specially Designed Academic Instruction in English) strategies. I am not at all convinced that students know what "best practice" is in their specific discipline or as applied to the learning of specific students. I am not sure I know. I even wonder if we have an adequate research base to guide their choices.

To summarize, my students and I accomplished a lot this semester. First the sparkles. They became more knowledgeable about and proficient using a variety of technological resources. They learned to access valuable resources on the Net and recognized potential classroom uses. They identified "increasing computer skills and competencies" as being an important goal for their own professional development. And now the blemishes. The additional demands placed on them to integrate technology into assignments created considerable stress and a negative attitude for some students. While they appreciate that technology *might* enhance their teaching and their students' learning, they are cynical about the reality. Few are convinced that integration of technology with their students in their subject area is viable. Two assignments in another credential course reinforced this view. They were to interview an instructional leader at a local school site regarding availability and use of technology for instruction; they were also to observe a teacher in their content area effectively using technology to help students meet subject matter standards. The results were dismal. Most principals had only limited knowledge of how computers were being used in their buildings; most could not suggest a technology-using teacher to observe. Few students were able to locate good models of teachers using technology within their subject area.

Technology standards require that students be placed in field experiences with teachers who are modeling such skills. I wonder where we will find them! Piloting technology integration was stressful for me as well. I have more questions than answers. Integration requires that all faculty participate. I wonder how we will encourage them to do so, and who will provide the resources necessary for them to do a first class job. Yes, in the best of worlds, beginning teachers should know how to use appropriate computer-based technologies to facilitate the teaching-learning process. I just wonder if we should expect them to do everything at once.

CalStateTEACH: An Integrated Curriculum Approach Empowering Teachers in Training through Technology–Jean M. Casey

A somewhat different approach to integrating technology into a teacher preparation is CalStateTEACH. CalStateTEACH is a new alternative path to the California Multiple Subject teaching credential with a CLAD (Cross-cultural, Language and Academic Development) emphasis. It is an 18-month program that culminates in a preliminary credential and 39 semester units of credit. The CalState TEACH approach is field-based, learner-centered, outcome driven, and is built around a set of activities and organized study that relies heavily on the school site as a learning environment. Technology is used to build an electronic community of support for the Intern as well as give them appropriate experiences to use technology successfully in their classrooms.

CalStateTEACH model

In the Cal StateTEACH approach, intern students do not have to attend classes at the university. They are in cohort groups of 20 and each group has a Learning Support University faculty member who visits their classroom monthly and communicates daily with them via e-mail and the Internet. They also have an Adjunct Site Faculty (a classroom teacher with at least 3 years of teaching experience) as a mentor at their school. They receive a kit of videos, texts, and software as well as complete Study Guides for the program. Upon successful completion of the program they receive a preliminary California State Credential.

Districts with Emergency Permit teachers in the CalStateTEACH program have certain commitments, including:

- Inform emergency teachers; show the program Overview video, and distribute applications
- Sign the Terms of Agreement with the university
- Identify Adjunct Site Faculty support teachers at each school site to work with the Intern Teacher(s) and university faculty member

Students in the first cohort 1A started the program September 7, 1999 with September 27,1999 being the last possible date to enroll for fall 1999. Cohort 1B will begin in January, 2000. The earlier participants apply, the more help we can give them toward passing their MSAT before school begins.

Curriculum

The curriculum is unique in that it is an integrated, spiral curriculum progressing in four stages. The first stage is 15 weeks, stage two is 17 weeks, stage three is 17 weeks, and stage four is 23 weeks. Vacations and breaks are interspersed throughout the program. The curriculum includes the normal Multiple Subject credential coursework plus the infusion of CLAD, mainstreaming, and technology curriculum.

The heart of the CalStateTEACH approach is its high quality academic and student support material using a variety of media. The quality curriculum, designed by 30 distinguished teacher educators in the California State University system, includes videos of the best mentor teachers in the nation, the latest texts, CD-ROM, cassettes, and access to university experts via the Internet. Students can study at the place and time of their choice, but not at their own pace. Students are guided and supported by an extensive instructional support system provided by faculty members who work with a small group of students in personal meetings and visits, in small groups, and on-line.

Features & Benefits

There are several features and benefits to the CalStateTEACH that make it particularly appropriate for teachers working with an Emergency Permit.

- The Emergency Permit teacher does not have to spend time driving to a university in the evenings.
- Most assignments pertain directly to the emergency or Intern teacher's classroom.
- Emergency teachers communicate using e-mail, the Internet, and online discussion groups.
- One university faculty member, who visits Interns at their school, conducts Saturday workshops and tailors the 18-month program to meet specific classroom needs.

Specifications

The high standards of this program have been approved by the California Commission on Teacher Credentialing. To complete the credential program, the Intern teacher will need a B.A.or B.S. degree; pass the CBEST and MSAT tests, and pass the summative assessment in all four stages of the program. Just because they are employed on an emergency credential does not mean that the participant will successfully complete this program. Program assessments help insure quality teachers.

Technology in the Teacher Education Classroom: Six Categories of Practice

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Abstract: Technology has the potential to make teacher education a more robust enterprise bnt not because we learn to make a Web page or use *WebCT* or create spreadsheets. Its potential for our practice lies in understanding the ways in which technology can solve our problems - the ways in which it can help us resolve the conundrum posed by the often competing need to meet standards, promote new notions of learning and teaching, and nse technology. This paper discusses five categories of technology practice that solve teacher educators' problems by: 1.) helping students prepare for class, 2.) supporting students' grasp of concepts through collaborative meaning-making, 3.) publishing and sharing insights, 4.) promoting resource-based problem-solving, and 5.) modeling how theory translates into practice. Descriptions of each category are presented.

Teacher educators are challenged by a conundrum. Their students, perspective teachers, must be prepared to enter practice able to cope with the complex dynamic of state standards (often accompanied by high-stacks testing), new notions of learning and teaching (ones not part of their own educational experience), and the press for teaching students about and with technology. Practicing teachers who return to higher education classrooms often do so because they seek to resolve the pressures of coping with these seeming contradictions. Teacher educators are not immune to the pressures of these competing challenges either for they too are asked to meet standards or competencies mandated by state legislatures and professional organizations while helping their students understand and put into practice emerging knowledge. And, they too are encouraged and/or required to make technology a part of their practice.

There is a pervasive national notion that somehow technology has the potential to improve education - to solve instructional demands. Yet, higher education's response to that notion is all too often expressed as the need to put syllabi on the Web, to beef up presentations with PowerPoint, or to deliver courses on-line. Thus, university faculty, in general, and teacher educators, in particular, ask or are asked how to make a *PowerPoint* presentation, how to create a Web page, or how to use *WebCT* or *TownHall*. Yet, these are the wrong questions. Rather, before we seek information on how to use these and other technologies, we ought to be asking: What are the educational problems that technology might help solve?

The Problem is Recognizing the Problem

Educators have traditionally adopted tools and strategies, writes Cuban (1986), only when those tools meet the challenges and problems they encounter, not because someone says to use that tool (Cuban, 1986). The criteria educators use relates not to available technology but to the problems they perceive as they seek to meet educational mandates. Thus, when the mandate for education is perceived as the need to get a batch of students to absorb certain knowledge and habits of practice in order to meet a set of standards and/or competencies, educators adopt strategies that enable them to teach a prescribed content and to show tangible evidence that students have performed satisfactorily. Educators have learned to ration their time and energy to cope with these demands and pass these practices to succeeding generations of educators. A collection of

teaching practices has emerged as resilient, simple, and efficient solutions. Technologies, no matter how appealing or lauded, that do not serve these goals are quickly rejected.

So, for example, teaching the entire class at one time is an efficient and convenient use of an educator's time. Lecturing, recitation, seatwork, and homework drawn from texts are direct, uncomplicated ways of transmitting knowledge and directions to groups. The tools that educators add to their repertoire are ones that are simple, durable, flexible, and responsive to teacher-defined problems. A chalkboard becomes an integral component of classroom practice because it solves the problem of writing, erasing, and keeping material as well as the problem of providing ready and simultaneous access for all students. A textbook becomes an integral part of classroom practice because it solves other instructional problems. It is portable, compact, and durable. It can be read for hours or a few minutes, skimmed or read carefully. All students can be assigned the same sections to be mastered individually as well as independently of class time. It travels easily.

Projectors, radios, television, and especially computers do not easily solve these problems. They are sometimes scare, sometimes undependable. Educators are not always skilled at using them. They have few, if any, experiences seeing others use these tools to promote learning. Thus, writes Cuban (1986:59), for many educators, "the simplicity, versatility, and efficiency of those aids such as the textbook and chalkboard in coping with problems arising from the complicated realities of classroom instruction far exceed the limited benefits extracted from using machines."

Educators confronted with new technologies are thus inclined to do one of two things: reject a new technology or adapt that technology to serve already recognized problems. *PowerPoint* supports classroom and conference presentations. The Internet becomes one more source of information to which students can be referred when writing research papers. Databases are collections of library resources or student records. Email serves to support dialogue with colleagues or to support the student advising load. Study of the role of technology to support K-12 classroom instruction is relegated to a separate course, and teacher education proceeds much as it always has. These uses of technology support the teacher educator's work, but they do not challenge time honored instructional practices in the teacher preparation or graduate level education classroom.

Still, there are some educators who do use a variety of tools as part of their instructional repertoire. There are educators, for example, who believe that films, television, and Internet resources enhance textbook reading. There are educators who are deeply concerned over visual illiteracy and seek to use television to enhance critical viewing skills. There are educators who believe that using camcorders to produce video helps students understand not only content but the anatomy of the media. There are educators who believe that teaching students to express content understanding using desktop publishing and web page designs value these tools' capacity to help students structure and communicate their knowledge using multiple forms of representation and non-linear patterns. There are educators who view television, camcorders, and a variety of computer tools as vehicles to motivate student learning, to supply relevant and meaningful content, and promote students' ability to reason and solve problems. "In effect, the practical criteria these teachers use in deciding what is best for them and students are broader than ones used by their colleagues" (Cuban, 1986).

Technology as Part of the Teacher Education Classroom

If technology is to have a role in the teacher education classroom, and more importantly, if technology is to make learning to be a teacher a more robust experience, teacher educators must stop asking questions about technology and start focusing on the problems which challenge teacher education. The remainder of this paper addresses six problems that confront teacher education and the ways in which technology offers solutions.

Preparing for Class

In the teacher education classroom, time limitations are perhaps the educator's greatest challenge. Many teacher education classes meet only once a week. Others meet for one hour, three times a week. A class is generally bounded by either a ten week quarter or a sixteen-week semester, making contact time with students only 48 hours if no holidays interfere. This time is precious, and the broad agenda necessitated by the complex and robust array of competencies, standards, literature, and activities places extraordinary demands on this time. There just never seems to be enough. Certainly, students are expected to spend considerable time in preparation for class. Yet, that time generally focuses on independent research and reading. Occasionally, students can

Another group of students was asked to use *NetMeeting* (http://www.NetMeeting.com), an online writing tool, to create a reader's theater to demonstrate the debate between advocates of phonics and advocates of whole language prior to class. They presented these reader's theaters during the next class period. As students watched the performances, they were asked to note common threads and to look for discrepancies. Three, after reading Howard Gardner's *The Unschooled Mind* and discussing the book using email, students were challenged to invent a school, create a desktop published brochure, and a one minute video advertisement. As students and the instructor reviewed the materials, they looked for reflections of Gardner's ideas as well as aspects of the "school" which contradicted Gardner's ideas. There were many rigorous debates. Four, after reading Vygotsky's *Mind in Society*, students were challenged to use a graphics program to create a map of

Vygotsky's mind modeled after the maps in Hampton-Turner's *Maps of the Mind*. Five, after reading Gilster's *Digital Literacy* and participating in a threaded discussion using *TownHall*, students were asked to use graphics and word processing programs as well as a large piece of butcher paper and markers to redesign the book cover. Students were challenged to complete their redesign in such a way that educators would be encouraged to read the book and see the relationship between the book and their practice.

Resource-Based Problem Solving

There was a time in the life of teacher educators when our central problem was selecting the right textbook and identifying the appropriate body of knowledge that informed the topics of the courses we taught. Our work focused on using the library and keeping abreast of the textbooks and journals published in our field. Education seemed a relatively straightforward, clear-cut domain. We could anticipate that our students would enter classrooms where textbooks were available to teachers with teacher's manuals to guide their practice. But the world of information has changed, as has the complexity of teaching and learning. No longer is it clear exactly what knowledge students will need. Neither is it clear which resources will best structure their practice nor can we guarantee what problems they will encounter during their life as practitioners. Those entering teaching today must become problem solvers, and they must be able to solve those problems within the context of an ever-growing knowledge base. Teacher educators must find ways to help those entering practice and those currently practicing use the plethora of resources – online, offline, in their communities, and among their fellow educators. Today's teacher educators must ask: *How can we help students become resource-based problem solvers?*

Two examples will serve here to illustrate the ways in which technology can support resource-based problem solving. The first example rests on the work of Bernie Dodge (http://edweb.sdsu.edu/webquest/webquest.html). While it is clear that one important skill is the location of resources either using library databases or "surfing" the web, what is more important is using identified resources to solve problems. The WebQuest is an Internet based instructional strategy that sets a context, identifies a problem, clearly specifies an outcome or product, and provides links to resources necessary for solving the problem. While this strategy has become extraordinarily popular among K-12 educators, it has the potential to serve teacher educators as well. The author teaches an introductory course to Secondary Education licensure students called The Culture of Teaching. One of the important course topics focuses on the legal parameters surrounding educational practice. In addition, these students do not take a course in educational technology. Rather, technology is embedded throughout their coursework. A WebQuest was created to engage students with the ethical and legal issues associated with the attendance of AIDS students in high schools (http://mason.gmu.edu/~mballard/WebQuest.htm). This WebQuest asked small groups of students to create an "AIDS policy" for their school. Links were provided to legal sites, sample policies from other schools, and to sites containing medical information about AIDS. After students had completed their policies and shared them with other groups, groups of four students were presented with other legal issues related to such areas as special education and discipline. They created their own WebQuest, locating both text and Internet resources. Classmates then solved each others' WebQuests. In this way, it was possible to help students explore the legal issues associated with teaching and to teach them about the WebQuest as an instructional strategy.

A second example of resource-based problem solving is a graduate course created by Evelyn Jacob. The course, Education and Culture, is designed around a Cultural Inquiry Process (CIP). In teaching the course, Jacob and Ruess (In Press) had identified two problems. One, since the body of relevant cultural research was not organized around addressing practitioner's puzzlements, it was necessary to "cover" much research before practitioners had sufficient information to use the CIP in their own practice. Second, although post-course interviews supported the content of the course, students expressed a need for support to continue using the CIP. Jacob and Ruess created a course web site (http://classweb.gmu.edu/classweb/cip/index.htm). This web site presents the six steps of the CIP and, for each step, provides links to information supporting each step, research related to using cultural perspectives to develop educational interventions, and sample CIP Cases. Additionally, a mechanism is provided for small groups of students to support each other in implementing the process and in seeing a variety of potential perspectives related to individual puzzlements. Students who have finished the course are encouraged to return to the site, using both the text and interpersonal resources of the site to solve their instructional problems.

Publishing and Sharing Insights

In the traditional teacher education class, knowledge resides with the instructor. The purpose of the class is to transmit the instructor's knowledge to students. Student knowledge is tested by objective tests, research papers, and various other, generally written, assignments. The flow of learning is from the instructor to the whole class and back to the instructor, student by student. Decisions about appropriate instructional strategies and technology use, in particular, center on supporting this flow. Instructors solve teaching problems by choosing lectures sometimes supported by *PowerPoint* presentations, projected Internet sites, and notes or diagrams on chalkboards. Instructors additionally ask students to respond with written tests, prepared presentations, and research papers. Sometimes student work is supported by word processors and Internet references. If, however, the teacher education classroom is to honor students as teachers and teachers as students as well as the social construction of knowledge, the flow of learning from the instructor to students and individual students to the instructor must be reframed. The problem facing teacher educators is not how to support this flow but, rather, *how can the flow of learning be shifted from instructors to students toward students, supported by instructors, creating, publishing, and sharing insights?*

Secondary education students completed a field experience, shadowing a high school student for a day. When they returned to class, they were asked to divide into groups of three and challenged to reflect on their field experience, identifying five generalizations about the school lives of high school students. They then created a five slide, *PowerPoint* presentation – one for each generalization. Instead of presenting their slides to the class, groups rotated around the room, examining each others' presentations and noting similarities and differences. A final list of generalizations was created by the class and posted. Each week as students and the instructor explored high school students' development and learning, they returned to the generalizations to see if they could further elaborate meanings and explanations associated with their observations. Their midterm exam centered on returning to their original *PowerPoint* presentation and building links from each slide to student generate explanations, text-based resources, and Internet sites. Most groups added additional generalizations that their continued learning experiences demanded. In this way, technology supported the shift from the instructor as the holder of knowledge to students as creators and elaborators of their own knowledge.

The final examination for a graduate cohort studying technology and learning was structured so that assessment was not based on individuals demonstrating mastery of the course content but, rather, on students collaborating to apply their knowledge to the creation and publishing of a learning product that reflected the principles they had studied. Together, students analyzed the commercial product, *Hooked on Phonics*, including a copy of one of the *Hooked on Phonics* television commercials. The product was discussed in terms of the learning philosophy underlying the product's design as well as the design of the box and promotional materials. Students were randomly assigned to groups of four and challenged to create the perfect educational software program, reflecting the ideas and theories they had encountered during the course. Among the many tools that supported students were graphics programs, word processors, glue, and colored pencils. The final product was to be the software's packaging and a desktop published brochure explaining the power of the software. Groups switched finished products and used word processors to write a comprehensive analysis of the ways in which the product reflected learning principles as well as to point out conflicts with theories or to recommend elaborations.

Modeling Theory to Practice

The most powerful model of teaching for teachers comes from their own experiences as learners. Thus, if one's learning experience happens only in a teacher-centered, print-based classroom, one is likely to teach in that way. If teacher educators perpetuate that learning experience, the traditional image of instruction persists and is reinforced. If we, as teacher educators, use technology only to give better lectures or as additional sources of literature for research papers, perspective and continuing teachers will have no better image of the role of technology for teaching and learning. If, however, teacher educators seek to identify and understand newer instructional problems and then choose to use technology in ways that solve those problems, they offer perspective and continuing teachers images of both new instructional problems and new uses of technology. In all of the examples above, technology use did not focus on the "hows" of using technology. Neither did it focus on modeling the use of technology within the K-12 curriculum. Rather, technology was used to support students' own learning. It was used to solve authentic teaching and learning problems.

Second, using technology to address the problems of supporting preparation for class, assisting students to grasp concepts and collaboratively create meaning, promoting resource-based problem solving, and creating, publishing, and sharing insights represent solutions to teaching problems reflect newer understandings of learning that are constructivist, social, and distributed. They reflect instructional choices that not only use technology to support learning but convey an alternative version of teaching and learning. Teacher educators must be careful not to talk one talk and walk a different walk. They must be careful not to advocate a particular vision of teaching and learning while practicing a different vision. Using technology to solve the problems described above allows teacher educators to solve the last problem – modeling theory to practice.

Conclusion

Cuban (1986) characterizes education's history with technology as proceeding through four phases: enthusiasm, scientific research, disillusionment, and teacher bashing. As teacher educators, we have experienced and sometimes contributed to the enthusiasm for the electronic technologies. We are cognizant of and have contributed to the research associated with technology. Yet, our slowness to use technology to support our own teaching – promoting technology by word more than deed – has made it difficult for entering and continuing teachers to use technology to support their own teaching. Today's disillusionment with technology centers not only on problems of access, maintenance, and cost but jeopardizes efforts to realize the potential of technology. Some have begun to question technology's role in education, citing teachers' lack of use. Policy makers have begun to lean toward such technology applications as large, integrated learning systems and teacher-proof, "how to" curriculums. Teacher educators have the responsibility to carefully rethink instruction, identify relevant problems, and find ways to solve those problems by making wise use of technology and conveying a vision of educational practice consistent with newer understandings about teaching and learning.

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Videos in Technology Integration (VITI): A Multimedia CD-ROM

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Abstract: This paper is a report the on the rationale, design, development, and evaluation of *Videos in Technology Integration* (*VITI*), a video-case based, multimedia CD-ROM intended to provide teacher educators with concrete examples of exemplary technology integration. A review of literature shows that it is important that exemplary models of technology integration be incorporated into teacher education programs. However, video-case methodology specific to the area of teacher educators' technology integration had not been addressed. Inspired by the dedication to help teacher educators meaningfully integrate technology into their classrooms, the CD-ROM is an initiative in modeling exemplary technology.

Introduction

The Center for Technology in Learning and Teaching (CTLT), located in Iowa State University's College of Education, is dedicated to helping educators provide students with technology-enriched environments that enhance learning at all levels. In keeping with this commitment, *Videos in Technology Integration* (*VITI*), is a video-case based, multimedia CD-ROM designed to provide higher education instructors with concrete examples of exemplary technology integration.

Background/Purpose

Although the potential for technology use in teacher education programs is strong, few models exist for teacher educators who desire to use technology to facilitate learner-centered environments. As a result, many teacher educators who would like to integrate technology into the learning environment lack the knowledge to do so. Ultimately, such a lack of knowledge on the higher education level results in a lack of and/or ineffective integration of technology in the K-12 classroom. Because effective and appropriate technology use is not demonstrated for pre-service teachers, many lack the knowledge to effectively use technology to create a learner-centered environment. Therefore, it is important that we incorporate exemplary models of technology integration into teacher education programs.

While teacher educators who desire to use technology to facilitate learner-centered environments would benefit from models of exemplary technology integration, they possess such divergent backgrounds and expertise that traditional staff development does not meet the needs of all involved. To address the complexity of modeling technology-integrated learning environments for teacher educators, current research in instructional design suggests using video-case methodology.

The video-case methodology was inspired by the North Central Regional Education Laboratory's (NCREL) *Learning with Technology*, which features video and written cases designed to help teacher educators reflect and facilitate discussions on uses of technology in their classrooms. Furthermore, such methodology has been used extensively for professional preparation in business, medicine, and law (Hasslebring, 1994) and is equally, if not more, appropriate for teacher educators due to their expressed need to connect to real classroom environments. The video component provides a rich environment where participants observe the uses of technology and the effects it has on students and the teacher. The hypermedia component, which consists of linking text, graphic art, sound, and video, allows the user to control when and how these elements are delivered.

The video-case methodology, presented in CD-ROM form, allows anchored instruction, which provides a situation in which users share a common experience (Hasslebring, 1994). Within this shared experience, the user is able to reflect and develop his/her own meaning contingent on past experiences and ultimately transfer the learning to new and developing situations in his/her classroom environment.

A review of literature (Office of Technology Assessment 1995) indicates that video-case methodology specific to the area of teacher educators' technology integration has not been designed, developed, implemented and evaluated. Therefore, the purpose of this project was to create a multimedia CD-ROM that incorporates video cases featuring exemplary technology integration by teacher educators to be used by teacher educators.

The context of this paper includes a description of the design process, the CD-ROM, and the status of a preliminary summative evaluation.

Methods (The Design Process)

To complete the study, a multimedia research team was assembled. The research team consisted of higher education faculty, graduate students, and pre-service teachers of various ages, gender, ethnicity, and socio-economic background. The diversity of the research team assisted cross-validation among data sources, data collection, time periods, and theoretical schemes. The team members volunteered their participation according to their interests in and/or connection to technology integration in the classroom. For example, most of the higher education faculty participants had expressed the need for such a modeling program because of their past experiences with technology integration. Due to their participation in a mentoring program (Thompson, Schmidt, & Hadjiyianni, 1995), these faculty members were able to gain knowledge of appropriate and effective technology integration into their classrooms, and as a result, now serve as the subjects featured in Videos in Technology Integration. Other participants involved in constructing the CD-ROM had a background in the areas of video photography, instructional design, and research methods.

The research team conducted structured interviews and observations of faculty members who exemplified model technology integration to gain perspectives of teacher educators on technology integrated learning environments. The selection of featured faculty members was determined by their reputation for technology integration in their teaching.

The selected faculty participants (previously described) of the video case multimedia project were video taped in their technology integrated classrooms. The video showcased the faculty participants, the classroom set-up, and the administered lesson. The collected video footage was then edited into vignettes to make up the major component of the multimedia program. The editing was done through Adobe Premiere. The video was edited and categorized into peer debriefings, interviews, reflections, mentoring, and information on relevant reference materials. Then, the vignettes were labeled and assembled in a way that would allow the viewer to gain an understanding of how technology is integrated to facilitate a learner centered environment. Ultimately, the vignettes, linking text, graphic art, and sound were comprised into a user-friendly multimedia program using Authorware and burned onto a CD-ROM.

The CD-ROM

The CD-ROM, entitled Videos in Technology Integration (VITI), features a total of nineteen video vignettes highlighting technology-integrated lessons, and instructor and student interviews. Menu bar buttons and clickable text allow the user to navigate through the multimedia program. Current features include:

- a concept/navigation map that allows the user to have an overview of the product's totality
- an introduction/welcome that contextualizes the program by giving background, purpose, and general description
- a list of the featured content areas
- titles of the featured video vignettes and their descriptions
- video vignettes featuring exemplary technology integration

Currently, the program has three major content areas: Math with Anchored Instruction: The Jasper Woodbury Series; Math with Distance Education: The Iowa Communications Network; and Reading and Language Arts with PowerBooks. Users can access the video vignettes by selecting a content area and then clicking on a video vignette title. The titles are worded in the form of questions that might be common among users.

Math with Anchored Instruction: The Jasper Woodbury Series

What is the Jasper Woodbury Series?

Why would I use this?
How does it support learning?
How could I use this?
What are the strengths and challenges?
How do students respond?

Math with Distance Education: The Iowa Communications Network
What is the ICN? Iowa Communications Network
Who uses the ICN?
How might I benefit?
How might students benefit?
How do students respond?

Reading and Language Arts with PowerBooks.
Why use Powerbooks?
Who uses them in class?
What should I know?
How does it support learning?
What are the strengths and challenges?
What are the students' responsibilities?
How do students respond?

The question formatted titles contextualize the content, prompt users to discuss issues surrounding technology integration, and act as navigational tools and cohesive elements that allow the vignettes, collectively, to tell a story. When users select a vignette, they are guided through the video by a higher education instructor whose narration addresses the question embedded in the vignette title.

The CD-ROM is formatted for Macintosh. The recommended minimum configuration is Power Mac, System 7.5 or higher, 16 MB RAM, thousands of colors, monitor resolution of 800 X 600 or higher, 2X CD-ROM drive, and Quicktime 3.0. No installation is necessary. To run the CD, the user can simply place CD-ROM in the CD-ROM drive and double-click on the *VITI* icon.

Preliminary Results

In Spring 1999, the current version of the CD-ROM was assessed by twenty-five faculty members of the Iowa Association of Colleges of Teacher Education (IACTE) via the Iowa Communications Network (ICN) as an anchor of the Videos in Technology Integration Iowa Discussion. The Iowa Discussions through the ICN was aimed at fostering conversation and interaction between Colleges of Education in the state of Iowa. Topics of discussion included: uses of video cases in teacher education; the current state of technology use in teacher education programs in the state of Iowa; and visions of future possibilities of technology in teacher education. The institutions represented were University of Iowa, University of Northern Iowa, Iowa Wesleyan, St. Ambrose, Graceland, Clark, Grinnell, Upper Iowa University, Loras, William Penn, Dordt, Central, Drake and Simpson (Long, S. & Thompson, E. A., 1999)

In addition to taking part in ICN sessions, involvement in the Iowa Discussions consisted of reviewing the CD-ROM and completing a survey. The surveys were aimed at gathering information about teacher educator's beliefs about technology and teacher education and those of their institutions, and their reactions to the CD-ROM. Participating faculty members received the CD-ROM either via the IACTE conference or by mail (Long, S. & Thompson, E. A., 1999).

While the ICN sessions were successful, currently, the analysis of surveys is in its preliminary stages (Long, S. & Thompson, E. A., 1999).

Implications

While the CD-ROM features a number of video vignettes, the CTLT hopes that *VITI* will continue to grow and evolve, collecting more video of exemplary technology integration and spanning across many more content areas.

In conclusion, because no policies for continuing educators' knowledge of technology integration have been predetermined, educators are finding themselves ill-prepared to ready students for the "real world" in which technology plays a major role. Therefore, the preliminary results of the project are significant. The program has potential for widespread impact on classroom technology integration, and can be useful to educators and policy makers. It is our hope that ultimately the multimedia program will have a sequential effect on classroom technology integration. The program can serve as a model for teacher educators who can in turn model exemplary technology integration to their pre-service students. These students can, subsequently, effectively and efficiently integrate technology into their K-12 classrooms.

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Preparing Tomorrow's Teachers Today: Using Videos of Technology-Using Teachers to Enhance Pre-Service Teachers' Technology Skills

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Abstract: This paper describes the development of CD-based video clips and case histories to be used in a course in instructional technology. The videos illustrate real K-12 teachers using technology in real teaching situations. The video clips and case histories are used to help preservice teachers better conceptualize how to use technology as a learning tool. The process of video development and use of the videos in teaching is described. Initial student reaction to the videos has been positive.

Tomorrow's technology-enhanced schools will require that teachers be prepared to use and integrate digital instructional technologies (DIT). National and local standards, such as the National Mathematics Education Standards (National Council of Teachers of Mathematics 1989) and the National Science Education Standards (National Research Council, 1996), require that preservice teachers learn how to use technology effectively as learning tools in teaching. Currently, the lack of real-world classroom models that use DIT as learning tools for instruction inhibits beginning and advanced students from implementing digital technology effectively into instruction. Preservice teachers come from classrooms in which they have used DIT mostly for low level educational purposes such as drill and word processing. Thus, few preservice teachers come to college with experiences or schemata that allow them to conceptualize how to teach effectively using DIT.

The Course

At Iowa State University, preservice teachers take CI 201, Introduction to Instructional Technology typically as sophomores and before they have completed teaching method courses or teaching practica. CI 201 teaches basic technology skills in the context of using the technology as a teacher and encourages preservice teachers to incorporate technology as learning tools in the future teaching. We currently use the Grabe and Grabe (1998) Instructional Technology Book and emphasize the Grabes' ACTIVE model in the course. The Active Model argues that technology should be used in a manner such that the learning tasks are:

- *Active* - tasks require cogntive behaviors that emphasize the transformation of information into personal knowledge,
- *Cooperative* - tasks require meaningful interaction among students,
- *Theme-based* - tasks are flexible and multidisciplinary based on an organizing theme,
- *Integrated* - tasks emphasize content area knowledge and use technology tools to encourage learning this content in ways that are meaningful, and
- *Versatile* - tasks make efficient use of technology skills and develop those that can be applied repeatedly.
- *Evaluation* - Finally, evaluation tasks allow the assessment of the student's ability to *use* the knowledge and skills we want them to learn

By emphasizing the use of technology for learning tools and the ACTIVE model, we hope to lead future teachers towards constructivist uses of technology that promote knowledge development that is meaningful and transfers to new situations.

CI 201 is a large course. Two sections of 150 students meet twice a week for lecture and once a week for a 3 hour lab. Departmental faculty teams provide the lectures and teaching assistants working under the direction of the course lecturers teach the laboratories. Most of the student assignments in the course ask the preservice teachers to demonstrate use of technology skills by using those skills to create technology-based lesson that they will use with their future students. Throughout this course, preservice teachers design and develop technology-based lessons and projects targeted to the specific classroom situations in which they intend to teach.

We schedule CI201 early in the preservice teaching sequence to provide students with technological skills that can be used in later methods, technology, and practica courses. This early exposure to a technology in teaching course compounds our students' difficulties in developing models of effective technology use in education. Most students have not yet begun to think about themselves as teachers and they have not yet incorporated contemporary teaching models into their thinking. This lack of prior experience and teaching knowledge makes it difficult for them to conceptualize and imagine effective learning-tool teaching uses for technology that they can incorporate in their own teaching.

The Videos

To address this issue, we have begun to develop videos of exemplary uses of technology in real classrooms. Funding provided by ISU has allowed us to videotape teachers in Iowa who are using technology effectively as learning tools for their students. Modeling is known to be an effective method of teaching (Pressley & McCormick 1995). According to the report, *Teachers & Technology: Making the Connection*, "Video can extend the range of student observation into the classrooms with the best teachers, wherever they are located. Whether live broadcasts from a classroom or tape, they can provide teacher education students with models of effective teaching and the opportunity for reflection on what constitutes good teaching" (Office of Technology Assessment, 1995, p. 166). The videos developed in this project present our preservice teachers with authentic PreK-12 learning situations that integrate technology.

Our project had one overriding goal: To develop a collection of digital video segments to be used in teacher education courses, primarily CI 201, that exemplify PreK-12 classroom situations in which teachers and students effectively use DIT as learning tools. These videos show PreK-12 students using technology; and include interviews with teachers and students describing their uses of technology for learning and teaching. The interviews ground the teaching situation in a meaningful context. The teacher is asked about the overall place of the videotaped activities in the overall curriculum and about the goals and purposes of the lesson and the technology activities. Interviews with the teachers' students present the students' conceptualizations and reactions to the learning situation including the use of technology.

Two types of uses for the videos are planned and partially implemented. One use is to prepare short segments on CD that can be used in a large class to illustrate particular points. The second use is to provide students with longer video cases on CD that would be used as part of outside of class case history or problem-based assignments. Both the nature of the videos and the uses we plan and are implementing are different from the standard videotapes commercially available and their typical use. Commercial tapes are typically long sequences that tell a cohesive story. They often relate tangentially to the specific goals of a given lesson. Rarely can an instructor use a video to present several short examples of a particular teaching approach or concept. In their typical use, the content as discussed in class is often distant in time from the examples provided in the tape. Instructors may show a video to introduce a unit that may last for several class periods. Students are expected to remember the examples in the video as they encounter the concepts and schemata taught in the unit. This elapsed time weakens the instructional effectiveness of commercial videos.

As conceptualized, the proposed videos would include both longer sequences and short, specific examples aligned directly with specific course concepts that can then be integrated into a lecture or class discussion. For example, given appropriate videos, an instructor could illustrate a discussion of the pedagogical value of using a hypermedia program to produce collaborative reports with:

- a short (2-5 minute) sequences showing a 3rd grade team in the process of developing a social studies hypermedia project, and
- a middle school math class creating a hypermedia report involving graphics and algebraic prediction equations based on a water quality study they have done in their local environment,
- a high school English classes hypermedia project on major authors and works of the cultures of the students in the class.

These multiple examples would be timely to the on-going discussion. They would provide students with models appropriate to their intended teaching level. Presenting multiple examples of to be learned concepts and schemata facilitates learning (Andre 1997). Providing models with which students can readily identify also facilitates learning (Pressley and McCormick 1995). Thus, this use of video segments should help preservice teachers better understanding effective technology integration into teaching processes and strategies. Such a use of technology would provide just-in-time instruction to support preservice teacher learning.

Learning would also be reinforced through the case examples provided to students on CD. These case histories would contain multiple segments of video that would cover more completely a whole unit involving technology. The segments would contain examples of students using the technology, interviews with students about their use, interviews with the teacher explain the goals and purposes of the unit, interviews with the students about their overall reactions to the unit, and examples of student produced materials. As part of laboratory and take-home assignments, preservice teachers would be asked to review and analyze the case. The preservice teacher would be expected to identify strong and improveable points, to suggest revisions in the unit, and to consider how the approach might be adapted to his or her own teaching. Discussion time in laboratory sections would allow students to present their case analyses. Our plan for producing video cases, described below, would provide multiple examples across grade levels of learning tool uses of technology. Having example cases closely related to the preservice teacher's intended grade level and subject matter facilitates the effectiveness of the cases.

Video Development

To develop the videos, we contacted teachers and administrators and located a cadre of teachers spanning PreK-12 grades who were willing to participate in these videotaped cases. Permission to video and release for future use of the videos for teaching purposes was obtained from school district personnel, parents of students in classrooms being videotaped, and the participating students where this was an age appropriate question. Four specific topics of instructional technology use in classrooms were targeted:

1) PreK-12 student use of the World Wide Web for research, project development and computer mediated communication, and Web page development tools;
2) PreK-12 student production of hypermedia projects;
3) PreK-12 student use of integrated software programs (i.e., desktop publishing, databases, spreadsheets) for interdisciplinary research and writing projects; and
4) PreK-12 student use of software to develop problem solving and critical thinking skills.

Specific grade levels (e.g., early childhood education, elementary, middle, and secondary education) were targeted in each of the four targeted topics for video development. Approximately 1 academic year was

spent in collecting the original video samples. A digital video camera was used to create the videos. These original videos were reviewed by the senior faculty and graduate students involved in the project and segments were identified for editing into the videos to be used in CI201.

As noted, two types of edited sequences were identified. The first consists of relatively short sequences (several seconds to a few minutes) that illustrate particular teaching points. These shorter sequences will be used in lecture to illustrate effective technology uses. In some cases, these shorter sequences were combined into a video case history. Students in CI201 will analyze these case history as part of laboratory or homework assignments. Both the shorter examples and the video cases will be prepared on CDROM and made available to students in the course.

The following paragraphs describe two of the instructional activities that have been videotaped in classrooms.

- Second grade students design and produce electronic portfolios using mPOWER with the assistance of 8th grade students enrolled in a multimedia development course. The purpose of the project is for the 2nd grade students to visually represent and document what they have learned in 2nd grade by producing a multimedia portfolio. This project involves 8th grade students who provide one-on-one instruction on how to use a multimedia program to elementary students. After receiving initial assistance from the 8th grade students, the 2nd graders work independently on their portfolio in their classroom for the rest of the school year. This collaborative multimedia development project supports the districts' learner outcomes in the areas of collaborative learners, responsible communicators and problem solvers.
- In a sixth grade language arts class, students work in collaborative groups as they plan and publish newsletters that document people and events during various decades of the 1900's. During this four-week instructional unit, each 6th grade student has 24-hour access to a portable laptop computer for gathering research, importing graphics and writing notes and articles for the newsletter. Video clips of this classroom showd students actively engaged in a learning activity where they are learning and applying language arts skills throughout the writing process.

Initial Use

Editing of the videos onto CD is proceeding. Initial uses of some of the videos clips provided informal support for the concepts. Preservice teacher reaction to these initial uses have been quite positive. Use of the videos is perceived by the preservice teachers to help them better conceptualize ways to effectively use technology in real teaching situations. In the presentation for SITE 2000, we will describe the development process in more detail and illustrate the available videos and CDs. In addition, student reactions to the use of the videos will be described.

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Using Videotape Technology as a Tool To Enhance the Transformation of Preservice Teachers Into Practicing Teachers

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ABSTRACT
Today, more than ever before, field experiences are an integral part of teacher preparation programs. As the accountability movement promoting performanced-based assessment grows, teacher educators are looking for opportunities to integrate real-life experiences into their programs. This article describes a videotaping program at the University of the Incarnate Word designed to provide accurate data to preservice teachers regarding their performance in an actual classroom settings. This videotape technology provides the opportunities that prospective teachers need to effectively reflect and assess their development toward mastery of state-mandated competencies.

Today, more than ever before, field experiences are an integral part of teacher preparation programs. These field experiences provide authentic contexts in which preservice teachers gain the knowledge and skills necessary to integrate theory with practice. It is believed that prospective teachers should learn to systematically observe, recognize, and practice teaching behaviors prior to entering the teaching profession. However, field experiences alone are inadequate for the transformation of preservice teachers into practicing teachers.

The importance of developing in new teachers the ability to self-assess and reflect on their practice of teaching is well documented in the literature (Koorland, Tuckman, Wallat, Long, Thomson, & Silverman, 1985; Moore, 1988; Struyk, 1991; Jensen, 1994; O'Donoghue, 1996; Holodick, Scappaticci, & Drazdowski, 1998). In addition, research clearly reveals that preservice teachers reflecting upon teaching can enhance their repertoire of pedagogical knowledge (Freiberg & Waxman, 1988). Reflection and self-assessment of teaching performance must accompany meaning field experiences in the schools for the continued growth of preservice teachers to occur.

In order for preservice teachers to effectively assess their own teaching, accurate data must be collected, analyzed, and interpreted. While data provided preservice teachers should come from a variety of sources, one tool for data collection is the use of videotaped teaching episodes to foster self-assessment and reflection. Since the videotape can be stopped, reversed, and fast-forwarded, it is possible for the preservice teacher to focus on specified aspects of the lesson. However, simply videotaping preservice teachers and having them assess their teaching performance without established structured procedures will be ineffective (Holosick, Scappaaticci, and Drazdowski, 1998).

State-Mandated Beginning Teacher Competencies

The State Board of Educator Certification (SBEC) was created in 1995 by the 74th Legislature to govern the standards of the education profession in Texas. In 1997, SBEC approved and adopted Teacher Proficiencies that reflect the skills and knowledge needed by beginning teachers to enhance student learning. In addition, SBEC developed competencies to reflect mastery of the Teacher Proficiencies and

created state-mandated exams based on these competencies. These proficiencies, competencies, and exams are integrated into the teacher preparation program approval process in Texas. All teacher preparation entities are held accountable for the performance of educators who complete certification requirements from the entity.

A high priority in the University of the Incarnate Word (UIW) teacher preparation program is for our preservice teachers to meet the state-mandated competencies. Videotape technology, while not a new or innovative technology, has proven to be an effective tool to help our preservice teachers meet the competencies and make the transition from preservice teachers into practicing teachers.

Videotaping Program

Structured procedures and activities were established by the education faculty at the University of the Incarnate Word, utilizing videotape technology in field experiences throughout the teacher education program. These procedures and activities, used as benchmarks in the program, require preservice teachers to videotape a lesson in their field setting for two semesters prior to student teaching. Each semester, the student and faculty view the videotape and assess the student's teaching performance relative to the state-mandated competencies established for beginning teachers in Texas. These competencies, used by every teacher preparation program in Texas, are designed to ensure that new teachers have the knowledge and skills to teach in Texas public schools. The student is required to view the videotape, reflect on teaching behaviors, mark the professional development competencies observed in the lesson, and give an example of the behaviors illustrating the competencies listed in Table 1. At the end of the semester,

Professional Development Competencies
Domain I: Understanding Learners
O1: The teacher uses an understanding of human developmental processes to nurture student growth through developmentally appropriate instruction.
02: The teacher considers environmental factors that may affect learning in designing a supportive and responsive class- room community that promotes all students' learning and self-esteem.
03: The teacher appreciates human diversity, recognizing how diversity in the classroom and the community may affect learning and creating a classroom environment in which both the diversity of groups and the uniqueness of individuals are recognized and celebrated.
04: The teacher understands how learning occurs and can apply this understanding to design and implement effective instruction.
05: The teacher understands how motivation affects group and individual behavior and learning and can apply this understanding to promote student learning.
Domain II: Enhancing Student Achievement
06: The teacher uses planning processes to design outcome-oriented learning experiences that foster understanding and encourage self-directed thinking and learning in both individual and collaborative settings.
07: The teacher uses effective verbal, nonverbal, and media communication techniques to shape the classroom into a community of learners engaged in active inquiry, collaborative exploration, and supportive interactions.
08: The teacher uses a variety of instructional strategies and roles to facilitate learning and to help students become independent thinkers and problem solvers who use higher order thinking in the classroom and the real world.
09: The teacher uses a variety of instructional materials and resources (including human and technological resources) to support individual and group learning.
10: The teacher uses processes of informal and formal assessment to understand individual learners, monitor instructional effectiveness, and shape instruction.
011: The teacher structures and manages the learning environment to maintain a classroom climate that promotes the lifelong pursuit of learning and encourages cooperation, leadership, and mutual respect.
Domain III: Understanding the teaching environment
012: The teacher is a reflective practitioner who knows how to promote his or her own professional growth and can work cooperatively with other professionals in the system to create a school culture that enhances learning and encourages positive change.
013: The teacher knows how to foster strong school-home relationships that support student achievement of desired learning outcomes.
014: The teacher understands how the school relates to the larger community and knows strategies for making interactions between school and community mutually supportive and beneficial.
015: The teacher understands requirements, expectations, and constraints associated with teaching in Texas, and can apply this understanding in a variety of contexts.

Table 1: Professional Development Competencies
Texas Education Agency

students are required to compare and contrast their two videotaped lessons, reflecting on ways to improve their instruction and make decisions accordingly. An education faculty member also views the videotape, marks the professional development competencies he/she observed in the lesson, and gives an example of the student's performance illustrating the competencies. A feedback conference is scheduled between the faculty member and the student to discuss the videotaped lesson relative to the state-mandated competencies.

Conclusion

Through the utilization of videotape technology, preservice teachers are able to use videotapes to record their performance in the classroom. This videotape can later be used for discussion and formative development. After viewing the videotapes and reflecting on their demonstration, prospective teachers begin to realize that improvement is always possible and indeed necessary, even in the best of circumstances.

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Preparing Technology-Based Teachers: Lessons from a K-12/University Collaborative

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Abstract: The integration of technology throughout the curriculum of both K-12 schools and higher education is widespread throughout America. There are over 1.6 million computers in American schools today (Rosenthal 1999). Millions of dollars are being spent on educational technology (Bull, Nonis, & Becker, 1997), as educators strive to establish a reasonable ratio of computers to students--some (Smith, 1999) suggesting as little as one-to-four, respectively. The preservice teachers enrolled in the Technology-Based Teacher Education program at Lehigh University partner with experienced inservice teachers for a semester to work towards the educational goal of integrating technology into an established curriculum. Preliminary analysis of survey and interview data suggests the partnership may accelerate the professional development of new teachers and provide a support structure for experienced teachers who are beginning the integration process. Both inservice and preservice participants expressed perceived benefits from the project.

The systematic introduction of technology into classrooms has become an increasingly important school reform issue since the 1980's. Recently, the integration of technology into established school curricula of both preservice and inservice teachers has emerged as a focus for colleges of education and K-12 schools. Understanding the role of technology integration within K-12 classrooms is vital to the professional growth of both novice and experienced teachers. Technology resources are requiring educators to rethink how they teach. Educators must focus on integrating technology into the school day: using technology to communicate, to think and to learn (Dwyer, 1996).

Technology as a Tool

Technology--particularly, computer-based applications and software--is emerging as a viable instructional tool for many inservice teachers (Conte, 1998). However, some educators simply have not adopted technology as a tool to use in their curriculum. Lack of comprehensive training is the number one reason why teachers are not using technology in their classrooms (Sykes 1997). Insufficient time and non-existent or inappropriate incentives hinder teacher inservice work (Smith, 1999). If educators are to recognize technology as useful for effective teaching, then staff development should begin with the establishment of underlying philosophies and goals for the use of this technology. Curriculum orientations should guide the goals on how technology should be used. Once a philosophy has been adopted, then the inservice teacher needs relevant and ongoing instructional support (Bull, Nonis, & Becker 1997). On-going staff support and encouragement is key to teachers use of technology in their curriculum (Conte, 1998). Sometimes teachers are unaware of what technologies are available in their schools, or of how to

take advantage of them when they obtain them. Therefore, when a teacher is willing to give technology a try having onsite support is key. Teachers who come across problems while teaching with a technology, and have support, are more willing to keep trying. Sadly, the opposite is true. Teachers lacking support and encouragement will more likely give up a technology enriched lesson when it goes awry (Conte, 1998). Schools must devise strategies for strengthening capacity within their own ranks in order to sustain their efforts and continue to grow (Maddin, 1997).

Preservice Teacher Education

Our preservice teachers must be skilled and supported in using technology, as well. Presently, thirty-eight states have technology requirements for teacher preparation programs (Rosenthal, 1999). Studies document that preservice teacher technology education has not kept pace with the changes that have affected the quality and quantity of technologies (Anonymous, 1999). Many preservice teachers find that the experience of using a computer is lacking for practical purposes (Laffey & Musser, 1998). Schools of education often overlook the very basic needs of their preservice teachers. According to Rosenthal (1999) only two of the thirty-eight education programs require actual evidence of proficiency in the use of technology in teaching for certification. Through her research Rosenthal (1999) presented several areas in teacher preparation programs that lacked initiative to fulfill these requirements. For instance, many teacher education programs lack the hardware and software necessary to incorporate technology into the teaching agenda.

Some education faculties have not been provided the training they need to use technology effectively. Other higher education faculties have little understanding of the changes technology is bringing to the K-12 classrooms and have not adjusted their own teaching methodologies to reflect these changes. This lack of modeling to preservice teachers provides little support of the use of technology to enhance teaching (Anonymous, 1999). According to a recent study conducted at the University of Michigan several factors deter the growth of preservice teacher education programs. For example, a lack of a written, funded and updated program will ensure little future growth. Finally, many preservice teachers who work in schools for field experiences do not typically work with master teachers who can provide them with support and information on the use of technology.

Technology-Based Teacher Education Program

The Technology-Based Teacher Education (TBTE) Program at Lehigh University is addressing this need of preparing teachers with the belief that modern technologies can and should be used as an educational tool. The TBTE program weaves technology throughout the course work and experiences of the preservice teacher. This ensures that the preservice teacher has a broad and meaningful understanding of how technology, teaching and learning interact. It is the programs belief that technologies--such as computers and the Internet-- are more likely to succeed when their use addresses actual needs, encourages the development of a professional community and is grounded in sound theoretical understandings (Nonis, Bronack & Heaton 1998). One area that TBTE stresses with its preservice teachers is field-based experiences. Preservice teachers enrolled in the Seminar in Elementary and Secondary Education regularly work in classrooms with inservice teachers. In addition to working with an inservice teacher, these preservice teachers are actively observing experienced, model teachers.

Seminar in Elementary and Secondary Education

The Seminar in Elementary and Secondary Education course is designed to be the first course perspective teachers take as they begin the 5-year BA/MEd teacher education program at Lehigh University. The course outline touches on several basic elements of teaching, both from the historical model and the present day perspectives. The discussion-based format allows students to share their ideas, interests and concerns regarding education today as they plan to become our future teachers. In addition to the discussions and weekly readings that are assigned to each student, the last hour of each class is spent in a "Tech Talk." Tech Talks range from learning about email and word processing documents, to databases and digital cameras. Each student is responsible for demonstrating competency in using that specific technology by the end of the course. The objective of the Tech Talk is to introduce to these preservice teachers the varied technologies, both hardware and software, available to them as future educators. This knowledge base also assists them in their field experience work via the Lehigh/Moravian Partnership.

The Lehigh/Moravian Partnership

The students enrolled in the Seminar in Elementary and Secondary Education course at Lehigh form a partnership with Moravian Academy--a K-12 Independent School--to address the needs of both preservice and inservice teachers. The partnership provides a variety of opportunities for both the preservice and inservice teachers. First, the preservice teacher spends quality time observing, interacting and conversing with an experienced

educator. The preservice teachers use a Web-based journal form on the course website to share their reflections with the course instructors via field notes for each visit to their classroom. These notes asked the individual students to reflect on the topics discussed, technologies explored, and ideas generated. The field notes allow the preservice teachers to contemplate, reflect, and share concerns about their experience and serve as an on-going update for the instructors on the progress of each preservice-inservice dyad. Second, the preservice teacher work in an environment where technology is available throughout the school. The preservice teacher has an opportunity to see how technology is used in an actual classroom setting. Third, the partnership experience provides an opportunity for inservice and preservice teachers to collaborate on technology integration within an existing curriculum to solve real educational problems. Through conversation, observation and experience the inservice teacher learns more about new technologies and techniques available for teaching.

The Lehigh/Moravian Partnership is overseen by a faculty member at the university and administrators from Moravian Academy and is coordinated by a doctoral student who is a former teacher at Moravian Academy. The coordinator decides on placements for each team and meets with both the preservice and the inservice teachers when necessary. Placement depends on the academic interest and grade level that most interests the preservice teachers. Schedules of both the preservice and inservice teachers are considered, as well. Each semester begins with a gathering of both groups for introductions and orientation to the project. The preservice teachers spend a minimum of 20 hours observing and working with their mentor teachers. The objective for the preservice teachers is to observe and work with an experienced educator. The preservice and inservice teachers decide together upon an area of the established curriculum where technology can be embedded to enhance the learning experiences of the students in the class. The preservice teacher is then responsible for researching and finding appropriate technologies to address the stated needs.

Toward the end of the semester, each preservice teacher is responsible for developing and delivering a final project. The project involves teaching a technology-rich lesson to the students--in partnership with the inservice teacher. The projects vary. Some use the digital camera to incorporate photos into writing samples and slideshows. Others use a specific piece of software--such as Hyperstudio or Powerpoint--to complement a part of the existing curriculum. The inservice teachers provide informal feedback to the students during the presentation. At the end of the semester, each inservice partner provides more formal feedback to their preservice intern through a course evaluation. Finally, the preservice teachers present an overview of their lesson to their peers during their Seminar class. Included in their overview presentation is a written description of the lesson and example of the project.

Formal Evaluation

Data from the first partnership cohort was collected at the end of the Spring 1999 semester from both the preservice and the inservice participants via a 12-item end-of-course survey. Each participant was asked to respond to the Lehigh/Moravian Partnership Feedback Form, a five-point Likert scale questionnaire concerning issues of guidance, structure, professionalism, and benefit of the program. Results in each category are displayed in Table 1, below:

Factor	Preservice (N=19) Mean (SD)	Inservice (N=15) Mean (SD)	F
Guidance	3.91(.86)	3.86(.48)	4.86
Structure	3.92(.90)	3.76(.77)	0.50
Professionalism	4.40(.71)	4.66(.53)	2.39
Perceived benefit	4.36(.60)	4.48(.74)	0.20

p < .01

Table 1: Results of End of Course Survey--Preservice and Inservice Participants

An independent t-test was conducted to investigate differences between the inservice and preservice participants with regard to the four factors. No significant differences were found between groups ($p < .01$). It is important to note that, given the small number of participants and the exploratory nature of this initial study, the results of the t-test must be viewed as prefatory.

Further data gathering is in process as the partnership continues to develop. In Fall 1999, a second cohort of inservice/preservice dyads was begun. The inservice and preservice teachers were asked to respond to the

Technology Teacher Survey once at the beginning of the semester and again at the end. Sample statements for this survey were divided into several categories: technology skill and knowledge, enthusiasm regarding technology, challenges implementing technology and confidence using technology. This survey targets the overall use of technology in the classroom. The data from this survey will add further to our growing understanding of the impact and effectiveness of the Lehigh/Moravian partnership.

Conclusion

The goals of the Seminar in Elementary and Secondary Education course and the Lehigh University/Moravian Academy Partnership includes the development of techniques that help emerging teachers close the gap between the potential of technology and its realization by teachers in their own classrooms. Certainly the experiences of both the preservice and the inservice teachers varied depending on the match made between the two and the expectations that each group had going into the partnership. Generally speaking, however, each pair succeeded with the overall objective: integrating a new piece of technology into an established curriculum. Some had more success than others with the working partnership created within each team. The field notes provide an outlet for the preservice teachers to express concerns. The inservice teachers used meeting time and emails to communicate concerns or problems.

Several modifications arising from what we have learned from the first cohort have already been initiated in the second group. For example, a more formal email system is now available for those inservice teachers involved to communicate with the coordinator on a more regular basis. Other suggestions made from the final evaluation by both the preservice and inservice have led to modifications in what technologies are covered and what initial skills are targeted as primary. By the end of the Spring 2000 semester, over 40 preservice teachers will have had the opportunity to work closely with experienced educators via the partnership. Many of the inservice teachers who took part in the partnership were only marginally facile with technology at the start. Yet, by the end of the course, all the inservice teachers had adopted some form of technology as a tool for both their own teaching and their students' learning. For most, this was a remarkable paradigm shift that will affect their practice to the ends of their careers.

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Pre-Service Teachers As Models

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Abstract

Integrating technology into the curriculum sounds simple. We've talked about it and have been "work-shopped" on it since the early 1980's. But, as educators, what have we accomplished in those years? This paper will share one teacher educator's experiences from germination of ideas to the implementation and success of using student interns (pre-service teachers) as models for the integrative use of technology in the learning/teaching process.

Introduction

Integrating technology into the curriculum sounds simple. We've talked about it and have been "work-shopped" on it since the early 1980's. But, as educators, what have we accomplished in those years? Many educators have taught courses and presented workshops but little has changed. What has been happening in most schools (if anything) is just more of the same - instruction delivered and practiced - now by both teachers and computers. There have been some changes in certain areas of the curriculum, in some parts of the country but not enough to equal the amount of money and time that has been spent by school districts and the state and federal government.

When you walk down the hallways of most schools - both K-12 and higher education - one still sees the teacher as the center of the classroom. Teacher talk is still the strategy that dominates most classrooms today.

Changes are beginning to occur, though slowly (Parker, 1996).

With over thirty years of educational experience – twenty-two years as a middle school educator, I decided about twelve years ago that a different approach was needed if technology integration was to make a difference in the learning environment of our K-12 schools. The approach that it utilized most often in teacher training in use of technology, is learn the technology and then the educator uses it in their learning/teaching environment. Much of the technology "in-service" has been working *with* the tool, not how to *use* it in the learning/teaching process. But, little integration has occurred using this model. Educators need to *see* it being used in the learning/teaching process (Beck & Wynn, 1998). I believe that learning to use technology in the learning/teaching process is more a change in the way we see students learn than in the actual use of the technology itself. It is the shift from teacher directed to student directed learning that may be the actual problem that needs to be solved.

Most of the teachers in today's educational settings received their knowledge and skills in teaching years before the utilization of technology became a reality, and years before much of the research on how

students learn became known to us. Thus, it stands to reason that not only do educators need to learn about technology but also about new learning theories and models.

I became aware of the need for a different approach when I was asked to speak to a group of pre-service teachers at my undergraduate alma mater. It was then that I realized that a new group of educators, ready to take on the responsibility of being educators, had no more experience using technology in the classroom than the teachers already in schools. Teacher education programs were failing to help the situation (of integration of technology) in any way. They were graduating students with little or no knowledge of the use of technology in the learning/teaching process. Much of what was being taught was the same as when I had graduated from the institution some 20 years ago. Following this realization I studied other teacher education programs around the nation and found that my alma mater was not alone. Most of the teacher education programs were not addressing the issue of technology integration nor the ideas of active learning.

It was then that I began to see a plan for how teacher education could make a difference in the unending pursuit of utilizing technology in the learning process. It was then that I realized "an" answer to this long and enduring problem of the lack of technology integration. Start at the pre-service level and have these students become the "models" of the integration of technology in the learning process.

It took a few years, but I am now involved in doing just that. Pre-service teachers involved in the teacher education program where I now facilitate the learning process are the "technology integration models" for their mentor teachers in their K-12 field-based experiences.

As part of this program, students are taught by the professors to integrate technology into their lesson units and plans. This is modeled by the professor and in turn modeled by the student interns during their field-experience. In this paper I will describe how pre-service students are playing an integral part in technology integration truly happening - with the excitement of learning by student interns, mentors and K-12 students soaring.

The Process

Besides my *enlightenment* that teacher education can play a major role in the area of integrating technology, there are a few other details that help me work with the students in our teacher education program to become the "integration of technology models."

First, my doctoral study in Educational Systems Design made me aware that teacher educators have not been an integral part (if any) of school change and/or restructuring. As part of one of my comprehensive exam questions, I looked at a study done by Dr. Alison Carr (1996) that looked at refereed articles written by "systems thinkers" dealing with school change. In the thirty-five articles that were designated as such, only two mentioned teacher education. Neither of these articles dealt with teacher education in any detail.

This was an affirmation of my beliefs on how we, as teacher educators, may be missing the boat with technology integration, as well and school transformation. In teacher education we have a chance to begin to make a difference in schools - yet we are rarely involved in the change efforts in the K-12 arena.

Second, my assignment as an Associate Professor in residence in a K-6 school has given me the opportunity to "see" first hand how teacher education students can make a difference in the integration of technology into the learning process. I spend four full days a week in a K-6 school that was built three years ago. This school was designed by a group of teachers in the district who are now teaching there. The school is a neighborhood school, not a magnet school, yet it has an emphasis on the use of technology in the learning process. All teachers in the building were hired from within the district with the knowledge that the university would be an integral part of the learning environment, that teacher education classes would be taught in the university classroom (built as part of the new school), and that university professors would be available for training and support of their efforts. I was hired to work with them on a daily basis.

Sounds great. However, in practice not all went as well as we had hoped - at the beginning. First we needed to work through the K-12/higher education rift that is evident in most areas of the country. This takes time and patience. Then it was finding time for me to work with the teachers - before school, during school, after school - *time* - the unending push for more time.

A year ago, our teacher education program became completely field-based. Our students are spending over 50% of their time and work in the K-12 classrooms. I saw a possible answer to the on-going problem of time for training and team teaching. Instead of one person (me) trying to find the time to work with each of the teachers, my students now do this work.

During our class time - I model, we plan, we collaborate, and we prepare lessons that involve the integration of technology into the curriculum. This year has been a wonder - my students, their mentor teachers, and their K-6 students have been involved with many lessons and projects that support the new state curriculum standards AND integrate the use of technology AND everyone involved is thrilled with the results. This year professors at the other PDS sites are using this same process.

Third, the university received a state grant that has helped us restructure our teacher education program. The teacher education program is now completely field-based, all classes being taught at one of the seven PDS sites. Most of the money received from the grant purchased hardware and software (a university classroom lab and additional computers being placed in classrooms where interns are working with mentor teachers), and a professional development library ($10,000 per PDS site) for the seven professional development schools (one high school, one junior high school, and five elementary schools) where we teach our courses – one being the elementary school where I reside.

Before you start thinking - of course this would work with all of this support - I believe that this project can be replicated with the resources that most teacher education programs and school districts now possess. A change in the collaboration efforts between the university and the school district need to be solidified (little money needed for that), classrooms in school district buildings where teacher education classes can be taught need to be made available, and the technology resources of the K-12 schools need to be utilized as part of the teacher education program. Much of what will be mentioned in the remainder of this article can be done with one computer in a classroom that has Internet capability and is hooked to a large monitor or projector for full class or group viewing.

Model/Learner Project

This project emphasizes the use of technology in the K-12 field-based teacher education courses. As mentioned earlier, teacher education students at all seven professional development schools must integrate technology into the lessons taught as part of their internship. Thus, they are modeling, for their mentor teachers appropriate ways to integrate the use of technology into the curriculum. Reciprocal teaching (Palincsar, & Brown, 1984) occurs when the mentor teacher models for the interns various teaching strategies, classroom management strategies, lesson planning, and other essential components in the everyday learning environment. Both interns and mentor teachers team plan and team teach lessons using technology as an integral part of the lesson.

The integration of technology in the learning/teaching process takes on an apprenticeship model (Collins, Brown, & Newman, 1989) of learning. The apprenticeship moves back and forth from intern to mentor teacher as lessons are planned and taught, by the mentor teacher, in a team teaching environment, and intern-facilitated lessons. "In the apprenticeship model the learner sees the processes of work. In the traditional apprenticeship, the expert shows the apprentice how to do a task, watches as the apprentice practices portions of the task, and then turns over more and more responsibility until the apprentice is proficient enough to accomplish the task independently." (Collins, A., Brown, J. S., & Holum, A., 1991). During their apprenticeships, both the mentor teacher and the intern learn new ways of facilitating learning,

using active learning processes as well as integrating the use of technology as a tool in the learning/teaching process.

Some examples of the intern modeling for the mentor teacher include:

1. Interns (pre-service teachers) use one computer in a classroom - utilizing a large screen monitor for full class instruction.
2. Interns use the Internet as a motivating factor at the being of a unit or lesson.
3. Interns use the Internet as an integral part of a lesson - student interns develop webquests and web pages as part of a course in the teacher education program.
4. Both interns and mentor teachers participate in collaborative on-line projects such as AfricaQuest, GalapagosQuest, AsiaQuest (Classroom Connect), Earth Day Project, Hundred Day Project, Jamestown, M&M Project, Problem of the Day, and many more.
5. Interns use of SmartBoards for full class instruction. Many of the mentor teachers have the availability of this hardware but have not used it until the interns demonstrated its use in a lesson they taught.
6. Both interns and mentor teachers use on-line field trips to enhance a unit or lesson or in preparation for a real-time field trip.
7. Use of *PowerPoint* by interns, mentor teachers, and students to present information, including use of Internet sites.

Conclusion

These projects serve as an on-going professional development for both interns and mentor teachers in the integration of technology into the learning/teaching process. The projects are always changing as new ideas, new sites, new technologies (digital cameras with video capability) are added to the teacher education program.

In the past two years I have witnessed what can happen to the learning process of interns, mentor teachers and K-12 students as technology plays a more important role in their instructional lives.

I challenge each and everyone of us, as educators, whether we be K-12 educators, teacher educators, or administrators, to model for learners the integration of technology into the active learning process. As Collins, Brown, and Holum state it:

> Apprenticeship is the way we learn most naturally. It characterized learning before there were schools, from learning one's language to how to run an empire. We have very successful models of how apprenticeship methods, in all their dimensions, can be applied to teaching … they help point the way toward the redesign of schooling… as well as improve the ability to learn throughout life.

The use of the apprenticeship's four basic aspects of modeling, scaffolding, fading, and coaching can, and I believe will, lead us to a dimension of learning that we all strive.

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A Collaborative Technology Partnership

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Abstract: Partnerships between universities and local K-12 school districts provide learning opportunities for university professors, K-12 students and teachers, and pre-service teachers enrolled in undergraduate programs. This paper describes a partnership between a southwestern university and a local K-12 school district. The partnership was designed to enhance computer competence and confidence in 250 middle school students, build an on-going relationship between the university and the local school district, provide opportunities for pre-service teachers to observe best practices in technology integration in K-12 educational settings, and allow a university professor to conduct a qualitative research project.

Introduction

Partnerships between universities and local K-12 school districts provide learning opportunities for university professors, K-12 students and teachers, and pre-service teachers enrolled in undergraduate programs. This paper describes a partnership between a southwestern university and a local K-12 school district. This partnership was designed to:

- enhance computer competence and confidence in 250 middle school students;
- build an on-going relationship between the university and the local school district;
- provide opportunities for pre-service teachers to observe best practices in technology integration in K-12 educational settings; and
- allow a university professor to conduct a qualitative research project.

A K-12 teacher and administrator initiated a partnership with the state university in which a K-12 teacher and a university professor collaborated to team-teach classes to middle school students. These students were bussed to the university campus where they spent approximately ten hours in a technology-rich environment. The students completed web-based research projects and then created multimedia projects summarizing their research. Undergraduate university students observed the team-taught classroom and gained insights into best practices of technology use in K-12 education. The university researcher conducted a qualitative study on the middle school students' understandings of technology. Data sources included an open-ended survey, observations, document review, and focus groups. This paper describes the process of establishing this partnership, the participants, the workshop model, and benefits to each stakeholder group.

The Process of Establishing a Collaborative Technology Partnership

A partnership between a southwestern university and a local K-12 school district seemed advantageous for all stakeholders: middle school students could benefit from use of computer facilities at the local university, K-12 administrators could satisfy parents' desire for greater access to technology for their children, undergraduate students studying to be teachers could observe K-12 technology integration on their own campus, and a university researcher could conduct an extensive study on middle school students using technology. Since this

partnership was beneficial for all involved, establishing the alliance was straightforward. Each stakeholder outlined goals and objectives to other stakeholders, and during several collaborative meetings, they developed a workable plan for this collaborative technology partnership. Details about stakeholders and the semester-long development process for this project are outlined below.

Time Frame	*Stakeholders*	*Task*
Start of semester	K-12 Teacher District Administrator	Initial inquiries about the feasibility of the project.
Three weeks later	K-12 Teacher District Administrator University Teacher/Researcher	Introductory meeting to establish goals, discuss dates and facilities, and do preliminary design.
Next three weeks	K-12 Teacher University Teacher/Researcher	Planning sessions to establish curriculum, choose participants, and investigate bus and room availability.
Mid semester	K-12 Teacher University Teacher/Researcher	Submitted research proposal to appropriate groups at K-12 district and university. Finalized bus and room availability.
Two weeks later	K-12 Teacher K-12 and University Administrators University Teacher/Researcher	Research proposal approved.
Next two weeks	K-12 Teacher University Teacher/Researcher	Pilot project with 30 students. Adjustments made based on pilot project.
End of semester	K-12 Teacher K-12 and University Administrators University Teacher/Researcher	Evening meeting for participants' parents and teachers to introduce and explain the project.
Throughout the following semesters	K-12 Teacher University Teacher/Researcher	Groups of 25-35 students participated in the project at the university computer classroom. Researcher conducted qualitative study. Undergraduates observed team-taught setting.

Participants and the Workshop Model

The primary participants in this project were a teacher from the participating K-12 district, a university professor serving as teacher-researcher, approximately 250 middle school students from a local K-12 school district, and undergraduates enrolled in the education certification program at the university. Middle school students were enrolled in classes for gifted and talented students in twelve elementary schools throughout the district. These students visited the university four times for two-and-a-half hours each visit. Students were predominantly Cancasian; approximately 20% were Hispanic, 3% were Asian, 1% were Native American, and 1% were African American. They had a mean age of 12.5 years. Socioeconomic status varied widely among the middle school students.

This project was grounded on the following assumptions:

- learning is an active process facilitated by the creation of an environment that encourages risk-taking and creative and critical thinking;
- teachers strive to create such environments to facilitate learning and provide opportunities for self-reflection and evaluation;
- learners learn by doing;
- learning is social and is fostered by collaboration; and
- technology is a tool for facilitating learning rather than the focus of learning.

Benefits to Participants

The project was designed to benefit many stakeholders. Documented benefits to each stakeholder group are described below.

During their four visits to the university computer classroom, the *middle school students* spent approximately ten hours in a technology-rich environment. Through completing a WebQuest on cloning and creating a *PowerPoint* presentation to share their research findings, they enhanced their skills in:

- using the Internet as a research tool;
- using the Internet as a tool for enhancing multimedia presentations;
- working collaboratively and reaching consensus;
- designing multimedia presentations using *PowerPoint*;
- delivering multimedia presentations to share their research with peers and parents.

The middle school students also became familiar with a college campus and became aware of higher education opportunities at the local state university.

University and K-12 administrators established both a workable model for K-12 – university partnerships and an on-going partnership. This partnership resulted in:

- increased goodwill between the two institutions;
- increased enrollment of K-12 teachers in graduate classes in educational technology courses at the university;
- increased access for K-12 students to computers and pedagogically-sound practices that integrate technology into the established K-12 curriculum;
- happier K-12 parents because of increased student access to technology;
- on-going dialog about ways to continue and expand this partnership.

University undergraduates studying to be K-12 teachers observed their university professor and a middle school teacher using technology in theoretically grounded and pedagogically sound ways. Student observations were meaningful as they involved good teaching practices in which technology was a tool rather than the curricular focus. Through a series of observations followed by class discussions, they were able to:

- provide a pedagogically sound argument for using technology in elementary or secondary classrooms;
- describe their view of the learner and the learning process;
- describe the categories of software best suited to their view of the learner and the learning process;
- describe best practices for using technology in elementary or secondary classrooms;
- describe the supports and obstacles to these best practices.

Finally, a *university professor* was able to conduct an in-depth and on-going qualitative study of middle school students' understandings of technology. By using open-ended surveys, observations, document reviews, and focus groups, the professor examined the changing relationships between gender and understandings and uses of technology. The results of this research are forthcoming.

Conclusion

Partnerships between universities and local K-12 school districts are advantageous to all stakeholders. This collaborative technology partnership:

- provided a workable model for K-12 – university partnerships;
- established an on-going relationship between the university and a local school district;
- opened the way for future partnerships with other K-12 school districts;
- enhanced the computer competence and confidence in 250 middle school students;
- provided opportunities for pre-service teachers to observe best practices in technology integration in K-12 educational settings; and
- allowed a university professor to conduct an in-depth qualitative research project.

As indicated above, all stakeholders benefited. In addition, a viable model for K-12 – university partnerships was developed and fine-tuned. This model can be used in the future with other interested K-12 districts in the area. As more partnerships are formed, all partners should seek funding to support several aspects of the project including student bussing, substitute teachers for K-12 teacher participants, and graduate research assistants. The university should continue to contribute the computer classroom and the time and efforts of the university teacher-researcher. Finally, future partnerships should strive to attract corporate sponsors so that K-12 educators, university educators and corporations are working together to optimize educational opportunities for learners at all levels.

The WebPage supporting this project is located at <http://www.west.asu.edu/achristie/peoria/IDEAL.html>.

Changing Preservice Teacher Education: A New Paradigm Integrating Technology

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Abstract: This paper will describe a project that was designed to create teachers for the 21st century by raising the minimum technology requirements in their course of study. This project required future teachers to apply their technology skills in the classroom at K-12 partner schools by creating an electronic portfolio with a set of technology-based classroom activities. This project directly served approximately 76 preservice teachers, 80 classroom teachers in 16 school districts, and a significant number of university faculty. The preservice teachers involved in this project volunteered to take an additional six credits in advanced technology that included topics related to instructional design systems and virtual learning communities. The preservice teachers were trained to use the most sophisticated technology tools for research, information analysis, and problem solving in all content areas including special education. This paper will present the why, how and the where changes occurred during the initial phase of this project.

Introduction

Currently every teacher education student is required to complete one three-credit technology course. This course is designed to ensure that every pre-service teacher receives a baseline of experiences using computer hardware and software for professional productivity, research, and classroom presentations. Students learn to use computer technology for desktop publishing, database management, spreadsheet analysis, and simple multimedia applications. They learn to evaluate software in a variety of curriculum areas, use e-mail, and use the Internet for communications and research.

The Project

This systematic initiative has four closely related educational objectives. First, the project ensured that all preservice teacher participants develop the knowledge and skills to integrate technology into their teaching and learning processes. Second, the project ensured that the K-12 cooperating teachers enhance their knowledge and skills in integrating technology into their own curricula. Third, the project provided opportunities for the university faculty to increase their knowledge and skills in the use of technology in their own teaching. Fourth, the project established a state-of-the-art technology resource center for use by preservice teachers, inservice teachers from surrounding school districts, and university faculty.

The first objective of the project was met by having three members of the School of Education designed two, three-credit courses that provided the educational opportunities for the preservice teachers to master the advanced technology competencies stated at the end of this paper. At the completion of these two technology courses the preservice teachers are required to demonstrate or provide documentation that they have mastered the 48 advanced technology competencies reflecting national educational standards. The content of these courses focused on the use of technology to improve student learning in the K-12 classrooms and reflect specific activities related to grade levels and content areas. The courses were team taught by three members of the School of Education who have specific expertise in the major content areas.

The second objective required recruiting schools and cooperating teachers for the project. During the summer of 1999, a week long workshop was conducted for the participating inservice and preservice teachers. The workshop included hands-on technology based activities and training to help their student teachers apply the advanced competencies in actual classroom settings.

. The third objective was met by having university faculty from specific content areas participate in workshops for the inservice and preservice teachers. The university faculty provided examples of how they have integrated technology into their instructional practices.

The fourth objective required the development of a technology center with advanced technologies that included over 30 multimedia stations with Internet access, scanners, digital cameras, CD recorders, and a variety of special education assistive devices. The center is equipped with wide-bandwidth communication lines designed for desktop videoconferencing. The technology center provides opportunities and resources for students, faculty, and inservice teachers to develop projects that promote the integration of technology into their curriculum. The project incorporated an extensive web-based component(http://planetx.bloomu.edu~center) that contains activities, resources, a newsletter, and examples of projects created in this program.

The key to the success of this project is the inservice teachers who acted as mentors for the student teachers participating in this project. In the initial phase of the project, the preservice teachers met with their respective mentors to design technology-based units and supporting lessons that match the existing curriculum being taught by the inservice teachers. During the second phase, the preservice teachers researched, designed, and tested their activites in the technology center. In the last phase of the project, the preservice teachers incorporated their technology-based activities into their student teaching experiences.

The two, three-credit advanced technology courses are currently an elective option for the university's teacher education program, however, it is the intent of the project that these courses will become a requirement for all entering freshmen in the School of Education.

Advanced Technology Competencies

For each of the following statements, code in **True for your Yes** response and **False for your No** response on the accompanying answer sheet. For each True response you must be able to document or demonstrate your knowledge and skills associated with that particular statement

1. Can you identify and use computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the teacher?
   Yes______ No______
2. Can you compare and contrast current instructional design principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum?
   Yes______ No______
3. Can you design, deliver, and assess student learning activities that integrate technology across disciplines for a variety of student grouping strategies and for diverse student populations?
   Yes______ No______
4. Can you identify and report on the responsible, ethical, and legal use of technology, information, and software resources?
   Yes______ No______
5. Can you identify and report on the basic principles of effective instructional design associated with the development of multimedia learning materials?
   Yes______ No______
6. Can you create and produce simple hypermedia/multimedia products that apply basic effective instructional design principles?
   Yes______ No______
7. Can you select and use appropriate tools for communicating concepts, conduction research, and solving problems in subject areas and grade levels?
   Yes______ No______
8. Can you organize and implement collaborative technology-based projects and team activities?
   Yes______ No______
9. Can you collect and evaluate examples of emerging programming, authoring, and problem solving environments?
   Yes______ No______
10. Can you create and initiate online workgroups to build a collection of knowledge on specific topics?
    Yes______ No______
11. Can you design and publish simple online documents presenting information that include links to critical resources?

Yes______ No______

12. Can you design, develop, and produce instructional units that involve compiling, organizing, analyzing, and synthesizing of information and that uses technology to support these processes?
    Yes______ No______
13. Can you conduct, evaluate, and report the research associated with online resources of information that support and enhance the k-12 curriculum?
    Yes______ No______
14. Can you identify and describe strategies to support the development of school and laboratory policies, procedures, and practices related to the use of technology in those environments?
    Yes______ No______
15. Can you research, evaluate, and produce recommendations for purchasing instructional software and hardware to support and enhance the k-12 curriculum?
    Yes______ No______
16. Can you design and write recommendations for the organization, management, and security of hardware and software in different learning situations?
    Yes______ No______
17. Can you identify strategies and product documents for troubleshooting and maintaining various hardware and software configurations in a variety of instructional settings?
    Yes______ No______
18. Can you select and configure a complete computer system and install the operating system and a minimum of one application package?
    Yes______ No______
19. Can you identify and use information access and telecommunication tools to support research and instruction throughout the k-12 curriculum?
    Yes______ No______
20. Can you use and demonstrate distance learning delivery systems including computer, audio, and video conferencing?
    Yes______ No______
21. Can you create and present a multimedia presentation using advanced features of a presentation tool and computer projection system?
    Yes______ No______
22. Can you install, configure, and demonstrate the use of mass storage devices?
    Yes______ No______
23. Can you identify and describe software currently used in classrooms and administrative settings?
    Yes______ No______
24. Can you investigate and recommend in writing, purchasing strategies and procedures for acquiring administrative and instructional hardware and software?
    Yes______ No______
25. Can you identify and classify adaptive assistive hardware and software for students and teachers with special needs?
    Yes______ No______
26. Can you evaluate and report on the technology concepts and skills being taught in a k-12 setting?
    Yes______ No______
27. Are you familiar with methods and strategies for teaching technology concepts and skills in a laboratory and classroom setting?
    Yes______ No______
28. Can you identify and upgrade technology supported curriculum to reflect on-going changes in this area?
    Yes______ No______
29. Can you design, produce, and demonstrate integrated technology-based activities that involve teaming and/or small group collaboration?
    Yes______ No______
30. Can you identify and present activities and resources to support regular professional growth related to the use of technology in the classroom?
    Yes______ No______
31. Can you describe student guidance resources, career awareness resources, and student supported activities related to technology?

Yes______ No______

32. Can you compare and contrast national k-12 technology standards with benchmarks set by state and local agencies?
    Yes______ No______
33. Can you identify and critique professional organizations and groups that support the field of educational technology?
    Yes______ No______
34. Can you design and produce a set of assessment strategies and methods that will evaluate the effectiveness of instructional units that integrate technology?
    Yes______ No______
35. Can you summarize and apply principles and practices of educational research to educational technology?
    Yes______ No______
36. Can you summarize and report major findings and trends related to the use of technology in education that support the integration of technology in the k-12 environment?
    Yes______ No______
37. Can you apply theories of learning, teaching, and instructional design and their relationship to the use of technology to enhance learning?
    Yes______ No______
38. Can you describe social and historical foundations of education and how they relate to the use of technology in schools?
    Yes______ No______
39. Can you design and produce a research project that includes an evaluation component of a specific technology in the k-12 classroom?
    Yes______ No______
40. Can you demonstrate the use of more than one authoring environment?
    Yes______ No______
41. Can you describe and analyze accepted principles of strategic planning to facilitate curriculum designed for teaching with technology?
    Yes______ No______
42. Can you identify and evaluate national, state, and local guidelines for developing curriculum plans for technology integration?
    Yes______ No______
43. Can you demonstrate methods for teaching hypermedia development in a problem solving format?
    Yes______ No______
44. Can you demonstrate methods for teaching at least one authoring program?
    Yes______ No______
45. Can you demonstrate methods for teaching the use of media-based tools – television, audio, print media, graphics?
    Yes______ No______
46. Can you observe and compare strategies used in educational technology in a variety of authentic educational settings?
    Yes______ No______
47. Can you develop and teach a series of lessons that apply technology to support learning?
    Yes______ No______
48. Can you document and assess a significant field-based activity involving experiences in instructional program development, staff development, resource management, and managing change related to technology use in schools?
    Yes______ No______

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Using Technology in Field Experience in Regular and Special Education

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Abstract: Preliminary results of a study designed to measure the effectiveness of two Funding for Results grants at Southeast Missouri State University are shared. These grants allowed the purchase of computer equipment and software that was used by Block III regular education and additional computer equipment, assistive technology and software that was used by Block IIIA special education students. Each of these groups used these supplies on their field placements. The study, using a pretest-posttest repeated measures design, was intended to measure the awareness level of both the preservice students using the equipment and the cooperating teachers working with the students. Results outlined in this paper summarize preliminary results as case studies of four students who described the impact of the technology on their field placements.

Introduction

Schools today are preparing the employees of the future. Projections for the year 2000 indicate that five of the ten fastest growing job areas will be computer related (College Planning Network 1996). Today's school students must be trained to function in a rapidly changing world, a world in which the amount of information at least doubles every 5.5 years (Naisbitt 1994). To be well-prepared, students must be trained to use technology and to access, search, and evaluate information. Schools have recognized this need and have increased their investment in technology for the last several years, with a recent ratio of students to computers at 5.7 to 1 (Market Data Retrieval 1999).

At the same time technology is increasing in the schools, the population of experienced teachers is declining. An estimated 2 million new teachers will be hired in the next decade (National Council for Accreditation of Teacher Education 1997). Schools of education have a valuable opportunity to fill these openings with teachers who are trained to use technology successfully. Indeed, teacher education institutions are recognizing this need. Seventy-six percent of education professors surveyed by the Office of Technology Assessment (1995) agreed that technology plays an important role today and eighty-two percent felt it would continue to play an important role. Yet, in a recent survey of graduates of teacher education institutions, more than fifty percent of the graduates felt that they had been poorly prepared in the use of information technology in the classroom. (Barksdale 1994). In a review of literature on information in technology and teacher education, Willis and Mehlinger (1996) concluded that while many students received coursework in information technology, little training in technology was tied to or required in field experience.

The National Council for the Accreditation of Teacher Education (NCATE) recognizes that teachers must be trained to use technology. To meet this need, NCATE collaborated with the International Society for Technology in Education (ISTE) to spell out minimum technology skills for all beginning teachers. The Council for Exceptional Children is currently working with members of their Technology and Media (TAM) Division to outline minimum assistive technology skills for

NCATE's list of competencies for beginning special education teachers (Lahm & Nickels 1999). NCATE recommends that schools of education infuse these technology skills into their regular operations.

ISTE has researched how teacher education institutions can successfully accomplish training preservice teachers to use technology. In a survey of teacher education institutions, the International Society for Technology in Education (1999) verified the Willis and Mehlinger (1996) results. Their survey found that most teacher education institutions do not routinely use technology during field experience. Their survey determined, however, that the use of technology during experiences is more highly correlated with successful technology integration than separate technology course requirements.

The need for preservice teachers to use technology in their field experience situations was the basis for this study. In 1997 and 1998, a $25,000 multi-year Funding for Results grant, "Enhanced Technology Experiences for Block III Elementary Education Students," provided educational software, laptop computers, and projection hardware for preservice teachers to take into the field during their Block III (third year) field experience placement. In 1999, another $25,000 Funding for Results grant, "Integration of Assistive Technology into Teacher Preparation", provided software, laptops, projection equipment, and assistive technology for preservice teachers in special education to take into the field for their Block IIIA (third year) special education field experience. This study is designed to measure the technology knowledge of both preservice teachers and their cooperating teachers in the field placements where the technology is being used. It further assesses the attitudes of both the preservice teachers and the cooperating teachers toward the technology being used in the field experience.

The Study

The state of Missouri has developed Funding for Results grants for the purpose of enhancing university classroom instruction. Portions of these grant monies are provided to each public university in the state. At Southeast Missouri State University, a committee decides which grants will be awarded each year with preference, in recent years, given to grants designed to improve experiential learning. The two grants involved in this study, "Enhanced Technology Experiences for Block III Elementary Education Students" and "Integration of Assistive Technology into Teacher Preparation" were designed to allow students to integrate technology into field experiences even when the field experience placement did not have a computer in the classroom.

The Funding for Results grants allowed the purchase of equipment that Block III regular education field experience students and Block IIIA special education students were able to take to their classrooms. This equipment included laptop computers, projection devices, and software for both grants. In addition, the Block IIIA grant allowed the purchase of software and hardware designed for students with disabilities. A survey instrument was designed for both field experience placements to be administered to both preservice teachers and cooperating teachers at the beginning of the semester and at the end of the semester. This survey instrument was designed to measure the awareness of instructional technology, software and hardware, and attitudes toward technology use in the classroom. Researchers designed the survey instrument to help answer several questions of both regular and special educators:

1. Will the use of this technology during the field experience improve the awareness of

technology that is available for instruction?
2. Will use of the technology improve its infusion into classroom instruction?
3. What is the teacher's opinion toward infusing technology into the curriculum?
4. Will the knowledge of the operations of computers and peripherals improve?
1. Are the teachers disseminating their new knowledge?

Additional questions were asked of the special education students:

6. Are the teachers more aware of methods for using technology in assessment?
7. Are the teachers more aware of technology that is available for students with disabilities?
8. Do the teachers feel better prepared to make recommendations for technology for students with disabilities?

The study used a repeated measures design, with a survey instrument administered at the beginning of the semester and a posttest survey at the end of the semester. Researchers predicted that each of these questions would show a positive increase as a result of using the materials and equipment purchased with the FFR grants. To measure the change, survey instruments were administered to both pre-service teachers and inservice teachers. The survey instruments were the same except that the special education students and teachers had questions about assistive technology that the regular education students did not have. The survey instruments were adapted from the instrument used by Blackhurst (1988).

The Results

While the posttest survey results are not yet available at the time of this paper, a structured interview was administered to four students, two from Block III and two from Block IIIA. These interviews provide a formative report on the anticipated results of this study. This paper is a description of their experience in using the FFR grant equipment as reported in four case studies.

Regular Education

Regular education students at Southeast Missouri State University proceed through a structured block program that involves numerous field experiences. At each level, preservice teacher participation and responsibilities in the classroom increase, so that by the time they student teach, pre-service teachers have spent over 250 hours in a classroom. Students involved in this study were part of the Block III level. Block III is the final level of instruction and field experience placement before pre-service teachers begin student teaching.

The Funding for Results grant, "Enhanced Technology Experiences for Block III Elementary Education Students" provided four laptop computers and two projection devices for students to use in the field. In addition, the grant purchased several software packages to take to their field placements. These software packages were in the area of mathematics, science, and social studies, as well as tool packages such as *Microsoft Office*, *The Cruncher*, and *The Graph Club*.

Regular Education Case Study 1: Annie

Annie was a junior at Southeast Missouri State University. She was placed in the professional development section of Block III, spending about 250 hours in the classroom during the semester. Annie was placed in a regular 4th grade classroom in a small city setting. Her students came from a generally lower socioeconomic level, with several minorities represented.

Annie used the computer technology in 4 lessons. During these lessons, Annie used web pages she had previously downloaded as the basis for a Missouri history scavenger hunt. A video projector was used for large group searches and students worked in pairs for small group work. She had previously shown the students how to conduct web searches, so they were fairly comfortable with the process.

Annie reported that she was already a competent computer user, having worked for the university computer development center helping faculty and students. She strongly felt that technology benefits students, saying, "My students were legitimately interested in learning when the material was presented in a multimedia format. It may not have provided new information, but it provided the excitement associated with learning."

Annie reported that she used a laptop, LCD projector, scanner, layout software and the Internet while teaching the students. She reported that use of the equipment helped her to better integrate technology into instruction by facilitating the development of student storybooks, integrating use of the Internet by using an Internet scavenger hunt, and incorporating an instructionally appropriate software package such as *Hyperstudio*. She further reported that she has shared her new knowledge at technology conferences and with teachers in the field who asked general questions about the technology. She learned to identify software for its clarity of instruction, its player control, and its fidelity in situations that were designed for the classroom. To maximize the integration of technology into the schools, she suggested the use of prolonged exposure for students and lots of teacher training involving meaningful skills.

The impact of the technology on the classroom teacher where Annie worked was evident in the post-instruction assessments conducted by Annie and her cooperating teacher. Students who had not previous shown much interest in social studies lessons were excited and motivated to complete their searches. According to the cooperating teacher, the fact quiz given several days after the searches also showed a greater degree of correct knowledge than usually was shown by previous classes. This teacher also commented that she planned to use similar techniques in her classes in the future.

Regular Education Case Study 2: Shannon

Shannon was a junior at Southeast Missouri State University. She was placed in the professional development section of Block III, spending about 250 hours in the classroom during the semester. Shannon was placed in a regular 4th grade classroom in a rural setting with very few minorities.

Shannon used the computer technology on 2 occasions. She had not felt that technology benefited her students much until she used *PowerPoint* with the students. She saw how much more students were motivated by the technology when it was used beyond the normal drill and practice mode. "The kids were so excited when the computer was used to present their lesson materials in a

new way. They also got to use a CD-ROM to further research the topic they were currently studying. This was much more meaningful than sitting at the computer to do daily math and reading work."

The impact of the technology on the classroom where Shannon worked was evident in the excitement generated during the discussion of the social studies topics covered by her *PowerPoint* presentation. The students also completed a fact book based on the presentation, working in small groups. The cooperating teacher commented that the students seemed to remember the facts more quickly than was usual in her class. She also noted that she would like her school to obtain a video projector for the elementary teachers to share since it made using the computer with the whole class much more effective.

Shannon reported that she used a laptop, LCD projector, CD-ROMs, overhead projector, and a TV-VCR while teaching the students. She noted that the equipment provided with the grants helped her to know more technology available for integration into instruction, but that she still did not know everything that was available. She reported that she improved her knowledge of the computer operations necessary to set up a presentation, but that setting up the equipment still was somewhat confusing to her. She had shared her lesson with other preservice teachers in her Block III class and received favorable responses. Shannon shared that she had learned to value software for its ability to stimulate students' minds. To maximize integration by teachers in the schools, she suggested not overusing technology, but using it meaningfully starting in the early grades like kindergarten or first grade and making equipment available for all classrooms.

Special Education

Special education students at Southeast Missouri State University proceed through a structured block program similar to the one in regular education with field experience at every level. In addition to classes with the regular education students, the special education students have a semester block with special education methods courses, Block IIIA. The field experience placements during this semester occur in a special education classroom.

The Funding for Results grant, "Integration of Assistive Technology into Teacher Preparation", allowed the purchase of five laptop computers and one projection devices for students to use in the field. Several items for students with disabilities were purchased: Intellikeys, Don Johnston Key Largo, adapted toys, software made for students with learning disabilities, an augmentative speech device, switches and switch adapters. In addition, the grant purchased several instructional software packages not specifically made for students with disabilities to take to their field placements. This software was in the areas of reading, writing, mathematics, science and behavior.

Special Education Case Study 1: Stephanie

Stephanie was placed during her special education Block IIIA semester in a K-6 learning disabilities classroom in a small city, middle class school. She used the computer technology each time it was available and all four occasions when her college supervisor made a formal observation. She had already used technology in the classroom, but this semester, she reported that she saw its expanded value in the area of writing for students with disabilities. She saw how students with learning disabilities who have a large oral vocabulary and lots of creativity could transfer what they want to say to paper without being hindered by poor handwriting.

Stephanie was convinced during this experience that the students benefited from technology and actually had opportunities to see observe its benefits. She was working with a second grader who spelled "center" as "senter" during a writing lesson. Using a word prediction program provided

by the grant, the second grader was trying to type the word. This word prediction software, *Co-Writer*, generates a list of ten words starting with the letter that was typed. The students can run the cursor over these words to have the software read the words. When the second grader could not find "center", she asked if the word began with a "c", discovering her own mistake. When told so, she finished the writing selection.

Stephanie stated that she was aware that computer technology could also be used for assessment. She said that she knew that a spreadsheet could be used to report behavior charting and that a multimedia authoring programs like *Hyperstudio* could be used for portfolios. Her chance to use these packages during this activity was limited though by her teacher who did not permit her to participate in reevaluations and Individual Educational Planning (IEP) meetings. However, she felt more able to make IEP recommendations for students with mild disabilities who benefited from software that bypassed reading and writing deficits.

Stephanie's technology skills were competent before this semester, but she gained the knowledge of setting up the projection device and became the computer technician for others in the class. She still felt a bit uncomfortable with the Macintosh operating system and chose to use the PC system for all her activities. Stephanie reported that she used the IBM laptop and projector, along with word processing software, word prediction software, spreadsheets, graphs, and IEP software and math software. She reported that the equipment provided with the grants helped her to know more technology available to be integrated into instruction for students with disabilities.

Stephanie was able to use the special education technology and software in several lessons. One of her lessons required that students write a paragraph about themselves. Only one of the four students wrote more than the minimum amount of sentences. When given the chance to use the computer, they each added more to their stories. They were motivated by the computers and felt that it was so easier to write using the computer.

Stephanie's final lesson with the computer used word prediction software again, but this time added *Inspiration* to generate character or story maps. Students created a story map with *Inspiration* and turned their map into an outline. This outline was then incorporated into a story that included digital pictures. They had fun using the hardware and software, stating that they did not know that writing a draft could be so much fun. Their results were well-written stories that Stephanie found were longer than their hand-written stories.

As a result of participating in the grant, Stephanie developed standards that she felt defined good educational software. She reported that good software needed to be self-explanatory, modifiable for different learning needs, educational and fun. Stephanie's recommendations for a district developing a plan for integrating technology included planning for a variety in software and hardware and having technology available for all students and teachers.

Stephanie was very involved in dissemination of what she learned through using the materials of the grant. She was asked to present her students' computer products to the administrators and to teachers in the elementary building where her field experience placement was located. Her teacher requested that her special education director purchase the equipment and software after seeing the results that Stephanie obtained with the students. In addition, she was invited to co-present with the grant author to an audience of special education teachers, administrators, and Missouri Department of Elementary and Secondary Education employees where she demonstrated the technology and explained how she used the software and hardware with her students.

Special Education Case Study 2: Laura

Laura was placed into a K-6 grade mixed disabilities classroom in a small city school district but in a building with primarily lower socioeconomic students and several minorities. She used computer technology in several lessons during her field placement. She reported that she felt much more knowledgeable about technology for students with disabilities than before this semester, although she felt that she still needed information for disability areas such as visually impaired, hearing impaired and physically disabled. She felt that computer technology that has been created for students with disabilities could benefit not only these students, but also those without disabilities. She noted that it could increase their academic performance and allow the students to meet their maximum potential. At the same time, she felt that some technology could be inappropriate for students with disabilities. "However, throughout this semester, I have seen students with ADHD and BD sit at a computer for the whole class period and not be disruptive, work diligently, and complete a productive piece of work. I feel that these students would not have finished the assignment if they weren't allowed to use technology in producing their assignments."

Laura felt that she could make recommendations about technology for students with disabilities because she had the opportunity to use the software and hardware and incorporate it into lessons. She also became aware of how software could be used to score an assessment and create a portfolio, although she had not had a chance to try them in a full classroom.

Laura had an opportunity to disseminate information about the computer technology, sharing information with peers and with teachers in the public schools, including schools outside of her field placement. She shared a variety of the software with her cooperating teacher and was asked by other teachers in the building to share it with them also. In addition, they asked her how they could apply the technologies in their classrooms. Her student teacher supervisor for next semester asked to see the equipment over winter break after watching Laura present it to local special education teachers, special education administrators, and Department of Elementary and Secondary Education staff members.

Laura feels competent now to infuse this technology into instruction. She used a talking word processor with a student in mathematics who benefited from hearing the math problem spoken. She also combined several packages into a lesson on Huck Finn. First her students used the Classic Adventures CD-ROM to read the book and took the quizzes that were included in the CD-ROM. Next, they used *Inspiration* to create a semantic map of events in the chapter. Finally, they would use *Write Outloud* with their semantic maps and outlines from *Inspiration* to write a report over the chapter. They asked her if they could print out the quizzes from Huck Finn to help them.

Laura reported that she was able to improve her operation of a computer and learned to connect peripherals like a projector and Intellikeys keyboard to the computer. She also used a talking word processor, *Write OutLoud*, IEP software, scanners, printers, a LCD projector, and a digital camera during this experience. She learned to identify good software by its student friendliness and its educational value. She also valued appropriateness, effectiveness, and cost efficiency. She looked for software that was motivating, provided feedback, and adjusted its rate of difficulty. To plan technology's effective use in schools, she learned to research new software packages to make sure it met student needs, taught what the teacher wanted, adjusted ability levels and was not biased. She recommended that assistive technology be interchangeable to increase its usefulness and that teachers be inserviced and encouraged to use the hardware and software.

Preliminary Conclusions

This study was undertaken to investigate the results of using technology with regular and special education students in an elementary school setting. Preliminary results indicate several findings:

2. Preservice and cooperating teachers were not comfortable integrating software and hardware into classroom lessons but improved their awareness, opinion of, and ability to infuse technology into instruction.
3. Preservice and inservice teachers disseminated the knowledge that they gained about technology.

Additional conclusions for special education indicate:

4. Preservice teachers were aware of some technology applications for assessment, but improved their knowledge through grant activities.
5. Preservice teachers were somewhat aware of technology that is available for students with
   disabilities, but improved this knowledge with grant activities.
6. Teachers, both preservice and inservice teacher, improved their ability to make recommendations for assistive technology for students with disabilities.

Discussion

NCATE (1997) has recognized the need for technology literate teachers to fill the need for a world that is demanding technology-trained workers. This study investigated the use of technology by both special and regular education students provided by two Funding for Results grants. Preliminary results of the study were reported through four case studies of preservice teachers, two in special education and two in regular education.

Results of these case studies indicated that all four preservice teachers improved their awareness, opinion, and ability to integrate technology into teaching. These results agree with the ISTE study (1999) that indicated a positive correlation between infusing technology into current courses in teacher education and successful integration. This awareness extended to an improvement in knowledge of assistive technology for students with disabilities for special education majors. This ability helps in making recommendations for assistive technology for the Individual Education Programs of students with disabilities.

Preliminary results indicate that both the preservice students and cooperating teachers shared their knowledge with other teachers. This ability to disseminate technology expertise was identified by Blackhurst (1988) as a recommended technology skill for teachers. This study seems to indicate that infusion of technology into field experience provides a method of making teachers aware of both of new technology and successful methods of infusing it into their teaching, providing them with the motivation to share this information.

This study investigated effects of one semester's use of technology provided by two FFR grants. Further research to determine the long term effects of these grants would be to follow up the students as teachers to determine if they continue to infuse technology into their own classrooms. Additional follow-up research on the cooperating teachers' classrooms is also recommended, to see if they continue to apply the methods observed and used during this semester.

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Getting Program and Faculty Up to Speed for NCATE 2000 Standards Project EXCITE

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Abstract: This paper provides a model for revising curriculum and training faculty to integrate technology into instruction while meeting new NCATE standards for teacher education units. Identified as key partners in this project are the undergraduate teacher education faculty and students, student mentors, technology staff, faculty and students in K-12 partner schools. The three-year plan, designed during the Summer 1999 with implementation beginning Fall 1999 is a work in progress. Key components include needs assessments, establishing a knowledge base, program redesign, professional development, fearless faculty, faculty accountability, tech support, teacher education students, and project evaluation.

In the 1990s school districts in the United States have invested billions of local, state, and federal dollars to equip schools with computers and advanced telecommunications equipment. During this same time period higher education institutions have scrambled to advance their own technology infrastructures. In many instances, technological advancement in higher education has proceeded unevenly, with Colleges of Education hard pressed to match the resource bases of such Colleges or Schools as Medicine, Engineering, or Business. This is an unfortunate situation given the critical need for "Teachers...to understand the deep impact technology is having on society as a whole...[especially when we wish them to develop] an attitude that is fearless in the use of technology" (NCATE, 1998, pp. 5-6).

In 1996 a joint AACTE/NCATE data collection project (Persichitte, Tharp, & Caffarella, 1997) assessed the level of technology use by schools, colleges, and departments of education (SCDEs). Too few students are expected to use computers, televisions and VCRs to share information in their campus classroom settings. Students do not use SCDE Web sites to obtain assignments and syllabi, implying that SCDE faculty are not making best

use of the available information infrastructure...it appears that the majority of faculty have not reached a comfort level beyond basic user skills with...information technologies. Willis and Mehlinger (1996) have succinctly summarized the literature on technology and teacher education when they say "Most pre-service teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology" (p. 978). This conclusion, coupled with the fact that the number of schools in the United States having access to the Internet has increased from 35% in 1994 to 89% in 1998 (NCES, 1999a), while classroom teachers in the United States are "least likely to report being very well prepared for activities...integrating educational technology into the grade or subject taught" (NCES, 1999b, p. 74), leaves the inescapable conclusion that Colleges of Education must in turn assume greater responsibility for the development of technology skills among their own faculty members and America's future educators. As Rosenthal (1999) points out, "Bringing the existing teaching force up to speed [technologically] is a massive task...[but it is] a problem that will be greatly exacerbated *if the teachers entering the profession have not been adequately prepared to use information technologies* [italics added]" (p. 22).

The general image of technology and teacher education described above characterizes, to some degree, the current situation in Wichita State University's College of Education. Until about a year ago, the College was essentially "on its own" to provide the technology and staff development necessary to bring faculty and staff into the personal computer age and to provide appropriate learning experiences for students. During the 1998-1999 academic year the College Technology Committee completed a technology mission, vision, and commitments document that incorporates recent International Society for Technology in Education Standards (ISTE, 1999) and current and draft standards of the National Council for Accreditation of Teacher Education (NCATE, 1998). During this time, the College's Technology Committee also completed a needs survey of all faculty and staff in the College of Education.

Though we face many of the obstacles to preparing technologically proficient teachers including lack of equipment, faculty training, technical support, and funds (among others), we have mapped out a 3-year plan to increase curriculum integration in our undergraduate teacher education program which has already culminated in three grants submitted and funded. These grants will provide (a) portable projection units and laptops, (b) a SMART Board, and (C) faculty development support through Expanding our Curriculum Integration through Technology Education (EXCITE).

The purpose of this paper is to share a model for revising curriculum and training faculty to integrate technology into instruction while meeting new NCATE standards for teacher education units. Identified as key partners in this project are the undergraduate teacher education faculty and students, student mentors, technology staff, faculty and students in K-12 partner schools (2 private and 8 public schools). The three-year plan was designed during the Summer 1999 with implementation beginning Fall 1999. The following design and process is a work in progress. Some steps in the process have been completed, others are in progress, and still others are yet to come.

EXCITE Project Design

Technology Plan

The College of Education was the first college unit on campus to develop a technology plan based on mission and goals statements. Both faculty and student goals were identified and developed within this plan. Action plans were also developed to provide a support structure for student access and integration of technology into instruction. The mission and goal statements of this plan can be found at http://education.twsu.edu/technology/plan.htm

Needs Assessment

A survey of classrooms used by the teacher education program was conducted in the fall of 1999 to determine hardware and software needs. At that time COE faculty members were scheduled to teach 63 courses in three different buildings. The survey revealed that only one classroom in the three buildings was connected to the campus network and another was being remodeled to include a network connection. Only one program had access to a portable projector. A portable electronic lectern was planned for one of the buildings. The College maintains one computer lab for student use with 20 Macintosh G3s, three Gateways, and a G3 server. A larger computer lab is available for all university students in a building not used by the College of Education. The university library has a small computer lab open for student access to the Internet. Neither of these labs can be used for instruction. As a result of this survey, the College of Education Technology committee submitted and received a grant to purchase 5 portable projectors. Our goal is to have as many classrooms equipped with appropriate equipment as possible and where equipment is not available, to have at a minimum video players, laptops, and portable projector units available.

COE faculty have participated in two separate needs assessment. The first needs assessment, completed in Spring 1999, determined the level of familiarity with technology, the frequency of use, the perception of potential of the technologies, and the amount of training received and needed. Table 1 shows the most frequently used tasks for which faculty use computers. (See more results on-line at http://education.twsu.edu/technology/needs.htm)

A second assessment, the Profiler Online Collaboration Tool, developed by Technology Assistance for Kansas Educators (http;//www.taken.org). This assessment is designed to determine the level of technology integration achieved by each faculty member. The Profiler was also administered to the student mentors along with a basic skills assessment. Partner school faculty also completed the Profiler.

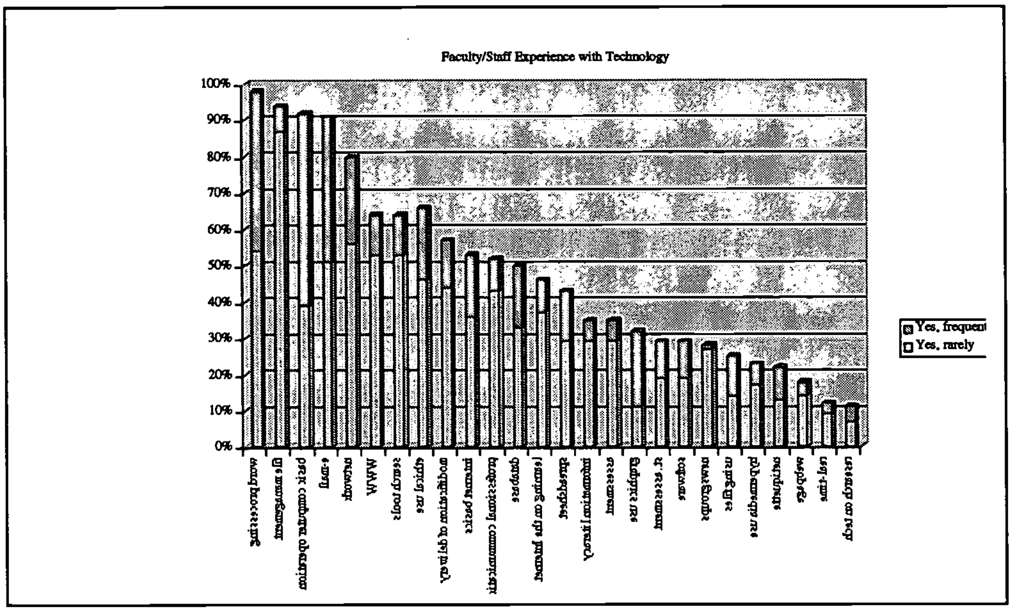

Table 1: Faculty reported use of computer technology in Spring 1999.

Knowledge Base

During Fall 1999 a subcommittee of the EXCITE Grant Advisory Committee met to examine technology standards of

several professional organizations including the International Society for Technology Education (ISTE), National Council for the Accreditation of Teacher Education (NCATE), and Kansas State Board of Education (KSBE), as well as student outcomes for the local school district, Unified School District (USD) 259. The committee recommended to the Undergraduate Teacher Education Programs Committee the endorsement of the ISTE standards as the basis for our program goals, major topics, and outcomes. Following their endorsement in October, 1999, the standards were presented to the entire teacher education faculty in December for their endorsement.

Program Redesign: Integrating Technology

Teams of faculty work together in each Block (semester) of the undergraduate teacher education program, coordinating instruction, curriculum, and field experiences beginning in the Preprofessional Block (second semester of the sophomore year), and concluding with Block IV (second semester of the senior year.). All sections of any one course in the program are taught from a common syllabus outline, the complete syllabus filed in the departmental office each semester. Following a review of those syllabi in Fall 1999, Project EXCITE facilitators will meet with each set of Block faculty to determine what types of activities they required of their students and the variety of instructional approaches used. During this meeting Project EXCITE facilitators will suggest ways that technology might support faculty instruction and student learning. The ideal progression would be that faculty would try the suggested strategies and if they felt they were appropriate, the additions would be made to the common syllabus outline which would be approved first by Block faculty, by department faculty, by the Undergraduate Teacher Education Committee, and finally by all teacher education faculty. At that point, the technology outcomes would be integrated into the undergraduate teacher education curriculum in a meaningful way, not as an added-on and isolated course.

Professional Development

Concurrently with program redesign specific to technology, and beginning in Spring 2000 faculty teaching required courses in Block II and all methods instructors (Block III) will participate in professional development designed to build skills in integration of technology into the curriculum, including use of the Internet and multimedia presentations. Key faculty from partnership K-12 schools and university student mentors will also attend the professional development activities. Fall 2000 will see these outcomes extended to all elementary, fine arts, music, physical education, English, math, science, social studies, and foreign language methods courses. Finally, in Fall 2001, outcomes for student teaching will require the use of technology in instruction.

As a partner in the EXCITE grant, Apple computer agreed to provide training workshops and server space for sharing Units of Practice developed by faculty and classroom practitioners. Student mentors and faculty were shown how to access Apple's Units of Practice and other educational resources. The format provided by Apples' units will be used to create a model for additional lesson plans.

To provide students and faculty authentic learning experiences with a variety of technologies EXCITE set out to involve faculty in instructional projects with partnership

schools and to build awareness of how technology is used in the schools. Our goal is to develop online models and videotapes of how partner schools use technology with their students that may be used in methods courses. Video conferencing and discussion forums to enhance communication between teacher education students and partner school students is encouraged.

Three public school Professional Development Schools (a high school, middle school, and 3 elementary schools) a middle school, two elementary schools, and 2 parochial elementary schools become partners of the COE in developing technology-rich environments. A list of "experts" will be developed using the Profiler to assist faculty and mentors in integrating technology into instruction. One elementary school is a computer magnet school. The teaching staff from that school are able to provide model lessons for methods classes. On-line chats will be developed between teacher education students and classrooms to explore how technology is used in the schools. Teachers from partner schools receiving professional development take the information back to their schools to (a) model the use with their students, (b) teach to their students, (c) train other faculty, and (d) provide support to university students assigned to them. Student mentors are assigned to each of the teams of block faculty as they work to integrate these new technologies into the existing program.

Fearless Faculty

The COE Technology Committee and Professional Development Committee worked with Project EXCITE personnel to plan and promote inservice for faculty based on identified faculty needs with the intent that we could develop technologically fearless and competent teacher education faculty who are capable of modeling and integrating technology into their instruction. A partnership with Apple Computer provided a series of workshops on integrating technology and developing multimedia for teacher education faculty and community school partners. In order to involve teacher education faculty from content areas such as music, math and art as well as classroom practitioners in the training, a meeting was planned that engaged all partners in the teacher education program in a discussion of how technology is being used, how it should be used, and how the partners could work to combine resources to meet our goals. Inservice was planned and implemented to include school practitioners as well as university faculty. The COE Professional Development Committee conducted their own survey of faculty needs and used the results to establish a series of workshops for faculty interested in online instruction and projection devices such as the SMART Board. To monitor faculty involvement, needs, and attitude, an electronic faculty log was initiated in Fall 1999.

During the fall semester, 1999, a multimedia cart was introduced to faculty who were in turn encouraged to use the various components of the cart in instruction. Faculty had support from tech staff in preparation and set up--but were encouraged to "go it alone" during instruction. Weekly logs from faculty included comments such as

> --" I do want to say that I was so encouraged to be able to make the mobile cart work perfectly the first time--in front of a class of 50! Whew. Everything went without a hitch on the PowerPoint presentation."

--" I tried an FER #2 presentation in CI 430 that had a PowerPoint presentation, video clips, CD-Rom resource evaluation and then showed students what the format of their paper would look like in an APA Format. Before I started, I got hives when I realized that I didn't have a back up plan for the lesson in case the cart crashed. When it was over I got a migraine--relief of tension. But I DID IT!!!! And it was great! I'm ready to do it again!"

Other informal on-line comments indicate that after some initial scouts (those sent to find the various types of technology that could be used), a few explorers (those sent out to see if it is really true) emerged:

"[One member of the tech staff indicated] she would like us to encourage totally electronic portfolios. Let's mention this to our advisees as an option. Who knows what wonderous things we may get!

(Thinking about the all-electronic portfolios...I feel like we're hanging on to a rock...tetering at top of Niagara Falls...and we're all about to get inundated with a [another] new gush of water (technology) forcing us over and down into the abyss below! I hope you all have on your lifejackets*!)

Faculty Accountability

Just how will faculty be accountable for the integration of technology throughout the pre-service program? Within the undergraduate teacher education program several program safeguards are already in place. Syllabi are filed each semester in departmental offices and are then checked against the program document for consistency with the program document. Technology integration can easily be seen by the course purpose, major topics, learning outcomes, and schedule of instruction and assignments. In addition, as part of Project EXCITE, faculty were asked to fill out an electronic log weekly that asked them to (a) describe any activity that modeled the use of technology for instruction, required students to use technology within the class time, or required students to use technology outside of class time to complete assignments, indicating any activity that is something new you have tried for the first time; (b) describe any activity that you would have liked to use but did not have the training, the software or the hardware necessary; (c) list any professional activities related to technology they participated in and how they thought they would use the training in their own teaching; (d) acknowledge any help they received from tech support staff, student mentors, faculty, secretaries, etc. and if so, from whom they receive help and for what purpose; and (e) tell us anything else they would like to share related to technology in their instruction?

Tech Support

The COE supports a full-time Coordinator of Educational Computing who provides instructional support for faculty and students interested in integrating technology into their instruction, and a full-time Technical Staff person who provides full-time technical support for faculty and students. The Tech Staff person supervises three part-time student assistants

based in the computer lab who serve as teaching assistants and technical support for students and faculty.

Teacher Education students were invited in Fall 1999 to submit applications to the EXCITE Mentor Program which will pair them with faculty based on faculty requests for assistance. Students applied for the mentor positions on-line and faculty submitted their requests for assistance on-line as well. Six students were selected and trained to provide assistance and training for faculty. The EXCITE grant provided $12 an hour for student mentors to work with faculty which created an additional 60 hours a week of assistance and support for faculty who want to integrate technology into their instruction. Student mentors receive training and experience they can use with faculty and in their own fields of study. This mentor program is intended to provide ongoing support for faculty beyond inservice and workshops offered by the college and the university.

Students

The primary focus of all grant activities is the enhancement of the undergraduate teacher education program. We hope to develop technologically proficient students. Students see teachers model appropriate use of technology in the courses, complete assignments in coursework using technology, and teach lessons to peers on campus and to students in schools. Competencies for knowledge and skills will be within meaningful components of instruction. Necessary changes in methods courses and evaluation instruments will follow.

Evaluation

As part of the current assessment process in teacher education, students use a professional portfolio to interpret their philosophy and pedagogy and provide evidence they are approximating and eventually accomplishing the goals of teacher education (Potthoff, Carroll, Anderson, Attivo, & Kear, 1996). The professional portfolio begins in Block I and is assessed each semester. Self-selected entries, teaching evaluations, and the list of relevant courses all provide potential resources of information about the use of technology in learning and instruction. In our previous research in the area of integration we found that "only our most intense and obvious efforts at modeling integration are successfully encouraging preservice teachers to submit integrated portfolio entries." (p. 57) It is our hope that modeling effective use of technology in instruction will have a significant impact on student use, which will be documented in their portfolios.

Other assessment activities include documentation as well as quantitative and qualitative evaluation components. Evaluation planning, implementation, and oversight are coordinated by the College of Education's Coordinator of Educational Assessment and Associate Dean for Administration and Graduate Program Support.

Conclusion

The model presented in this paper for revising teacher education curriculum and training faculty to integrate technology into instruction while meeting new NCATE standards for teacher education units may not be appropriate for every college of education. However,

it may offer insight into problems and suggestions for solutions that fit with other teacher education programs. Developing fearless faculty is a lofty goal, but once faculty become leaders, their students will be empowered to be leaders and advocates for change in schools.

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The Viewing and Doing Technology Project: Preparing Tomorrow's Teachers

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Abstract: Southwest Texas State University's (SWT) Center for Professional Development and Technology (CPDT) is a university-school partnership that involves 20 school sites and more than 300 preservice teachers. With funding support from the US Department of Education, the SWT CPDT is developing a model for preparing future teachers to use technology by helping university faculty integrate it into courses preservice teachers take. The model, titled the Viewing and Doing Technology Project, recognizes the knowledge and talents of faculty members who use technology and establishes themed workshops during which faculty share their expertise and help other faculty members to expand their knowledge.

Introduction

Southwest Texas State University's Center for Professional Development and Technology (CPDT) is an award-winning program that has been in existence since 1992. The university-school partnership is a vigorous one that continues to grow. Of the 20 school sites where university interns and teacher educators are assigned, five are secondary level. This project will focus one site, Hays High School, in order to establish a model by which all 20 sites can provide the optimal learning experience for preservice teachers.

Despite the strength of the field-based program, the infusion of technology is inadequate or lacking in the delivery of instruction by teacher educators, university instructors in departments outside of the School of Education, mentor classroom teachers at the sites, and cooperating teachers in the student teaching setting that follows the 9-hour field-based experience. Reasons for the deficiency are lack of development opportunities, poor equipment, and inadequate communication among stakeholders.

In order to best prepare future teachers to use technology, all stakeholders in the teacher preparation arena (university faculty, cooperating teachers, in particular) must model the use technology in effective and appropriate lessons. This became the primary goal of the Viewing and Doing Technology Project (VDT)—a one-year systematic effort that is funded by a $115,000 grant award from the US Department of Education. SWT and Hays Consolidated Independent School District, one of the members of the CPDT Consortium, matched the grant award, bringing the total funding for the VDT Project to $230,000.

The VDT Project was designed to ensure that interns observe competent to exemplary uses of technology in the delivery of instruction at both the university and the school level. The goal of the project is to enlist the cooperation of all stakeholders in a collective effort to provide a technology-rich learning environment for preservice teachers. Five objectives support the goal is attained: (a) support SWT education professors as they infuse technology; (b) use videocase methodology in classes and professional workshops; (c) collaborate with disciplinary departments to restructure courses; (d) provide professional development opportunities for cooperating teachers in high schools where preservice teachers will engage in student teaching; and (e) seek and acquire recognition and financial support from the Hays County community.

The outcome of a year of professional development activities will be the establishment of a model for the preparation of new teachers and the means for disseminating, expanding, and sustaining the model. The model will provide preservice teachers multiple opportunities to view appropriate and meaningful uses of technology in

instruction as well as to provide authentic opportunities for practicing new skills and strategies. This paper will describe each of the goals and anticipated outcomes of the VDT Project and provide a mid-year evaluation of the success of this effort.

Goal 1: Support SWT Education Professors as They Infuse Technology

Seven workshops were scheduled in the 1999-2000 academic year for the ten faculty members who teach in the field. Because the faculty are off campus Monday-Thursday, they have few opportunities to share knowledge and expertise. The seven workshops were designed to carve out a dedicated time for sharing. They were scheduled on a Friday in each of the following months: October, November, December, January, February, April, and May.

The ten faculty members who make up the VDT Team were invited to conduct one or more of the workshops and were interviewed to determine the expertise of the member and to select a topic for the assigned workshop. Six members agreed to conduct one or more workshops. Topics include putting courses online, creating web forms/surveys and using database programs to analyze input, doing a WebQuest project, writing/editing/revising papers collaboratively using a word processing program, creating interactive multimedia products, and using videocase methodology to teach preservice teachers.

The anticipated outcome of the workshops are the following: (a) all courses will be available online, (b) web sites will include forms or surveys for students to complete, (c) preservice teachers will be required to use multiple features of a word processing program to edit and revise writing, (d) WebQuest projects are included in the list of projects for each VDT Team member's course, (e) all VDT Team members use multimedia and require their students to do so, (f) all VDT Team members use videocase tools to teach classes. Outcomes are to be measured by examining each VDT Team member's syllabus for the Spring 2000 semester and for the Fall 2000 semester. The syllabi should show evidence of incorporation of the skills/strategies learned through the workshops.

In addition to the workshops, members of the VDT Team will receive "just-in-time" technical support from two graduate assistants who will be on call Monday-Friday from 8:30 a.m. to 3:30 p.m. These assistants will travel to the various school sites, if needed, to help solve technical problems and to teach the faculty member how to use particular software programs.

Goal 2: Use Videocase Methodology in Classes and Professional Workshops

A software program tentatively titled Classroom Windows (CW) is being developed specifically for the VDT Project. CW is a version of another software application, Literacy Education: Application and Practice (LEAP) (Stephens 1995), which has been re-purposed to fit the needs of the VDT Project.

LEAP is a videocase-based interactive software program designed and developed to use in university courses and professional development workshops that deal with methods for teaching reading and writing. LEAP was constructed according to the precepts of cognitive flexibility theory (Spiro & Jehng 1990). Users of LEAP are guided through short videocases, or minicases, of classroom teachers in naturalistic settings. Minicases can be explored from multiple perspectives through built in navigation routes in the software program. As in LEAP, CW will provide minicases of teachers and their students using technology in high school classroom settings. CW will provide guided exploration of the minicases as well as links to the World Wide Web and a threaded discussion group. The minicases will show teachers at Hays High School using technology with sophomore, junior and senior level students. Three teachers have been videotaped; their tapes will be edited and prepared for insertion into the CW software structure.

CW is still in production. The final version will be available on CD-ROM in late Spring 2000 and will be distributed to the ten VDT Team members for use in their classes. The anticipated outcome is that the team members will use this tool in Fall 2000 semester courses.

Goal 3: Collaborate wSith Disciplinary Departments To Restructure Courses

The rationale for expanding the professional development beyond the College of Education is that all of the secondary teaching methods courses are taught outside of the College of Education. It is critical, then, to insure that preservice teachers are exposed to effective application of technology in their disciplines and that they are required to practice using it within those classes.

A one-week summer workshop is scheduled in mid-May 2000 for 10 faculty members in the various colleges at the university. Five technology proficient faculty members within these colleges have agreed to conduct workshops that resemble the workshops conducted in the College of Education. One member will conduct a full-day workshop on each of the five days. The topic will be determined by the member's expertise and interest. Each of the five has been requested to bring one member of their staff whom they think would benefit from the experience.

The anticipated outcome of the summer workshop is that the information/skills shared each day are incorporated into the Fall 2000 semester syllabus of each attending member.

Goal 4: Provide Professional Development Opportunities for Cooperating Teachers In High Schools Where Preservice Teachers Will Engage in Student Teaching

Preservice teachers who are enrolled in the classes taught by the faculty members who attend the academic year workshops and the summer workshops will be placed in a student teaching setting in the Spring 2001 semester. If the cooperating teacher with whom they will work is not proficient with technology or not interested in integrating it, then it is likely that both student teacher and cooperating teacher may find the experience unproductive. To help prepare the student teaching environment for a technology-proficient teacher in training, eight cooperating teachers will be invited to enroll in a summer course at the university; tuition and fees will be paid by the VDT Project.

The anticipated outcome of this goal is that the eight cooperating teachers will support their student teachers in the Fall 2000 and Spring 2001 semesters as they both explore ways to integrate technology in the middle school or high school classroom.

Goal 5: Seek and Acquire Recognition and Financial Support from the Hays County Community

To assure a positive impact of the VDT model and to justify the energy, effort, and funding spent on the model, a continuity plan is vital. A team of faculty members is exploring the further development of the VDT Project. Plans for disseminating information, acquiring more funding, and enrolling more faculty members in professional development activities are being made. A promotional videotape will be distributed to possible funding sources as well as interested institutions in the community. Papers will be presented at conferences such as this one. Proposals for funding will be written in the Spring 2000 semester. Outcomes from the previous four goals will be reported in all of the materials that are written/developed for the continuity plan.

The anticipated outcome of this goal is that the VDT model is revised and refined and that funding and support is made available for expansion. Five of the field-based blocks—all at the secondary level—are involved with the VDT Project this academic year. It is hoped that the remaining 15 field-based blocks—all at the elementary level—will benefit from the next level of the VDT Project.

Conclusion

The VDT Team and all supporting individuals have dedicated much time and energy to the attainment of the five goals of the VDT Project. To date, evaluations of activities indicate that the model has been effective in helping

faculty members become more comfortable with technology. By June 2000, indicators will determine what components of the model need to be revised/restructured. By December 2000, the full impact of this model on how well new teachers are prepared to use technology will become evident. In informal interviews the VDT Team and others who support it have indicated that they are confident that the model will have a positive impact on both faculty and students.

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Using the Internet to Promote Technology Integration, Higher-order Thinking Skills and Motivation

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The purpose of this paper is to share the findings of a study that examines issues regarding K-12 integration of Internet instruction. The main thrust of this project involves the development of a comprehensive educational internet database dedicated to assisting preservice teachers entering the K-12 classroom to incorporate Internet resources via the creation of WebQuests based on the model developed by Bernie Dodge (1999).

Introduction

The Cognitive Domain

Educators continually strive to find ways to create learning situations that exercise higher level thinking skills. Bloom, Englehart, Furst, Hill & Krathwohl's (1956) taxonomy of educational objectives for the cognitive domain classified goals of an educational system into six objectives: knowledge, comprehension, application, analysis, synthesis and evaluation.

According to Bloom, et al. 1956), the first three levels of the taxonomy set up the foundation for higher-order thinking skills. Knowledge includes "those behaviors and test situations which emphasize the remembering, either by recognition or recall, of ideas, material, or phenomena" (Bloom, et al., 1956, p. 62). This objective also applies to transfer of learning in that the learner has to relate to and make judgments in terms of answering questions or problems at the time of testing that are posed in a different form than that of the original learning situation. Comprehension involves "the grasp of meaning and intent of the material" and application concerns "remembering and bringing to bear upon given materials the appropriate generalizations or principles" (Bloom, et al., 1956, p. 144).

Generally, higher-order thinking skills reside in a learner's ability to analyze, synthesize and evaluate concepts and information. Analysis involves breaking down material into its constituent parts to determine relationships between the parts. Analysis can be considered a prelude to evaluation and is

considered an important objective in the fields of science, social studies, and the arts, among others. As an objective, Bloom, et al. (1956) divides analysis into three levels: identifying or classifying elements of a communication, determining the explicit relationships among the elements, and recognizing organizational principles and structure of the communication as a whole.

The next educational objective that is considered to be indicative of higher-order thinking skills is that of synthesis which Bloom, et al. (1956) defines as "putting together of elements and parts so as to form a whole" (p. 162). Synthesis is a process of combining the elements in such as way as to create a pattern or structure not seen before. This category of the cognitive domain is thought to constitute creative behavior. According to Bloom, et al. (1956), the main difference between synthesis and the categories of knowledge, comprehension and application is that the first three objectives deal with "working with a given set of materials or elements which constitutes a whole in itself" whereas synthesis involves drawing upon "elements from many sources and put[ting] these together into a structure or pattern not clearly there before" (p. 162). Synthesis can be classified in terms of three sub-categories evidenced by their products: a unique communication, a plan or set of operations, and a set of abstract relations.

Finally, the last educational objective that is indicative of higher-order thinking is that of evaluation which is defined as "the making of judgments about the value, for some purpose, of ideas, works, solutions, methods, material, etc." (Bloom, et al., 1956, p. 185). Generally, evaluation involves a combination of all of the other educational objectives. It is also crucially linked to the affective domain and can, therefore, be regarded as indicative of motivation. Further, evaluation may be the last step in the domain, but it may lead to acquisition of new knowledge, re-evaluation of prior knowledge comprehension, or further analysis and synthesis. The evaluation component is composed of two components: judgments in terms of internal evidence and judgments in terms of external criteria. A major goal of our educational system is to expand a learner's existing and potential knowledge base by operationalizing and integrating knowledge, comprehension, and application with analysis, synthesis and evaluation to engender higher level thinking skills.

The Affective Domain

According to Gagne & Driscoll (1999), the most fundamental element to learner motivation is the "desire to enter into the learning situation." The cognitive domain is intertwined with the affective domain. According to Krathwohl, Bloom & Masia (1964), the most sought after kinds of affective domain objectives are interest and motivation. It is the motives, drives and emotions of the affective domain that are the predominant factors in the achievement of cognitive behavior. Achievement motivation results from positive affect and takes "the form of building upon self-discovery as a means of fostering interest in learning material" (Krathwohl, et al., 1956, p. 58). Krathwohl, et. al's (1964) taxonomy of educational objectives for the affective domain. fits well with a widely-known model of motivation - Keller's (1979) ARCS model. The four basic elements of the ARCS model are: Attention, Relevance, Confidence and Satisfaction. Learner attention may be captured by colorful graphics, animation or music. Relevance might be garnered by relating the topic to be studied to the learner's personal goals or lifestyle. Learner confidence may supported by providing an opportunity to demonstrate what they have learned to peers. Learner satisfaction can be enhanced by providing meaningful opportunieis to use the newly acquired knowledge or skill gained as a result of the learning experience. The purpose of the ARCS model is to make theory and research findings in the field of motivation applicable to classroom instructional settings.

As further support for considering both the affective and cognitive domains, research on learning and motivation has found that motivation increases an individual's energy and activity level (Maehr, 1984, Pintrich et. al 1993; and Vernon 1969) and promotes time on task in terms of initiation of certain activities and persistence in those activities. While motivation directs an individual toward certain goals, it is also dichotomous in that when people exert effort toward some goals, they often must direct it away from others (Csikszentmihalyi & Nakamura, 1989). Additionally, motivation affects learning strategies and cognitive processes employed by an individual. Generally, a task is, in and of itself insufficient for

successful learning. Cognitive processes such as attention, meaningful learning, elaboration, and self-monitoring comprehension must occur as people engage in a particular learning activity. Further, learners must think about what they are seeing, hearing and doing (Carroll, 1989; Tobin, 1986, Wittrock, 1983). Therefore, cognitive engagement is one of the benefits of a high level of motivation. Finally, intrinsic motivation is considered to be more central to producing meaningful learning than is extrinsic motivation.

Where Technology Comes In

The Internet and World Wide Web have great promise as they present new vehicles to enable educators to achieve their goals of promoting higher-order thinking skills while also enhancing learner motivation to promote the kind of cognitive processing necessary to produce meaningful learning.

In particular, an effectively designed WebQuest is an excellent vehicle to promote both higher-order thinking skills and motivation. A WebQuest furthers the technology integration initiative supported by educators across the country by offering an inquiry-oriented activity in which most or all of the information used by learners is obtained via the World Wide Web. Developed in 1995, by Bernie Dodge and Tom March, WebQuests are designed to maximize time on task by focusing learners' attention on using the information provided on the World Wide Web rather than searching for it. Effectively designed WebQuests encourage higher-order thinking skills such as analysis, synthesis and evaluation and are useful for integrating technology into the classroom while providing a safe way for students to research the Internet.

Part of developing a WebQuest involves researching appropriate World Wide Web links to be incorporated into a WebQuest. Anyone who has ever engaged in Internet searching has experienced the tremendous amount of time required to find meaningful and relevant sites while wading through a great deal of "garbage" to get to the good stuff.

In a recent paper, Herbert Simon and Richard King Mellon effectively summarize the dilemma faced by the technological revolution. They assert that it is not information that is the scarce factor today, it is a human being's ability to attend to the information and the time required to attend to it. "While the means of acquiring information have been expanding, there has been no expansion in the number of waking hours in the day available for attending to that information. Time and attention are scarce, and becoming scarcer every day. In particular, we have no time to process the new information that is being disgorged on us" (Simon & Mellon, 1996). According to Roblyer (1997), a predominant problem cited by teachers regarding Internet infusion is the amount of time required to adequately research and effectively integrate its use into K-12 classrooms.

Through the use of templates and other time-savings devices, WebQuests have the potential to give educators a concrete, quick-to-learn method of integrating technology into the curricula without requiring them to spend a prohibitive amount of time on the procedural aspects of learning new software. Further, it seems that it is just as important to motivate teachers to want to use technology in the classroom as it is to motivate students to want to learn.

WebQuests provide benefits to students in that they facilitate organization and management of on-line resources so that students are engaged in meaningful learning activities, thus reducing student time spent searching the Internet for sources and thus, promotes time on task. The Internet is a dynamic medium, full of information that is accompanied by visual and aural stimuli. If appropriately and effectively utilized via a WebQuest, these dynamic elements can help focus and maintain learner attention, promote student interest, and engender intrinsic motivation.

Methodology

The research undertaken is a multi-part project. The first part consists of "Linkey-Lou", a comprehensive educational Internet database developed using Microsoft FrontPage 98 and Microsoft Access. This web site is currently being developed to aid higher education faculty and pre-service educators in developing WebQuests to encourage technology integration while promoting higher-order thinking skills and motivation in elementary and secondary school students. The site, which is currently in development, consists of 4 main resource areas:

- Internet Ethics;
- Policies, & Security;
- Web Development;
- Professional Educational Organizations; and
- Software & Publishers, and Subject Web Resources.
-

Fig. 1 below represents an example of a resource page currently being developed.

Figure 1. Example from "Linkey-Lou" database.

EDIT 3318: Linkey-Lou Database

Applications of Technology in Elementary Education

Web Development (10 links)

Web Site Name	Content Area	Notes
Midi Library	music	MIDI files
Pop MIDI files	music	MIDI files
Free MIDI Files	music	MIDI files
KidQuest Sound Clips	music	resources
Academic Computing Services - TTU	resources	HTML guide
Hoxie High School	resources	school-related clip art
Hoxie High School	resources	MIDI files
Html help	resources	HTML resource
Tom March - Ten Stages of Working the Web for Educ	resources	WebQuests
Multimedia Schools - Voices of the Web	resources	multimedia

Home

A search mechanism is planned to enable educators to search the database by topic or keyword.

Another portion of the project involves the development of an evaluation rubric that will aid WebQuest developers to properly evaluate and select effective Web sites by assessing features such as aesthetics, cognitive effectiveness, cognitive task level technical sophistication, and resource quality and quantity. The evaluation rubric utilizes the foundations presented in the ISTE standards concerning planning and delivering instructional units for technology integration by incorporating guidelines for content comprehensiveness and clarity, screen design, motivational components based on Keller's ARCS model (Keller, 1979), interactivity, and higher order thinking skills.

Data will be collected and analyzed as a result of a focus group study to evaluate the comprehensiveness and effectiveness of the WebQuest resource guide. A focus group collects data by way

of a semi-structured group session which is moderated by a group leader and held in an informal setting. The purpose of a focus group is to understand all the perspectives of the participants. A focus group was chosen because it saves times by allowing a researcher to interview several people at one time, it allows one to collect rich data at a reasonable cost, it can explore topics and generate hypotheses for quantitative research, and group interaction tends to bring out data that would not otherwise be obtainable through observation or via questionnaires or surveys. The sample selected for the focus group will consist of purposive sampling, which concentrates on those subjects that will provide the most meaningful information. In the case of this study, focus group participants consist of preservice K-12 teachers who are enrolled in EDIT 3318, Applications of Technology in Elementary Education, at Texas Tech University. Data collection is in progress to assess whether our resource model aided effectively in the development of student WebQuests.

Additionally, quantitative data collection will entail collecting information from university-level methods educators concerning the site's present and potential usefulness to their students. This information will be used to determine other possible needs that the Internet database resource might serve to further the College's aim of preparing pre-service educators in the State of Texas. The instruments being developed will utilize a Likert-type scale with comment choices ranging from None to High and a qualitative survey for more depth of comment to aid in the future development of the resource guide.

Data collection for this project is currently in progress. Preliminary data will have been collected for presentation at the SITE conference in February, 1999.

Conclusion

It is hoped that preservice educators, university methods educators and other education professionals may benefit from the findings of this research. Additionally, it is hoped that, in the future, this comprehensive Internet resource can be further expanded in to further educators' goals of infusing technology into elementary and secondary classrooms, to provide enhancement of the current curricular goals of educational systems, and to promote rich and meaningful learning experiences for elementary and secondary public school students.

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Advancement of Student Technology Integration Skills through University Pre-service Coursework

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Abstract: In the United States (U.S.) there is a shortage of new teachers possessing skills to integrate technology into the classroom. The U.S. Department of Education has recognized this problem and has funded projects targeted at pre-service teacher education. This paper focuses on a technology enhanced teacher education curriculum supported by a U.S. Office of Education Preparing Tomorrow's Teachers to Use Technology (PT3) grant, which is designed to give pre-service educators the skills needed to integrate technology into their classrooms. Attitudinal measures, stages of adoption of technology and proficiency measures are addressed.

Introduction

Authorities estimate that 2,000,000 new teachers with technology integration abilities will be needed in the workforce of the United States over the next seven years, while the projected capacity of all the teacher education colleges in the nation is only half that amount (Green, 1999). Vast increases in the quantity of technology – infusing educators are needed, while the quality of good programs should continue to be improved, and greater progress toward equity in making the new teachers available to underprivileged students must be pursued as well. The Millennium Project: Pathways for Preparing Tomorrow's Teachers to Infuse Technology, is one of more than 100 projects funded in the USA by the U.S. Department of Education in pursuit of these goals.

The curriculum on which this project is based has a credible foundation, in part due to strong alignment with state and national technology standards, and in part due to the use of reliable indicators capable of showing progress toward course and standard goals. For more than a decade the Computer Education and Cognitive Systems Program in the Department of Technology and Cognition at the University of North Texas has been offering a three-course sequence that leads to curriculum/technology integration skills for graduates. For the past two years data have been gathered to assess the attitudinal changes and student perceptions of their own technology integration abilities. This paper reports on the impact of this curricular sequence.

The Curriculum

Undergraduate courses at the University of North Texas are numbered in a four-digit sequence for which the first number indicates the approximate year-level of the content and the remaining three indicate the focus of the course. In keeping with this scheme, the first course in the UNT integration sequence is

considered a freshman-level computer applications course (1100) that is fairly standard throughout the campus, but the educational version utilizes educationally-relevant examples. The second course is a junior-level teacher productivity course (3440) while the third is a senior-level (4100) classroom/learner technology methods course. Approximately 20% of the students in the second and third course enroll in the two concurrently. Students completing the entire sequence typically enroll in the third course one or two semesters before student teaching. This three-course sequence has for more than a decade been approved for a Texas Education Agency Information Processing Technologies (IPT) endorsement which can be added to a teaching certificate.

Beginning in 1997, in order to prepare future teachers for continuous K-12 technology integration as mandated by the new Texas Essential Knowledge and Skills (TEKS) curriculum, the third course was modified to include a major module on the TEKS. Students completing this sequence were encouraged to enroll in a graduate course (CECS 5500) focusing on locating and organizing materials related to the TEKS, during their last semester as an undergraduate. An undergraduate course focusing on technology integration was formulated during this time frame as well, and is scheduled to be offered for the first time during the spring semester of 2000. Funds awarded during the fall of 1999 from a U.S. Department of Education Preparing Tomorrow's Teachers to Use Technology (PT3) grant are greatly expanding undergraduate offerings in this sequence during the 1999-2000 school year and beyond. The content of these courses is described in more detail in Table 1.

Table 1. Content for Computer Education & Cognitive Systems (CECS) Courses in Technology Applications Sequence

CECS 1100: Computer Applications in Education
This is a tool-based course in which students learn to use an integrated word processing, spreadsheet and database package.
CECS 3440: Technology and the Teacher
This course includes the use of presentation software and theories as well as the instructional design of presentation materials.
CECS 4100: Computers in the Classroom
Students in this class learn to find appropriate instructional software for the classroom, develop a multimedia project, find Internet resources for classroom use, develop a technology infused lesson plan, and make a webpage to link to their instructional resources.
CECS 4XXX or equivalent from approved list or
CECS 5500: Computer Applications for Curriculum and Instruction
Topics in this course include theories of teaching and learning, locating and organizing resources relevant to the TEKS, and developing a model curricular unit integrating technology, as a final project.

Completion of this four-course sequence entitles undergraduates to a University of North Texas certificate in curriculum and technology integration. Although this certificate currently carries no official status other than recognition by the University of North Texas, it is consistent with the needs expressed by several Texas school districts and is closely aligned with the TEKS[1].

Instrumentation

Attitude measures

Instruments developed by the authors during 1995-97 (Christensen & Knezek, 1998; Knezek & Christensen, 1998) have been successfully used to assess pre-post changes in attitudes toward information technology in pre-service course participants for several semesters. The primary instruments used have been the Teachers Attitudes Toward Computers Questionnaire (Christensen, 1997), and the Teachers' Attitudes Toward Information Technology Questionnaire (Knezek & Christensen, 1998). These two instruments collectively measure 15 constructs related to attitudes toward information technology. Subscale

[1] Currently there are no teacher preparation standards adopted by the Texas State Board of Educator Certification, to be applied by the Texas Education Agency statewide, for the Technology Applications portion of the Texas Essential Knowledge and Skills.

reliabilities for sets of educators completing the instrument have ranged from .85 to .98. Changes in pre-service educators' attitudes on selected constructs will be featured in this paper.

Stages of Adoption of Technology

Christensen (1997) developed a direct self-report measure of educator stage of adoption of technology, based on the earlier work of Russell (1995). In this instrument, respondents select one of six stages that best represents where he/she currently lies in the continuum from Awareness (Stage 1) to Creative Application to new contexts (Stage 6). This instrument has proven itself to be useful tracking advances in in-service as well as pre-service educator development over time. A recent test-retest check on the reliability of this instrument for a sample of 98 teachers in the Dallas-Ft. Worth Metroplex, yielded a reliability estimate of .96. Stage of Adoption is a primary outcome measure reported in this paper. A copy of the instrument is provided in the Appendix.

Skills Assessment

The Technology Proficiency Skills Assessment Instrument (TPSA) (Ropp, 1998) was added to the battery of instruments completed by pre-service educators in the fall of 1999. This instrument assesses educator skills related to information technology in six areas: Electronic Mail, World Wide Web Utilization, Integrated Applications, Teaching with Technology, Multimedia Skills and Web Skills.

Impact of Curricular Sequence

Stages of Adoption

Data gathered to date indicates that the curricular sequence is reasonably well articulated and results in measurable advances in stages of adoption of technology, as reported by the course participants themselves. For example, during the fall semester of 1998, participants in the first course of the sequence (CECS 1100 – Computer Applications) began on the average at stage 3.1 and exited the course on the average at stage 3.9. Students in the second course in the sequence (CECS 3440 – Teacher Productivity Tools) began on the average at stage 4.1 (posttest data was not available), while students in the third course (CECS 4100) began on the average at stage 4.4 and exited from the course at stage 5.2. This can be compared to a typical teacher, as measured by a sample of more than 1000 from the same geographic area, during the same time frame. The average rating across practicing teachers was 4.13, a value lying near the center of the indices reported across the three-course technology integration sequence. These results are graphically displayed in Figure 1.

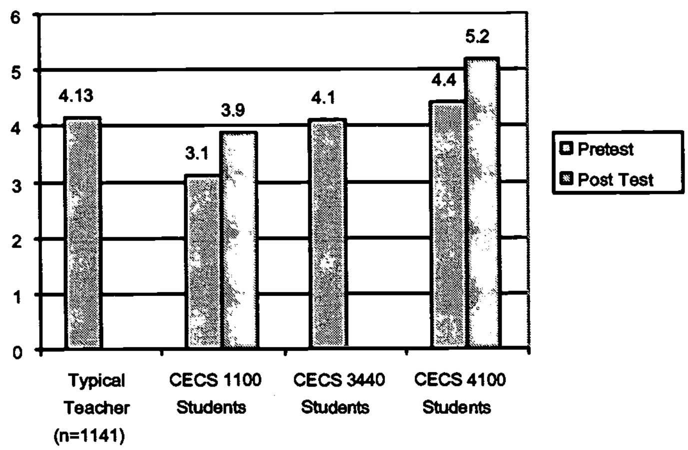

Figure 1. Stages of adoption of technology for three classes of pre-service teachers versus in-service teachers (1998).

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Pre/Post Attitude Changes

Students in the third course of the sequence (CECS 4100) have in the past exhibited reduction in anxieties, the development of more positive attitudes toward technology for student learning, and more positive perceptions of technology as productivity tools. In addition, pretest data gathered from first course, second course, and third course students during the fall of 1999 indicate that the trends in attitudes for the three courses generally mirror the differences previously reported with respect to stages of adoption. Three of seven attitudinal constructs measured revealed significant differences between students in these three courses. As shown in Figure 2, students in the third of the three-course sequence were significantly higher ($p < .05$) than both other courses on F1 - Enthusiasm and F6 - Productivity.

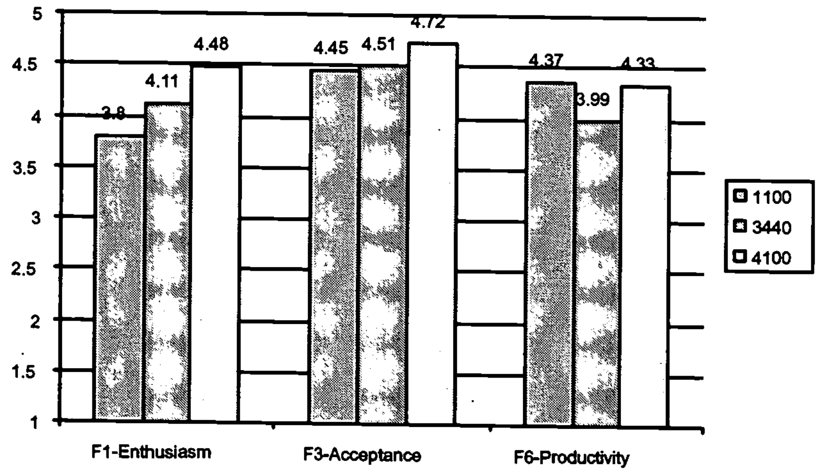

Figure 2. Fall 1999 pretest attitudinal measures for three UN T classes

Technology Skills Assessment

Data were gathered from UNT pre-service teachers using the Technology Proficiency Skills Assessment (TPSA) for the first time during the fall of 1999. Initial findings, based on one CECS 4100 class of 21 students, are graphically displayed in Figure 3. Students enrolled in the Computers in the Classroom course reported large skill gains ($p<.001$) in six major areas measured by the TPSA. The effect sizes on these gains (post-test mean - pretest mean, divided by pretest standard deviation) ranged from 1.94 to 2.29. The average gain in level of technology proficiency was approximately two standard deviations.

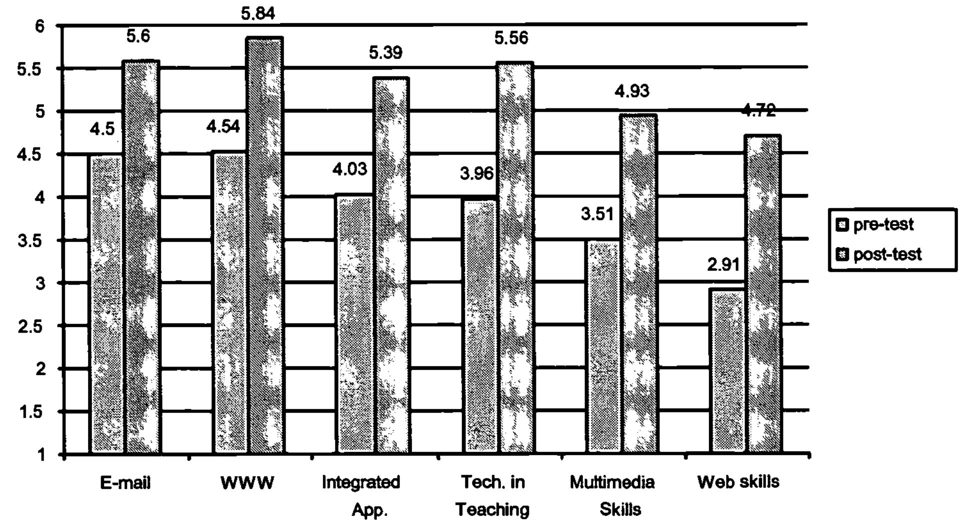

Figure 3. Pre- and posttest technology integration skills comparison for CECS 4100 pre-service students.

Texas Essential Knowledge and Skills (TEKS) Proficiency

During the spring of 1998, students enrolled in CECS 4100 – Computers in the Classroom were given an additional form that enabled them to assess their level of knowledge of the K-12 Technology Applications curriculum and the resources provided by the state of Texas to support teachers in fostering student learning. As shown in Table 3, the effect size for self-reported improvement in knowledge of the TEKS ranged from .8 to 3.7. This can be compared to effect sizes ranging from .2 to .8 for the attitudes showing significant ($p = .05$) positive gains for the same group.

Table 3. Fall 1998 changes in attitudes and knowledge for computers in education (CECS 4100) students

	Pretest	Post Test	Sig.	Pretest SD	Effect Size
Email (TAT)	5.73	5.94	0.05	1.07	0.20
WWW (TAT)	6.09	6.35	0.03	0.91	0.29
Multimedia (TAT)	5.53	5.99	NS	1.35	
Teacher Prod. (TAT)	6.37	6.24	NS	0.75	
Classroom Prod.(TAT)	6.57	6.41	NS	0.59	
Familiar with TA TEKS	2.00	3.62	0.0005	1.16	1.40
Confidence in integrating TA-TEKS	1.33	3.17	0.0005	0.49	3.76
TA-TEKS resources	1.13	4	0.0005	1.19	2.41
Stage of Adoption	4.36	5.23	0.0005	1.00	0.87

- Note. TA-TEKS are the Technology Applications Texas Essential Knowledge and Skills
- Note: TAT is Teachers' Attitudes Toward Information Technology Questionnaire

Discussion

Texas adopted a new curriculum in 1997 that requires the integration of technology throughout the K-12 curriculum. However, Texas has not yet settled on a new set of teacher education standards for this new curriculum. In the absence of statewide guidelines, the University of North Texas, in consultation with area schools and educational service centers, has produced a Technology Applications Curriculum Integration sequence which consists of four courses at the undergraduate level. The technology infusion emphasis gives pre-service teachers the opportunity to learn how to structure lessons, student projects, and student activities that are motivational, involve active participation, permit collaboration, emphasize content mastery, and incorporate individualized instruction. As these teachers enter their profession, they will have a unique set of skills and technology-related experiences that empower them to be adept in their

classroom environment, plan the equitable use of technology resources, and build a dynamically networked learning community based on curricular goals.

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Appendix
Stages of Adoption of Technology[2]

Stage 1: Awareness
I am aware that technology exists but have not used it - perhaps I'm even avoiding it.

Stage 2: Learning the process
I am currently trying to learn the basics. I am often frustrated using computers. I lack confidence when using computers.

Stage 3: Understanding and application of the process
I am beginning to understand the process of using technology and can think of specific tasks in which it might be useful.

Stage 4: Familiarity and confidence
I am gaining a sense of confidence in using the computer for specific tasks. I am starting to feel comfortable using the computer.

Stage 5: Adaptation to other contexts
I think about the computer as a tool to help me and am no longer concerned about it as technology. I can use it in many applications and as an instructional aid.

Stage 6: Creative application to new contexts
I can apply what I know about technology in the classroom. I am able to use it as an instructional tool and integrate it into the curriculum.

[2] From Christensen, R. (1997). Effect of technology integration education on the attitudes of teachers and their students. Doctoral dissertation, University of North Texas. Based on Russell, A. L. (1995). Stages in learning new technology: Naive adult email users. Computers in Education, 25(4), 173-178.

Giving Teachers the Tools They Need to Integrate Technology

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Abstract: Today, elementary teachers often are required to integrate technology in their classrooms and to teach students to utilize technology. In Pennsylvania, preservice elementary teachers typically receive one course in technology instruction. There is little or no attempt to demonstrate to these preservice teachers ways to integrate technology into their classroom assignments in education or in methods courses. It is important to give preservice teachers the training and experiences they need to make valid decisions in the use of technology as a tool for instruction. In the program described in this paper, preservice teachers first master the use of technology for their personal needs. Second, students are taught ways to evaluate software packages. Next, they have opportunities to create lesson plans that integrate technology in appropriate ways. Finally, students are given opportunities to use technology in actual classroom situations with small groups of elementary students during methods classes.

Introduction

Although computers and technology are expanding in classrooms across the nation, a study conducted by *Education Week* and reported in *The New York Times,* (September 29, 1999) concludes that teachers remain Abefuddled about how exactly to incorporate the machines into their lesson plans." Often technology is used in the classroom simply to satisfy the demands of district officials or teacher review polices. According to a study conducted by the National Education Department and cited in *The Pittsburgh Post Gazette* (January 29, 1999) and in *The New York Times* (January 29, 1999), A78 percent of teachers reported training in technology, [but only] 20 percent felt >very well prepared to use it in their classrooms.'" Weinman and Haag (1999) argue that in 1997 researchers found that Aonly 15 percent of teacher candidates nationwide had received at least nine hours of technology training." This means that while new teachers are typically unprepared for 21st century technology, educational institutions need and expect new personnel to be able to provide leadership implementing technology throughout the curriculum and district.

Dr. Arthur Wise, president of the National Council for Accreditation of Teacher Education (NCATE), argues that most schools of education do not adequately train teachers to use and integrate technology into their teaching. By the year 2000, technology will have to be integrated throughout the coursework for a college to maintain NCATE accreditation. (Rosenthal, 1999). Rosenthal (1999) cites Lynn Silver, national strategic relations manager for Apple computer, who says that, Schools of Education must ensure that our future teachers can use technology to communicate, collaborate, and support critical thinking and problem solving.

According to the Milken Exchange, the Afederal government estimates that [the United States] will need 2.2 million new teachers over the next decade to accommodate both the increase in students and the public's demand for smaller class size" (Basinger, 1999). To establish baseline data on the status of technology use in teacher-training programs, the Milken Exchange surveyed 416 teacher-preparation programs representing approximately 90,000 graduates for the 1997-98 school year. The survey results indicate that over 70% of these teacher-training programs require at least some instruction in Instructional

Technology. The institutions that reported the highest levels of student technology skills and experiences, were Athose with no heavy computer course requirements, but those that made use of technology on a routine basis throughout the teacher training program" (Basinger, 1999).

The Milken-ISTE report cited above makes these conclusions:

1. Information-technology instruction should be integrated into all courses and SCDE activities, rather than being limited to stand-alone classes.
2. Institutions should engage in technology planning that focuses not only facilities but on the integration of information technology in teaching and learning.
3. Student teachers need more opportunities to apply information technology during field experiences under qualified supervision.
4. Faculty should be encouraged to model and integrate technology (Basinger, 1999).

Further research is needed to discover "the most effective models for learning how to integrate information technology into classroom practice" and "widespread dissemination of this new knowledge when available" (Basinger, 1999).

In a recent survey to elementary principals in Western Pennsylvania conducted by the Robert Morris College Education Department, 80% of the respondents stated that they would give special hiring preference to candidates with a professional expertise in technology. These administrators cited a need for new teachers to be proficient in evaluating and implementing technology software for computer, multimedia, and video use. For these reasons, Robert Morris College has developed an elementary education program that integrates technology into the basic education as well as the educational methods courses.

The Program

Given the opportunity by the State Department of Education to devise a new elementary education degree program, Robert Morris College (RMC) responded by incorporating technology not only through Instructional Technology courses, but by integrating technology into all education and methods courses throughout the curriculum. Table 1 lists the courses and course sequence for elementary education preservice teachers.

Freshman 1st Semester	**Sophomore 1st Semester**	**Junior 1st Semester**	**Senior 1st Semester**
CE212 Principles of Information & Computing **CO120** Communication Skills I **NS___** Science Elective **PY251** General Psychology **QS101** College Mathematics I ***Or*** **QS105** Mathematical Reasoning w/Applications	**CO220** Communication Skills III **CO221** Communication Skills IV **ED315** Educational Psychology & Practicum **PY355** Human Growth and Development ______ **Elective**	**CI310** Information Systems Applications **CM300** Instructional Media Design **EL301** Special Needs in the Elem. Classroom **EL405** Science Methods **EN275** Children's Literature ______ **Business Elective**	**ED335** Elementary Content Area Reading & Practicum **EL402** Language Arts Methods **EL404** Mathematics Methods ______ **Liberal Arts Concentration** ______ **Liberal Arts Concentration** ______ **Elective**
Freshman 2nd Semester	**Sophomore 2nd Semester**	**Junior 2nd Semester**	**Senior 2nd Semester**
CO121 Communication Skills II **EC101** Principles of	**CO230** Communication Skills V **ED310** Foundations of Education & Practicum	**EL401** Reading Methods **EL403** Social Studies Methods	**ED420** Supervised Teaching **ED421** Student Teaching Seminar

Macroeconomics **EL100** Computer Literacy for Education **FA103** Introduction to Art and Music **QS201** Mathematics for Elementary Teachers	**EL200** Electronic Media for Teachers **EL302** Life, Physical and Earth Sciences **GG201** Economic/ Cultural Geography	**HS101** American History to 1877 ***Or*** **HS102** American History-1877 to Present **SO231** Principles of Sociology ______ **Liberal Arts Concentration**	

Table 1: Course sequence for elementary education preservice teachers.

Thus, at RMC pre-service elementary education majors are required to take 15 credits of technology courses: nine from the college technology core and six from the RMC core. With this background, students are prepared to effectively use technology to teach content in specific subject areas. These technology core requirements are not intended to make technology experts of elementary majors: rather, the goal is to produce competent, confident elementary teachers who are comfortable with the use of technology as a tool when implementing successful teaching strategies. To accomplish this goal, RMC faculty used the National Education Technology Standards published by the International Society for Technology in Education as a model for designing courses and assignments. Table 2 lists the standards for grade 5 and the courses in which these standards are met.

Prior to completion of GRADE 5, students will:	**CI 212**	**EL 100**	**EL 200**	**CM 300**	**CI 310**	**Elem. Methods**
1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively. (2)	I	O	O	I	I	
2.Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide. (1, 2)	O	O		O	O	O, I
3. Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use. (2)	I	O	O	O	O	I
4. Use general-purpose productivity tools and peripherals to support personal productivity, remedial skill deficits, and facilitate learning throughout the curriculum. (3)		O	I	O	O	I
5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, and scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside		I	O	O		O, I

the classroom. (3, 4)						
6. Use telecommunications efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests. (4)	O	I	I	I		
7. Use telecommunications and online resources (e.g., e-mail, online discussions, Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom. (4, 5)		O	I	I	O	
8. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem-solving, self-directed learning, and extended learning activities. (5, 6)		I	O	O		I
9. Determine when technology is useful and select the appropriate tools(s) and technology resources to address a variety of tasks and problems. (5, 6)		I	O	O	O	I
10. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources. (6)			I	I		I

Table 2: Standards for grade 5 and the courses in which these standards are met. *I* represents the courses where the standards is included, and *O* represents courses where the standard is an objective of the course.

The integration of technology in course assignments illustrates to preservice teachers in a concrete manner ways in which technology can and should be used as a tool for educators instead of a Aby-product.≅ Some examples of learning activities in various courses include:

- searching for appropriate Internet sites and creating hyperlinks for elementary students,
- corresponding via e-mail to elementary students,
- evaluating software packages in content areas such interactive readers,
- creating graphic organizers and data bases, using commercial packaged software such as PowerPoint™ and ClarisWorks for Teachers™,
- evaluating on line lesson plans and teacher materials,
- using scanners to integrate pictures of students' work into text and presentations,
- and evaluating video segments for use in the classroom.

Through these courses and activities, preservice teachers learn that technology is a natural extension of their lessons and can be incorporated in the classroom. More importantly, students learn the appropriateness of technology in classroom assignments. They learn when the use of technology is inappropriate as well as when the use of technology can enhance instruction.

In order to practice and present the ways they have integrated technology in their course assignments, all elementary education majors have access to presentation classrooms. These classrooms are equipped with computers, projection screens, video recorders and players, CD players, and camcorders. These students also have access to computer classrooms and labs. In addition to the presentation

classrooms, these preservice teachers have access to a resource lab that is equipped with additional materials, both hardware and software. Here they are able to work on specific assignments, prepare lessons, and experiment with the technology. Elementary students, therefore, are able to demonstrate their individual use of technology in presentation situations in a variety of classes before they enter the methods classes.

Another unique feature to the RMC elementary education program is the use of area public schools and personnel to teach methods courses. Students spend part of the day in real schools with real elementary teachers and students. They are able to use the resources found in public schools to complete projects and assignments. School personnel teach method classes in the afternoons to the RMC students. Thus, RMC elementary majors benefit from instructors who are expert in translating theory into practice. They also benefit by having the opportunity to observe, for extended periods of time, real elementary classroom situations and instruction. Our public school partners benefit by having RMC elementary students who are competent in technology suggest ways that technology might be integrated into daily lessons.

Program Evaluation

Like all educational programs, evaluation of this new elementary education degree will be on going. The success of this program will be stringently evaluated in order that RMC can continue to deliver a high quality, technology-driven program that is demanded by the education community. RMC is dedicated to students, to colleagues in basic education, and to prospective elementary education students in classrooms today and in the future. RMC's intent is to provide a program that strongly prepares elementary preservice teachers to help public school elementary students embrace the technology at the elementary level and prepare them to accept the technological challenges of the intermediate level. Thus, the success of this program will be evaluated by the following five measures:

1. An Elementary Education and Technology Steering Committee of colleagues from schools surrounding our campus will help guide the program. Most of the committee members work in schools where RMC students will be placed for field experiences. Receiving continual feedback from these individuals will be instrumental in assuring progress and improvement.
2. The cooperating teachers who supervise our students during student teaching will provide the second measure.
3. The faculty who developed and who will teach in the elementary education program will evaluate their courses. Students, in these courses, will also complete an evaluation form.
4. The Education Advisory Committee will provide feedback on up-to-date issues in education and how courses at RMC are meeting the requirements that these issues demand. Two of the new four members of the committee will be elementary technology specialists.
5. A formal evaluation request will be sent to the employers of graduates asking for feedback on the success of the graduate in the performance of classroom duties and how these graduates are integrating technology in their classrooms.

"Today's students live in a global, knowledge-based age: They deserve teachers whose practice embraces the best that technology can bring to learning" (Education Digest Oct. 1999). It is the primary goal of the RMC faculty to prepare teachers who are intellectually prepared, professionally dedicated, and socially responsible and who strive to bring out these same qualities in their students. It is our philosophy that the teacher education program must enable prospective teachers to help their students grow in intellectual curiosity, self-confidence, knowledge, responsibility, and interpersonal relationships. It is our strong belief that prospective teachers must be prepared not only to capably teach in the educational programs of today, but also to build successful programs needed for the future. To achieve these objectives, it is important that students understand their roles as professional educators, to define life-long goals, and to accept the obligations associated with the achievement of professional status. In keeping with this basic philosophy, RMC has developed a technology-based elementary education degree program to fill the needs of the future.

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RESEARCH

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Educational institutions at all levels are recognizing the importance of technology in the teaching-learning process. This growing awareness of the roles technology can play in the educational arena has spurred considerable research. This year's SITE conference papers reflect a diversity of issues that are germane to the integration of technology in the educational setting. Thus, the researchers not only address the issues related to the use and integration of technology but also highlight the attitudes, beliefs and perceptions of stakeholders in using Instructional Technology, along with research on technology in practice.

The first portion of the research section is devoted to the perceptions and attitudes of the stakeholders in the educational arena. Fourteen papers reflect the diversity of the educational community. Each of these papers focus on teachers', preservice teachers', and / or students' outlook pertaining to instructional technology. Ertmer, Ross and Gopalakrishnan look at the pedagogical beliefs and classroom practices of exemplary teachers finding that these are all rooted in student-centered classrooms where technology is only a means to an end. They suggest that finding ways to connect teachers with peers who have had successful experiences implementing technology is crucial.

Topper investigated how teachers' assumptions and beliefs about teaching and learning influence their technology usage. Owens and Magoun look at teachers attitudes towards technology focusing on differences among school systems, teaching level, gender and teaching experience. Beers, Paquette & Warren describe how the use of technology is affected by school philosophy and the location of the technology in the building.

Greene and Zimmerman look at the effects of field experience in a technology rich environment on preservice teachers. This paper reports changes in students beliefs related to these experiences using a blend of quantitative and qualitative research tools. Prouty and McGrew-Zoubi describe attitudes and beliefs related to the developmental appropriateness of educational software that targets preschool children. Nanci researches the attitudes and beliefs of inservice teachers towards educational software evaluation criteria that they were asked to apply. Sammons and Strickland examine how teacher characteristics and attitudes relate to multimedia creation and conclude that confidence in their own ability inspired by proper training is most important. Gershner, Snider, Huestis and Foster describe a program implemented to integrate emerging technologies into the teacher preparation program. This program was multifaceted in its approach to reach preservice teachers, mentor teachers and isntructors. Concerns about individual attitudes and perceptions focused this research project.

Yu-mei Wang has two papers, both are looking at student teachers' perceptions. One paper focuses on the perceptions of teacher roles in the classroom with computers and the other focuses on computer use during Practicum experiences. Orit Hazzan describes the attitudes of preservice teachers on the use of instructional technology in the mathematics classroom. Akyurekoglu interviewed middle school teachers on their perceptions of computers and its use in the classroom. Coleman provides a rationale for using web pages linked with databases for field based teacher education programs. This paper addressed the perceptions of college faculty, K-8 teachers, and preservice teachers in regard to this type of instructional technology.

The second division in this section is devoted to the differential competence/use of technology in the classroom. This is also a large, diverse group of research documents with a common theme of Research on Technology in Practice. Pierson looks at the relationship between technology use and teaching ability. This paper uses graphics to illustrate excellence in teaching ability and technology integration. This combination requires content knowledge, pedagogical knowledge, and technological knowledge. Becker's study discusses a model of addressing computer anxiety while increasing technology integration in the classroom. Drost and Abbott reported on the findings of a two part study determining how teacher education programs prepare preservice teachers to utilize technology. This study also looked to determine a relationship between the initial decade of certification and a willingness to use technology.

Leh, Meyers and Fisher present case studies that describe the computer literacy levels of school teachers and levels of computer use by a group of elementary school children. Zhang, Chen, Hartley and Fowler describe their ideas related to "CyberJive" which they operationalize as jargon used in information technology. Their study highlights the difference between high school students' and preservice teachers' understanding of CyberJive.

Serdiukov's paper identifies the different technologies used in education based on the SITE Conference Proceedings. He also presents the most frequently used terms in Educational Technology. Chen conducted a content analysis of SITE annuals from 1990-1999. His research identified growth focusing on telecommunications, hardware/software tools and dissemination of annuals.

Rimor and Kozminsky discuss students reflections on their working in a database environment and propose a methodology for analyzing reflection data. Hartley and Bendixen discuss the influence of learner characteristics when using hypermedia: specifically learner's epistemological beliefs and self-regulatory skills. These characteristics are known to influence learning in traditional environments, but have been overlooked in hypermedia research. Bao investigated the usage of a web based distance learning management system, *TopClass*, to enhance a traditional research course. This paper describes the experience and reflections associated with the incorporation of this new technology into the class. Molebash and Milman show gains in confidence with technology for preservice teachers who take an introductory educational technology course. Murphy provides a comparison of ICT competence and attitudes between two samples of student teachers.

Chih-Hsiung Tu redefines the social learning theory for an on-line learning environment. Three dimensions of social presence are discussed including social context, online communication and interactivity. Greene and Zimmerman summarized the results of a study conducted on preservice teachers utilizing the Fifth Dimension. Preservice teachers used their experiences with this program to respond to an open ended instrument determining what is teaching and learning. Topper's second paper investigated the patterns of email use in established teacher inquiry groups f ocusing on individual teacher's professional growth.

The final division in this section focuses on methodological issues related to the study of instructional technology and state standards for technology. Adamy's paper identifies the potential benefits of using the computer in analyzing qualitative data. He specifically identifies software that are useful in content analysis and would enhance action research. Gunawardena, Lowe and Carabajal review the models and methods available for evaluating on-line learning.

Reehm used the technology standards implemented in the state of Kentucky as the backdrop for research. New standards put into place impact initial and continuing certification for teacher educators. This study will help determine future action by Colleges of Education to better prepare teachers to enter the field.

This body of research reflects the dynamic growth and movement in the use of Instructional Technology in today's schools. Tomorrow's teachers will benefit from the many hours of research conducted by this group of educators.

Technology-Using Teachers: How Powerful Visions and Student-Centered Beliefs Fuel Exemplary Practice

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Abstract: This research examined the pedagogical beliefs and classroom practices of seventeen exemplary technology-using teachers. Open-ended questionnaire, interview, and observation data were collected and analyzed to identify the beliefs and practices that were common, as well as distinct, across teachers. Findings suggest that teachers' exemplary technology practices were guided by strong pedagogical visions which were rooted in their beliefs about student-centered classrooms. Teachers' primary reasons for using technology related, not to extrinsic rewards, but to the many ways in which students benefited.

Introduction

Previous research has examined the relationships among teachers' levels of technology use and a number of key factors including years of experience (Hadley & Sheingold 1993), degree of self-confidence (Marcinkiewicz 1994), and access to resources (Gilmore 1995). Although these factors are considered crucial in shaping teachers' use, Hadley and Sheingold noted that classroom integration may be more highly influenced by the particular context of the school, community, policies, purposes, and individuals involved. Thus, the same "key" factor (e.g., knowledgeable peers) may look and act differently in different situations; serving, perhaps, as an incentive in one context yet as a barrier in another. More specifically, although some teachers have limited access and support, they seek to incorporate technology in ways that put learners and ideas at the core of the educational process and that achieve *consequential* student outcomes (i.e., those that extend to real world applications). In other contexts, teachers with unlimited access and high levels of support may achieve negligible, or unintended, outcomes by using technology in carefully prescribed ways that focus primarily on students' acquisition of low-level skills (Harrington 1993).

Hadley and Sheingold (1993) suggested that technology's impact is a function of teachers' use, as well as their interpretations of that use. These interpretations depend on the value teachers assign to technology, which is embedded in the beliefs they hold about teaching and learning, in general, and about the use of technology, specifically. Based on the assumption that teachers behave in concert with their beliefs (Erickson 1986), it is important to identify the interpretations, meanings, and beliefs that foster exemplary technology practice (i.e., the use of technology to achieve consequential student outcomes, as described above) as well as additional incentives that motivate teachers to persist in their efforts.

Pedagogical beliefs provide a meaningful context for understanding what teachers are trying to accomplish in classrooms, as well as the methods and tools they choose for doing so. By identifying beliefs common to exemplary technology-using teachers, educators will be in a better position to situate technology training within a supportive pedagogical framework, thus increasing the chances that teachers will learn to use technology to implement new practice and achieve new goals.

This Study

Purpose

This research was designed to explicate the pedagogical beliefs of technology-using teachers in an effort to understand what leads to and supports integrated technology use. Specifically, the following questions guided data collection and analysis:

- What are the pedagogical beliefs of exemplary technology-using teachers?
- How do these beliefs facilitate and support meaningful uses of technology?
- What are teachers' perceptions regarding the incentives that foster meaningful use?

Methods

We used a qualitative case-study design to examine and describe the pedagogical beliefs of exemplary technology-using teachers. Case study methodology allowed us to examine the phenomena of technology integration in-depth and to describe it through our participants' eyes. Through a series of written responses, telephone and e-mail conversations, and extended face-to-face interviews and videotaped classroom observations, we examined how teachers' beliefs aligned with and supported their classroom technology use.

We initiated the participant selection process by soliciting self- and peer-nominations of exemplary technology-using teachers from k-12 school colleagues located within an hour's driving distance of the university. Twenty-two teachers, representing 17 different classrooms (8 teachers constituted 3 teacher-teams), completed an application form in which they described their beliefs and practices regarding classroom technology use. Seventeen of these 22 teachers were available for in-depth interviews and classroom observations (including all three teams). Teachers who were interviewed represented a range of subject areas, classroom contexts, and levels of access to technology and were not considered to be significantly different from those who were not interviewed.

Our interview sample included teachers from two high schools (grades 9-12), one 6th-12th cross-age private school, five middle schools (grades 6-8), one prek-8, and six elementary schools (grades 1-5). Five of the 17 teachers taught at private schools. The high school teachers (a 3-teacher team and a single teacher) taught science, four middle school teachers (a 3-teacher team and a single teacher) taught music, and 3 teachers (one elementary, one middle school, one prek-8) taught computer skills in a lab setting. The remaining teachers taught in self-contained elementary or cross-age (6th-12th grade) classrooms. The majority of each school's population was white; ethnic minority students accounted for 4% to 45% of each school's enrollment (Tab.1).

Teachers' applications comprised our initial data set. Specifically, 22 teachers (8 male, 14 female) completed the application form in which they described their instructional and professional uses of technology, their visions for an integrated classroom, and examples of successful classroom uses of technology. In respect to this last item, teachers were asked specifically "to include information about the *roles* you, your students, and the technology played, how students were *grouped*, the *goal* of the activity, its relevance to the *curriculum*, and the manner in which you *assessed* outcomes." By considering successful use from the teachers' point of view, we gained valuable insights into teachers' definitions of technology integration, as well as the kind of visions toward which they were oriented. Furthermore, the specific information that teachers included in their successful examples helped us identify similarities and differences among the relevant dimensions of teachers' pedagogical beliefs and classroom practices.

Based on teacher and researcher availability, 17 teachers were interviewed and observed in their classrooms during the 1998 Fall semester. Eight teachers were interviewed two times; nine teachers were interviewed one time. Four teachers were observed one time; all other teachers were observed two or more

times. Observations were conducted over a one or two hour time period; interviews lasted approximately an hour. Field notes were taken during each observation; interviews were audiotaped and transcribed. Interviews enabled us to examine, in more detail, teachers' beliefs about technology use and to identify the incentives that motivated them to integrate technology; observations enabled us to witness the manner, as well as the extent, to which teachers' beliefs were translated into practice.

Open-ended questionnaire, interview, and observation data were analyzed using both within- and cross-case analyses (Patton 1990). We began by searching for recurring words and themes that captured each teacher's beliefs about classroom practices as well as their technology use relevant to those practices. We also identified incentives that teachers perceived had impacted their use. Secondary data obtained through telephone and e-mail conversations, and teacher and student artifacts (lesson plans, technology projects) were used to support or negate tentative themes that emerged in early analysis stages. Finally, case profiles were created for each teacher and then compared across teachers to discern both common and unique patterns of beliefs and incentives related to exemplary technology use.

Name	Years Tchg	School Size	School Location	Ethnic Makeup	Public/ Private	Grade Level	Content Taught	Special Features
Kate	21	360	urban fringe of large city	18%	private	3k-5	Compu-ters	
Teresa	3	400	urban fringe of large city	DK	private	prek-8	Compu-ters	school for gifted; predominately white
Melissa	5	917	urban fringe of mid-size city	8.4 %	public	1	All subjects	
Joan Jessie	6 12	600	urban fringe of large city	20%	3.6%	1-2	Science themes	looping; job sharing; sci & tech magnet school
Lindsey	5	505	small town	3.8%	public	4th	All subjs	
Vivian	17	527	urban fringe of mid-size city	3.8%	public	4th	All subjs	
Bev	23	800	urban fringe of large city	45%	public	6-8	Music, Commun ication Skills	
Mary Joe BethAnn	21 29 14	863	mid-size central city	13.6%	public	6-8	Music	team planning
Emilie	5	204	urban fringe of large city	15%	private	6-8	Compu-ters	
Jamie	8	6	mid-size city	0%	private	6-12	All	crossed-age students
Don	10	395	large city	24.6%	private	9-12	Science; Compu-ters	
Sam Annie Connie.	30 6 10	2000	mid-size central city	10%	public	9-12	Biology	team taught; block 8 schedule; 45 students/hour

Table 1: Demographics of Interview Sample of Technology-Using Teachers (names are pseudonyms)

Findings

Teachers' technology integration stories are described using three overlapping themes: guiding visions, teaching pedagogy, and intrinsic incentives. Within each theme we highlight both the similarities and differences among teachers and their uses of technology.

Guiding Vision

Teachers' uses of technology were guided by what they believed was most important for their students to know and do, rather than by what could be done, given current technological capability. For example, one high school teacher stated, "To me the computer is not the coolest part of this. It is may be the weakest part. Learning happens when people are doing. The computer allows us simply to do more of that." Teachers were quick to recognize that technology enabled them to achieve educational visions that focused on learning, not technology. A few teachers took this a step further to emphasize, not specific content goals, but students' attainment of independent learning skills. As a fourth-grade teacher stated, "It's important not just to teach about carnivorous plants and that kind of thing, but to teach the skills of how you go about finding information on the Internet." A music teacher noted, "We feel more successful (when we use technology) motivating kids to like our subject area, but even more important, motivating them to like to learn."

While some teachers believed that technology had *changed* their educational visions, others simply saw technology as an enabler--a tool that allowed them to teach the way they have always wanted to teach. As one biology teacher noted, "I have always been devoted to the notion that you have to be active to learn. This computer technology has allowed me to pursue that. It hasn't really changed my philosophy; it has *enabled* my philosophy, allowed me to continue my philosophy that I have had for a long, long time."

Perhaps because these teachers had such strong visions of classroom technology use, they did not appear to be easily frustrated by common implementation barriers. In fact, many of these teachers had achieved high levels of use despite the lack of equipment, training, or time. Teachers tended to approach barriers with no-nonsense attitudes. It was quite common to hear a teacher state that a particular barrier was "no big deal—I'll just write a grant." Or "It's not a problem—I'll find resources in the community." All of the teachers we interviewed faced barriers, yet none of them permitted the barriers to halt their efforts. Their unwillingness to give up in the face of difficulty allowed them to overcome barriers that typically keep others from proceeding. It is important to note, however, that all of the teachers interviewed in this study felt strongly supported by their school administrations. By providing ongoing technical support, as well as multiple opportunities for continued professional development, the administrations demonstrated a strong commitment to technology integration, in general, and to these teachers, in particular. However, it is unclear from the results of this study which came first; were teachers' visions facilitated by this strong support or was support provided as a result of teachers having strong visions for use? Additional study is needed to determine the relationship among these factors.

Teaching Pedagogy

Teachers expressed similar beliefs about classroom practice, particularly as they related to four main categories: teacher, student, and technology roles; classroom organization and activities; curricular and social characteristics; and assessment practices. Specifically, teachers described learning environments that placed students in self-directive roles, themselves in facilitative roles, and technology in supportive, tool-oriented roles. In addition, classrooms tended to be flexibly organized and managed, with students moving easily among activities and groups. A great deal of students' work occurred in cooperative groups and revolved around the completion of project-based assignments.

Thematic instruction and interdisciplinary approaches were commonly noted among the teachers interviewed. For example, a music teacher noted how students' projects required knowledge of social studies and English, a math teacher described his use of process writing, and a middle school computer teacher noted how her students completed a project involving foreign languages, math, science, technology, language arts, and geography.

Almost all teachers interviewed described their classrooms as being student-centered; that is, they provided opportunities for students to set their own goals, make choices about learning methods and activities, and self-evaluate progress. Assessment practices were quite varied and included the use of

rubrics, self-reflective journals, oral quizzes, group debriefings, product try-outs, peer evaluations, oral presentations, and web-based publishing. Although a few teachers still mentioned assigning grades, it appeared as though grades were based on multiple alternative assessment measures.

Intrinsic Incentives

There were many reasons why teachers persisted in their efforts to use technology. Not surprisingly, the incentives that inspired them were rarely related to external rewards. Rather, our participants indicated that their efforts were powered by their perceptions that technology leads to increased student motivation and achievement outcomes. As one teacher noted, "I use it because it allows the students to be active learners."

Although some teachers mentioned that they, themselves, enjoyed using technology, the majority of teachers were quick to point out that the primary reason for using technology related to the many ways in which students benefited. Student benefits were thought to go beyond preparing students to use technology for future jobs. Teachers noted how technology enabled all students, including students with attention deficit disorders, learning disabilities, and low self-esteem, to meet academic goals. In addition, students from culturally diverse backgrounds were thought to benefit from using technology. Teachers noted that students were more likely to *own* their learning when they created multimedia presentations or other technology-based products. As one music teacher noted, " When students create their own songs, it's their work. And they are so intent on it. They truly own their music when they are on computers."

When used well, teachers perceived that technology helped students make connections within and across subject areas, thus making content more meaningful and more authentic. As one teacher noted, "They use it as a tool for inference and other higher thinking skills, and have fun, too." Teachers also believed that the use of technology made classroom learning more dynamic and relevant, motivating students to actively engage in the learning process. "Students are engaged and excited about what they are doing."

Perhaps the incentives that inspired these teachers, and the successes that they have achieved, can be leveraged to help other teachers initiate the technology integration process. As we search for ways to motivate more teachers to begin the process, we might consider finding ways to connect them (via e-mail, classroom observations, or virtual field trips) with those who have already seen success in terms of increased student engagement and high levels of independent learning. According to Glenn and Knapp (1996), these types of successes can serve as powerful change agents: "What ignites the final fires of enthusiasm and commitment to change is when teachers see their colleagues integrating technology tools successfully, when they see students enthusiastically using them, and when they see the sophisticated products that these students create" (p. 221).

Summary

Although our participants described a variety of approaches to achieving technology integration, they shared a common vision of their students as self-regulated learners, capable of setting goals, making choices, monitoring progress, and evaluating learning outcomes. As noted by one high school biology teacher, "The least important of our goals is that they learn biology. We are much more concerned that they become independent learners and critical thinkers." Furthermore, this goal, although attainable *without* technology, was perceived as being more readily achieved when technology *was* used as one of many available learning tools.

Educational Implications

Achieving meaningful technology use is a slow process that is influenced by many factors. When educators and researchers look for ways to help teachers use technology effectively, it may be important to look at what they have (in terms of beliefs and practices) in addition to what they do not have (in terms of equipment). Understanding teachers' visions for technology use and their beliefs about teaching and

learning may be necessary if we are going to support their efforts to initiate and sustain the kind of systemic changes required for innovation to become practice.

The purpose of this study was to explicate the pedagogical beliefs that support integrated technology use as the first step in developing an effective approach to technology education for both pre- and in-service teachers. As with any professional development endeavor, it is critical that we know where we want to go first and then figure out how information technologies can help us get there. The results of this study suggest that it is important to address pedagogical issues during training efforts. Furthermore, it appears important to spend time fostering visions of technology use that focus on providing, increasing, improving and/or assessing student learning, as opposed to visions that focus on increasing technological capability (e.g., obtaining laptops for every student). It is hoped that by sharing these few teachers' stories, others who are just beginning their own technology integration journeys may benefit. By examining both the pedagogical beliefs and classroom practices of exemplary technology-using peers, we expect that teachers will gain a better understanding of *how* technology can be used (the practical considerations), as well as *why* it should be used (the supporting pedagogy). The visions and beliefs that have empowered our participants, as well as the strategies they have devised to overcome common obstacles, provide models for others who wish to change current classroom practice. It is our hope that the teacher case profiles generated from this study can serve as powerful reflection tools for others—visions on which to reflect and from which to grow new and even more powerful visions.

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TEACHERS' BELIEFS ABOUT TECHNOLOGY, TEACHING, LEARNING, AND THEIR ROLE IN SHAPING PLANS FOR CLASSROOM TECHNOLOGY USE

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Abstract

Teachers' beliefs about teaching and learning shape their approach to planning and carrying out curricular activities in the classroom. These beliefs are filters through which teachers make sense of the curriculum and influence the instructional approach they use. Assumptions about the role of educational technology are an important influence on the plans and activities teachers make when they prepare to integrate technology into their teaching practices. This study examined individual teachers' beliefs and knowledge related to teaching and learning as articulated in a graduate-level course, looking closely at how these beliefs and knowledge shape plans for technology use in teaching. The results offer insights into the nature of teacher beliefs that shape technology use and help to clarify the interactions between knowledge and belief about teaching, learning, and technology. This line of research represents an important area for further study as more and more teachers view technology as a valuable pedagogical tool.

Introduction

Students in a Master's level educational technology course represent a place to investigate and better understand the relationships between teachers' beliefs about teaching, learning, and technology. Experienced teachers in an educational technology graduate program bring with them prior experiences, assumptions, and attitudes towards technology that are made public in class discussions. This provides a site for studying the interactions among individual teachers' beliefs and plans, influenced by the subject matter in the graduate course, by the instructors plans and activities, and by their peers.

Researchers have developed a variety of ways for thinking about teacher knowledge and beliefs that shape their classroom practices. Teacher beliefs -- encompassing suppositions, commitments, and ideologies -- have been studied in a variety of settings and contexts. It is generally assumed that beliefs are more often associated with affective and evaluative cognitive components than teacher knowledge, but that beliefs play an important role in teaching practices.

Calderhead (1996) identified five categories of teacher beliefs: (a) beliefs about learners and learning, (b) beliefs about teaching, (c) beliefs about subject areas, (d) beliefs about learning to teach, and (e) beliefs about self and the role of teachers in learning. Teacher beliefs about learners and learning often come from assumptions about student abilities, although beliefs about teaching usually reflect a teacher's overall beliefs about teaching and sustaining positive social relationships with their students.

Building on the work of Shulman (1986), Grossman (1990) offered a framework for thinking about teacher knowledge that includes: (a) general pedagogical knowledge, (b) subject matter knowledge, (c) pedagogical content knowledge, and (d) knowledge of context. General pedagogical knowledge describes a body of general knowledge, beliefs, and skills related to teaching and learning not specific to any particular content or domain. Subject matter knowledge includes not only factual knowledge of the domain, but also knowledge of the substantive and syntactic structures of the discipline. Pedagogical content knowledge incorporates beliefs about the purposes of teaching a specific subject area, knowledge of students' understandings of that subject area, curricular knowledge, and knowledge of instructional strategies and

representations. Contextual knowledge refers to individual teachers' understandings of the school culture and setting in which they teach.

Teachers' knowledge and beliefs play an essential role in their practices and shape the learning that goes on inside and outside their classroom (Borko & Putnam, 1995). These beliefs and knowledge shape teachers' learning as they work to improve their teaching, acting as filters through which teachers view educational change. In order for teachers to adopt new educational innovations, such as technology, they will need to "think in new ways about students, subject matter, and the teaching-learning process" (p. 38).

While individual teachers can expand their knowledge and learn about technology, they need opportunities to develop and sustain professional relationships with their peers to effect changes in the larger school culture. These professional relationships, which I consider *collegial*, provide a supportive context for examination of teacher beliefs and teaching practices as well as a collective environment for changing aspects of the school culture necessary for successful technology adoption.

Graduate Course Description

EDG621: Topics in Educational Technology is a Masters' level course offered each term under the Advanced Studies in Education program at Grand Valley State University. In the past, this course has been taught in a traditional lecture format with some hands-on work in a computer lab. When I designed this course for the Fall 1999 term, which was my first time teaching it, I changed the format to include more discussion and less lecture while maintaining the hands-on experience in the lab. I also instituted a course research project in preparation for the Masters Thesis or Project students are required to complete before they graduate.

The published course goals were described as follows:

> This course is intended to provide students with broad and deep exposure to a variety of educational technologies, drawing on their own interests and experiences in the classroom as well as research in the field. Using research on educational technology, where research takes a variety of different forms, we will examine how technology can support the goals and purposes of K-12 education. There will be a dual focus in this class on research related to the use of educational technologies, provided in traditional print publications (books, journals, etc.) and in electronic form, as well as the experiences of students in the context of their schools and districts.

A large part of my role in this class was facilitating conversations among students around the course readings, drawing on their experiences in the classroom. I wanted to create an intellectually stimulating environment for these students to make public their assumptions about teaching and learning in order to expose them to peer scrutiny. Another goal was to stimulate collegial interactions among students around technology learning in this class. I also wanted to encourage students in this class to connect what they were learning and the work on their projects with their classroom experiences, making this course more relevant to their everyday lives. As students in the class shared their views, their experiences, and their understandings of the course readings, I was given a glimpse into the ways they thought about using technology in their classrooms.

Research Questions

- How do teachers' assumptions and beliefs about teaching and learning influence their plans for technology use?
- How do teachers' uses of technology influence their teaching beliefs and practices?
- What is the relationship between teachers' beliefs, knowledge, and practices, and their use of technology for teaching and professional development?

Methods of Inquiry

After the term ended, I qualitatively analyzed the data I collected for this study to identify and track individual knowledge and beliefs related to teaching, learning and technology. Data collected includes field notes from my reflective journal (kept by me during the year), e-mail and Course Info conversations (Blackboard, Inc.) among graduate students (archived), surveys filled out by graduate students, and selected entries from graduate student journals (turned in as part of the class). Using triangulation, I analyzed student participation in the class and examined how their beliefs about teaching and learning -- as articulated in their journal entries and in their class correspondences -- shaped their planned uses for technology in their own classroom settings.

Procedures

During the fall 1999 and spring 2000 terms, I collected data from the participants as part of a Master's level courses I taught at GVSU. I analyzed the data looking closely at how students' beliefs and knowledge of teaching and learning -- as articulated in their class and on-line conversations, as described in their journal entries, and as described in surveys -- shaped their plans for use of technology in their teaching.

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The Effects of Technology on the Attitudes of Classroom Teachers (E-TACT)

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Introduction

Everyday, one sees or hears news about the latest advancements in educational technology and what these new technologies can do for our children and their learning environment. The focus of these studies concentrated on the effects of technology in the classroom and on the students. One major aspect, which is often overlooked in these investigations, is that of the teacher's attitude toward this technology and its utility as a learning tool. This study focuses on the often-overlooked teacher-link in the successful implementation of technology in the learning environment and investigates the attitudes towards technology of teachers from three school districts in Louisiana. In this research, differences among school systems, teaching level, gender, and teaching experience are studied. This study surveyed K-12 teachers representing three types of school systems - an urban system, a rural/urban system, and a rural system.

Survey Instruments

To assess the attitudes of the respondents in the study, the Teacher's Attitude Toward Information Technology (TAT) version 1.1 survey instrument was distributed to the faculties of the Monroe City Schools (an urban system), the Ouachita Parish Schools (an urban/rural system), and the Winn Parish Schools (a rural system). The TAT, which is composed of ten separate subscales, was developed and verified by the Texas Center for Educational Technology (TCET). TCET operates under the auspices of the University of North Texas and was developed by Christensen and Knezek (1998). Eight of the subscales are semantic differential subscales and were constructed using Zaichkowsky's (1985) Modified Personal Involvement Inventory. These subscales focus on a person's perceived relevance of the object based on inherent needs, values, and interests. The other two subscales uses Kay's semantic perception of computers (Kay, 1993) and D'Souza's (1992) classroom learning via electronic mail.

The Survey

The survey consisted of teachers from the Monroe City School System (MCSS), the Ouachita Parish School System (OPSS), and the Winn Parish School System (WPSS). Approximately five hundred (500) questionnaires were distributed to the faculty of these systems. Of these two hundred and forty-two (242) were returned for a return rate of 48 percent. The teaching level and system distributions are given in Table 1. In this study, there were 98 elementary school teachers, 42 middle school teachers, and 102 high school teachers. Furthermore, there were 101 teachers representing the urban school (MPSS), 68 teachers representing the urban/rural system (OPSS), and 73 teachers representing the rural system (WPSS), respectively. The study also consisted of by 42 males and 200 female teachers.

Table 1
Faculty Distributions

LEVEL	MCSS	OPSS	WPSS	TOTAL
Elementary	28	29	41	98
Middle	19	10	13	42
High School	54	29	19	102
TOTAL	101	68	73	242

The survey results documented the various levels of teaching experience. The distributions of experience level by system are shown in Table 2. The survey consisted of 14 new or first year teachers, 38 teachers with 2 to 5 years experience, 46 teachers with 6 to 10 years of experience, 33 teachers with 11 to 15 years of experience, and 110 teachers with 15 or more years of experience.

Table 2
Teacher Experience

Years	MCSS	OPSS	WPSS	TOTAL
0 - 1	6	2	6	14
2 - 5	17	9	12	38
6 -10	15	21	10	46
11.-15	14	10	9	33
15+	48	26	36	110
TOTAL	100	68	73	241 *

* One of the teachers did not respond to the question pertaining to teaching experience.

In summary, the two hundred and forty-two respondents, who returned the questionnaire for this research, adequately represented the three systems in each of the categories of teaching level, gender, and teaching experience.

Research Hypotheses

The research hypotheses of interest are multifaceted and consist of comparing the teacher's attitude toward technology by school system, teaching level, gender, and teaching experience. Friedman's two-way analysis of variance (ANOVA) by ranks was chosen as the statistical procedure for evaluating these hypotheses. This non-parametric procedure was chosen over other statistical methods so that we may circumvent any problems with the assumptions of these methods. Friedman's two-way ANOVA by ranks makes no assumptions and uses the ranks of the data rather than the data itself. The hypotheses of interest are:

Hypothesis 1: Teacher attitudes toward technology are not dependent on the system..
Hypothesis 2: Teacher attitudes toward technology are not dependent on the teaching level.
Hypotheses 3: Teacher attitudes toward technology are not dependent on gender differences.
Hypotheses 4: Teacher attitudes toward technology are not dependent on teaching experience.

Descriptive Statistics

The TAT subscales used in the evaluation and testing of these hypotheses are given in Table 3. Subscales F1, F3, and F7 relate to the teacher's attitude about e-mail, multimedia, and the WWW. Subscale F5 relates to attitudes on how technology can improve the teacher's productivity. Subscales F2, F4, and F8, on the other hand, represent the teacher's perception of the student's attitude toward e-mail,multimeadia, and the WWW. Subscale F6

Table 3
TAT version 1.1 Subscales

TAT Subscale	Description
F1	To me, e-mail is
F2	To my students, e-mail is
F3	To me, multimedia is
F4	To my students, multimedia is
F5	To me, my productivity is
F6	To my students, their productivity is
F7	To me, the WWW is
F8	To my students, the WWW is
F9	E-Mail in my classroom
F10	Computers are

relates to the teacher's perception of what technology can do for the productivity of their students, and subscales F9 and F10 relate to the teacher's attitude about e-mail in the classroom and to the teacher's general feelings about computers, respectively.

The data collected from this survey are summarized in Tables 4 through 7. Table 4 displays the average subscale values by school system; whereas, Tables 5, 6, and 7 display the average subscale values by grade level, gender, and teaching experience, respectively. The original data, quantified by the survey, ranged from 1 to 7,

Table 4

School Systems
Average Scaled TAT Scores

TAT Indices	MCSS	OPSS	WPSS
To me,			
F1: e-mail is	1.79	0.92	1.39
F3: multimedia is	2.36	1.84	2.12
F5: my productivity is	2.46	2.08	2.29
F7: the WWW is	2.40	1.78	2.22
To my students			
F2: e-mail is	0.88	0.61	0.74
F4: multimedia is	2.00	1.65	2.07
F6: their productivity is	2.23	2.04	2.40
F8: the WWW is	1.92	1.74	1.95
General			
F9:e-mail for the class is	0.53	0.16	0.34
F10: computers are	1.94	1.42	1.90

where 1 was a least favorable or a negative attitude and 7 was a most favorable or a positive attitude about the subscale being measured. A response of 4 represented an "I Don't Know" or "Not Sure" response. These values were recorded for the subscales of F1 through F8 and F10. Unlike these subscales, F9 was measured using a Likert scale with values ranging from 1 to 5 with 3 as the "I Don't Know" or "Not Sure" response and 1 for "Strongly Disagree" and 5 for "Strongly Agree." For this investigation, the data values were scaled to be centered about zero. For subscales F1 through F8 and F10 the values were scaled to -3 to 3. For subscale F9 the values scaled to -2 to 2. The most negative number represents the strongly disagree or the most negative attitude about the subscale; whereas, the most positive represents the strongly agree or the most positive attitude about the subscale.

Table 5
Grade Levels
Average Scaled TAT Scores

TAT Indices	ELEM	MIDDLE	HIGH
To me,			
F1: e-mail is	1.36	1.19	1.58
F3: multimedia is	2.08	2.44	2.08
F5: my productivity is	2.21	2.51	2.32
F7: the WWW is	2.03	2.31	2.26
To my students,			
F2: e-mail is	0.50	0.63	1.08
F4: multimedia is	1.88	2.04	1.94
F6: their productivity is	2.36	2.41	2.04
F8: the WWW is	1.66	2.02	2.04
General			
F9: e-mail for the class is	0.36	0.31	0.40
F10: computers are	1.82	1.87	1.71

Table 6
Gender
Average Scaled TAT Scores

TAT Indices	MALES	FEMALES
To me,		
F1: e-mail is	1.12	1.48
F3: multimedia is	1.61	2.25
F5: my productivity is	1.60	2.45
F7: the WWW is	2.05	2.20
To my students,		
F2: e-mail is 0.67	0.78	
F4: multimedia is	1.46	2.02
F6: their productivity is	1.39	2.40
F8: the WWW is	1.69	1.92
General		
F9: e-mail for the class is	0.37	0.39
F10: computers are	1.29	1.88

Results of the Study

The Friedman's nonparametric two-way analysis of variance by ranks test is used to evaluate the research hypotheses of this study. The two-way design developed by Friedman is the non-parametric extension to a two-way blocking design. The primary difference between the two designs lies in the fact that Friedman's analysis uses ranks; whereas, the block design uses quantitative or measured data. The blocks for the two-way ANOVA are represented by the TAT subscales F1 - F10 and the groups are represented by either school systems, teaching levels, gender, or teaching experience, depending of the hypothesis of interest. The data representing the cells of the two-way tables in this study are composed of TAT scores for each teacher in that category. In order to assess

Table 7
Teaching Experience Groups
Average Scaled TAT Scores

TAT Indices	0-1	2-5	6-10	11-15	16 or More
To me,					
F1: e-mail is	2.11	1.38	1.28	1.84	1.26
F3: multimedia is	2.59	2.02	2.21	2.44	1.98
F5: my productivity is	2.67	2.00	2.33	2.62	2.24
F7: the WWW is	2.61	2.03	2.04	2.57	2.09
To my students,					
F2: e-mail is	1.20	0.18	0.85	0.80	0.79
F4: multimedia is	2.09	1.60	2.16	2.17	1.83
F6: their productivity is	2.26	1.93	2.35	2.65	2.13
F8: the WWW is	2.36	1.58	1.94	2.31	1.73
General					
F9: e-mail for the class is	0.84	0.18	0.32	0.37	0.35
F10: computers are	2.02	1.75	1.72	1.98	1.71

average differences in the attitude of the teachers in our study, the data representing a cell in the two-way ANVOA were averaged prior to any analysis. The authors of this report felt that the average scaled values of the TAT subscales reflected the teacher's feelings about technology and as such these average feelings were used to evaluate the hypotheses of interest.

Systems. In this study, there were three types of systems - the urban system (MCSS), the urban/rural system (OPSS), and the rural system (WPSS). In this regard, the Friedman's anova by ranks indicated that a significant difference is present among the three types of school systems (χ^2 =15.80, p-value = 0.000). MCSS exhibited the largest average rank of 2.70; whereas, WPSS had the next largest rank of 2.30. OPSS had the smallest rank of 1.00. Tukey-Kramer's test indicated that MCSS's rank was significantly larger than OPSS's rank, and that the average rank of WPSS was not different for either MCSS or OPSS. Figure 1 depicts the average ranks by system.

Teaching Levels. When evaluating teaching levels, the data were divided into three mutually exclusive groups - elementary teachers, middle school teachers, and high school teachers. As with systems, the average TAT subscale score was used to represent the feelings about technology of the teachers in each of these three categories. The Friedman's two-way ANOVA indicated that a weak dependency on teaching levels is present (χ^2 =4.974, p-value = 0.083). Figure 2 depicts the average ranks by teaching level.

Figure 1

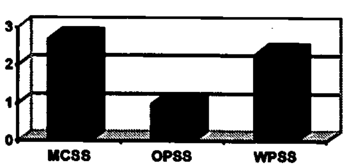
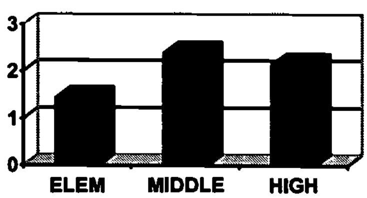


Figure 2



Gender. When evaluating gender differences, the data were divided into the two gender groups of Males and Females. The average TAT subscale was used to represent the feelings about technology of the male and female teachers. The two way anova by ranks indicated that the female teachers had a better attitude about technology than their male counterparts (χ^2 =10.00, p-value = 0.002). Figure 3 depicts the average ranks by gender.

Experience Levels. When evaluating differences in attitudes among the five teaching levels of 0-1 yrs, 2-5 yrs, 6-10 yrs, 11-15 yrs, and 15 or more years of experience, the average TAT score for each of the ten indices were used to represent the average feelings of teachers in each of these groups. The two-way ANOVA by ranks indicated that differences among the five groups are present (χ^2 =27.280, p-value = 0.000). Tukey-Kramer's technique indicated that groups 1 and 4 had the best attitudes toward technology and that they were better than groups 2, 3 and 5 which exhibited similar attitudes. Figure 4 shows the average ranks by experience level.

Figure 3

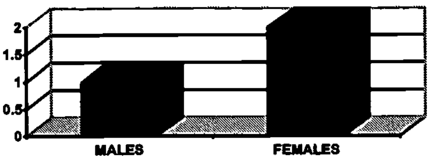
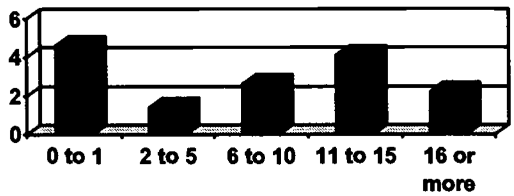


Figure 4



Summary

In conclusion, this study found that the average feelings of the teachers representing the three school systems did show that attitudinal differences about technology were present among the teachers representing these systems. The urban system (MCSS) teachers exhibited a better attitude when compared to the urban/rural (OPSS) and the rural system (WPSS). The survey indicated that the MCSS teachers' average attitude toward technology was 1.8 with a range of 0.53 (F2) to 2.46 (F5). WPSS averaged 1.6 with a range of 0.34 (F2) to 2.4 (F6); whereas, OPSS averaged 1.32 with a range of 0.16 (F2) to 2.08 (F5). Attitudes about e-mail were the lowest recorded values for the study. The teachers were not sure about what e-mail could do for their classroom or for their students. Overall the teachers representing the three systems felt optimist about technology; however, these feelings were not as positive as we hoped. The research showed that the he female teacher had a better attitude about technology than their male colleagues. The average attitude of the male teacher was 1.21 with a range of 0.27 to 2.05; whereas, the average attitude of the female teacher was 1.67 with a range of 0.39 to 2.5. Consistently, the male teachers had smaller averages than the female teachers on each of the TAT subscales. The analysis further indicated that a weak dependency on the teaching level is present. Elementary teachers have the lowest average score (1.5) when compared to their middle (1.7) and high school (1.6) colleagues. The TAT subscales for all groups ranged from 0.36 (F2) TO 2.51 (F5). When considering the category of experience levels, we a priori felt that the attitudes of the teachers would be decreasing over time. However, this was not the case. The first year teacher had the highest average 2.03 with a range of 0.84 (F2) to 2.7 (F5). The 2-5 year teachers had the lowest average of 1.4 with a range of 0.18 (F2) to 2.03 (F7). The 6-10 year teachers displayed an average of 1.6 with a range of 0.34 (F2) to 2.4 (F6). The 11 – 15 year teachers had an average of 1.9 with a range of 0.37 (F2) to 2.7 (F6); and lastly, the 16 or more years of experience teachers had an average of 1.5 with a range of 0.37 (F2) to 2.2 (F5).

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Student View of Classroom Technology Use

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Abstract: Nine schools in a large suburban school district were selected to receive training on the use of information technology. Teachers were trained to use the World Wide Web, create their own web pages, use Microsoft PowerPoint, and HyperStudio. Both teachers and a random sample of students were surveyed and interviewed near the end of the year regarding the use of instructional technology in their classrooms. Students seemed to be very aware of the use of technology in their classes. Classroom use of technology varies with grade level grouping K-2, 3-5, and 6-12. Teacher and student perceptions of how technology is used in the classroom were quite different. The use of computers seems to be greatly affected by location within the school and philosophy of each school, which varied with grade level.

Introduction

The Department of Education and Human Development of the State University of New York at Brockport is in its fifth year of a Goals2000 funded project to prepare pre-service teachers to use technology and to increase in-service teacher knowledge and use of technology. The project has involved placing hardware in individual schools, training teachers to use the hardware, networking the schools, setting up a listserv for communication, and having periodic meetings and mini-conferences. SUNY Brockport has been involved in both the in-service teacher training and primarily in the pre-service training of future teachers.

Each year the number of schools involved has increased. The first year, 1995 – 1996 involved the placement of hardware and training of a core of teachers in four schools on the use of the hardware, e-mail, and listserv. The focus during the first year was for each school to develop an operational definition of professional practice school, as it would be implemented at their site. The technology was used as a support communication among schools and SUNY Brockport.

The second year of the project, 1996 – 1997, involved the addition of three more schools and a focus on multimedia applications in the classroom. Teachers in participating schools were trained in the use of HyperStudio and encouraged to use it in their classrooms and with their students. Each of the participating schools continued to use the provided technology both for communication with other members of the project as well as for the development of multimedia presentations. During this second year a core of teachers at participating schools were also introduced to the Internet, the World Wide Web, and Netscape as resources for their teaching. The focus of training on the World Wide Web was on searching and retrieving information to be used by students and teachers.

In an attempt to encourage more use of Internet resources in the K-12 classrooms, the third year of the project, 1997 – 1998, added four more schools, and focused on introducing teachers to a World Wide Web subscription service developed by American Cybercasting, called Educational Structures. Teachers at each of the eleven participating schools were trained on the use of this new tool and encouraged to use it in their

classrooms. Pre-service teachers at SUNY Brockport were also trained on the use of Educational Structures in their classes at the college, so that they could serve as a resource for teachers in the schools to which they were assigned.

The fourth year and fifth years of the project, 1998 – 1999 and 1999 – 2000 continued to focus on helping teachers help their students use presentation graphics, either HyperStudio or PowerPoint and to increase their use of the World Wide Web. Teacher workshops and training sessions centered on learning to use the presentation software, using the WWW as a research medium, and using Microsoft FrontPage to create classroom web pages.

Evaluation Plan

Teacher Surveys

In order to evaluate the effectiveness of training in-service and pre-service teachers in the use of Educational Structures, the first author developed a Likert-Type questionnaire for teachers, interviewed a sample of teachers, and analyzed training records. Survey questionnaires focused mainly on the knowledge and use of Educational Structures and the World Wide Web in general. Data from district Technology Integration Teachers indicates what types of training were provided and the number of teachers attending. The Technology Office has also provided information regarding special requests by teachers for help with projects.

In addition, those in attendance evaluated the annual Mini-Conference through the use of Likert-Type survey response forms. The overall conference was evaluated as well as individual sessions.

Student Surveys

The authors developed three different student surveys, one for grades K – 2, one for grades 3 – 5, and one for grades 6 – 12. These surveys focused on the student's perceptions of how information technology, in general, and the World Wide Web, in particular, had been incorporated into their classes. Ninety-five students from grades K – 12 participated in the survey.

Seven students selected from different grade levels were also interviewed. The interview questions were based on the surveys and allowed the researchers to validate or further expand on the findings. The interviews were conducted one-on-one with randomly chosen students and responses were recorded verbatim.

Surveys in grades K – 2 were administered by their teachers and then returned to the researchers. Surveys were read to the students and they were asked to respond by placing a mark on the "happy face" indicating a "yes" or the "sad face" indicating a 'no." A total of 31 surveys were returned from the K – 2 level teachers to the researchers.

The researchers themselves administered the surveys to students in grades 3 – 5 and grades 6 – 12. Two of the researchers visited each high school, middle school and K – 5 school participating in the survey. Students were randomly chosen from each grade level and completed the surveys with the researchers out of the room.

The researchers randomly selected students to be interviewed from among those students who did not complete the survey. Each of the total of seven students was interviewed by one of the researchers in a one-on-one setting. The interviews lasted between ten and fifteen minutes. Responses were recorded verbatim and tape recorders were not used.

General Results

The following results are from the teacher surveys, data regarding training supplied by the Technology Integration Teachers and data from SUNY Brockport:

- A total of 256 teachers received training on Educational Structures.
- Approximately 300 students were involved in the project activities.
- 4 Teachers have developed and implemented HyperStudio based projects in their classrooms.
- One high school class and a group of elementary students each produced a HyperStudio presentation.
- In-service training of teachers on the use of technology, especially Internet access and HyperStudio, has rapidly migrated to the students. Students in several schools access and use information and images from the Internet in projects they do for classes.
- Teachers at one high school implemented an interdisciplinary authentic assessment program after receiving training through Goals 2000. They have reported high student achievement.
- The Goals 2000 grant has allowed the establishment of an electronic network within the school district. Schools that would not have been connected for years are already on-line because of equipment provided by the grant.
- Each school in the Goals 2000 project has developed their own model for implementing a Professional Practice School at their site. This bottom-up approach will make success more likely.
- Teachers and students have been accessing information and images from the Internet for use in lessons and class projects. Digital images have become a big part of student projects.
- Teachers are no longer "textbook bound." They are more confident in accessing current information from the Internet.
- All pre-service teachers learn to use e-mail and the listserv to facilitate communication with college faculty and teachers in the schools.
- A total of 195 pre-service elementary teachers received an average of 6 hours of training in the use of the World Wide Web and Educational Structures.
- Two schools in the project developed Student Teacher Manuals to be used with new student teachers.
- Student teachers at all project schools are included in all Goals 2000 activities creating more of a "community of learners."
- There has been a conscious coordination of the training of pre-service teachers at SUNY Brockport with the directions taken by the Goals 2000 project. There is a real sense of cooperation and involvement of all parties. Planning and ideas from the Goals 2000 Steering Committee are used in planning pre-service teacher training activities at SUNY Brockport

Teacher Use of the World Wide Web

The analysis of surveys returned by teachers involved with the Goals2000 project has indicated a substantial increase in the use of WWW resources in planning for instruction. Each of the teachers, working as part of the Goals2000 grant, has had at least one computer assigned to them. Due to location of rooms, telephone lines, network drops, and other infrastructure problems, not all of these have made it into the classrooms. In situations where the computers could not be located in the teacher's classroom, they were placed in a location within the school that would be convenient for the project teacher. Often, the telephone lines come into the main office and the teacher's room requiring computer placement at that location. As more and more schools are hooked up the wide area network in the district, more computers can be located in teacher classrooms.

Part of the problem in using Educational Structures and the World Wide Web as part of the classroom activities is that in many schools teachers only have a single computer in the classroom, if any. In several cases the computer is not in the classroom at all, but in the teachers room or the school office. The logistical

considerations severely limit full exploration of the power of the WWW and Educational Structures in the classroom.

Two of the most technologically advanced schools in the Greece Central School District are K-5 schools. These schools each have 4 or 5 computers in every classroom and the teachers are experienced in integrating the computer into their teaching. Another problem is that Educational Structures had only been designed with middle and high school students as the target population. American Cybercasting is presently expanding their materials to cover elementary students as well, but at the time the teachers were surveyed, the new materials were not available.

The middle and high schools tend to have a different philosophy regarding the use of technology and generally use a different configuration. The computers in these schools are located in media centers and computer labs and not in the classrooms. Students do use the WWW and Educational Structures in their work, but not in the classroom. As computer usage expands in the district, the middle and high schools will be equipped with at least one computer in each classroom making integration into teaching easier. Until that time, both teachers and students will continue to use computers as tools outside the classroom.

Teacher Perception of Instructional Technology Use

An analysis of the surveys returned by teachers involved with the Goals2000 project has indicated a substantial increase in the use of WWW resources in planning for instruction. Teachers indicated that they used computers mostly in their planning and preparing for classes. The surveys have provided the following information regarding teacher use of Educational Structures and the World Wide Web in general:

- Teachers responding to the survey used their computers between 1 and 5 hours per week with the World Wide Web.
- These teachers used the World Wide Web for class preparation and not for instruction or as part of work within the classroom.
- Teachers viewed World Wide Web use as a supplement to, not a replacement for, their usual teaching and preparation.

Student Perception of Instructional Technology Use

Analysis of student surveys and interviews indicated quite a different perception in the way instructional technology was used in their classrooms. It should be noted that student surveys focused on classroom use while teacher surveys focused on teacher use both in and out of the classroom. Differences in the use of technology were identified by grade level, with students in grades K –2 having different perceptions from those in grades 3 – 5 and 6 – 12. The student surveys and interviews produced the following broad perceptions.

Students in grades K – 2 use the computer anywhere from one to five days per week. They typically work alone at the computer and use it for practice, "games," and "typing stories" they have written. Videos and filmstrips are used often in classrooms with this age group, as are overhead projectors.

In grades 3 – 5 students use computers in their classrooms at least once per week. Students at these grade levels tend to work alone or with a partner. Some students use the computer for specialized purposes such as art. Students in this age group occasionally use the Internet. They also only occasionally watch videos or filmstrips. Interestingly students in grades 3 – 5 perceive their teachers as rarely using the overhead projector.

At the grade 6 – 12 level it was apparent that the teachers used the computers in the classroom more than the students. When students have a chance to use computers they work individually to "research, play games, e-mail, and type labs or other homework assignments." Most of the teachers and students used the

Internet in the classroom but it was usually the teacher who was in control. Filmstrips and videos were used occasionally and overhead projectors were used frequently. Teachers at these grade levels often give assignments that require the student to use a computer in some way, but that use must be outside the classroom.

Conclusions

The Goals2000 project has been successful in increasing the use of information technology both in and out of the classroom. Teachers are using the technology more than ever to prepare for their teaching. Teachers are also encouraging students to use the technology both for their own research and to prepare presentations for class. In a very short period of time teachers involved with the project have become very sophisticated computer users.

As a secondary outcome, teachers and technology integration teachers are looking at the placement of new computer equipment. The elementary classroom configuration with 4 to 5 computers in each classroom needs to be investigated for use at the middle and high schools. The location of computer labs, no matter how numerous, inhibits spontaneous use of information technology by students and prohibits its regular use as part of the instructional process by the teacher.

Students do indeed notice the technology being used in their classrooms regardless of their age and grade level. Many of the teachers actively use technology in their classes and some involve the students in such use. This occurs more frequently at the elementary grade levels than at the middle and high school levels. Students at the elementary level tend to use computers as part of their lesson while use at the middle and high school levels seems to have the teacher using it as a presentation device or model.

A final note. Over the 4 years of Goals2000 projects the Greece Central School District and the State University of New York College at Brockport have worked closely. The result of this affiliation has been the movement of more technology training into the college classroom and more use of pre-service teachers in the public school classrooms. Working closely with the school district has dramatically changed how we train and work with pre-service teachers.

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The Effects of Fifth Dimension on Preservice Teacher Beliefs

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Abstract: This research report summarizes the results of a study conducted on a group of undergraduates enrolled in an introductory preservice teacher education course. In this study participants were asked to respond to an open-ended instrument to determine their conceptions about teaching and learning before and after a field experience with public school children enrolled in the Fifth Dimension. Findings indicate the beliefs of preservice teachers change as a result of working in this technology rich environment.

Introduction

When preservice teachers enter teacher education programs they bring well established beliefs about teaching and learning. These preconceptions may be subject to change (Clark, 1988; Clark & Peterson, 1986; Florio-Ruane & Lensmire, 1990; Wilson, Konopak, & Readence, 1994) or may remain the same (Kagan, 1992; Weinstein, 1989, 1990). In several research reports, the findings indicate that teacher education programs have a limited impact on the beliefs of preservice teacher teachers (Finlayson & Cohen, 1967; Lortie, 1975; McDiarmid, 1990; Zeichner & Tabachnick, 1981). The influence of pretraining is more significant than formal training in pedagogy at the university level (Zeichner & Grant, 1981).

The degree to which teacher education programs impact preservice teachers is inconclusive. However, some research findings have revealed changes in preservice teachers' beliefs about teaching (Feiman-Nemser, McDiarmid, Melnick & Parker, 1989; Florio-Ruane & Lensmire, 1990; Tamir, 1991). Feiman-Nemser et al. (1989) investigated the preconceptions of preservice teachers and concluded that at entry-level, they defined teaching as telling whereas ending-level preservice teachers defined teaching as a more complex activity. Gibson (1972) found that the early part of the teacher education program seemed to significantly effect change in students' attitudes. Watter & Ginns (1995) concluded that college course work and student teaching may have some influence on teachers' sense of efficacy. The effects of field experiences on preservice teacher beliefs demands more research and analysis. What are the results when novices enroll in introductory level education courses that require a field component? How can we structure these experiences to ensure preservice teachers exit with more knowledge of the complexity of teaching and learning?

The Study

In this study we have drawn from the research of Gibson, Feiman-Nemser, and others to investigate the effects of an introductory course and its technology-rich field experience on the entry and ending level beliefs of preservice teachers. We utilized an open-ended instrument to determine students' conceptions about teaching and learning and to determine changes that might occur over time. Participants in the study consisted of 60 students enrolled in the introductory course CI – 2800 entitled Teachers, Schools, and Learners. These students were required to complete course work and a twelve week practicum in The Fifth Dimension which

operates in public school computer labs during the after school hours. Course content was closely linked to The Fifth Dimension through presentations, discussions, and reflections. The design of both CI – 2800 and The Fifth Dimension was based on the principles drawn from cultural-historical activity theory. Preservice teachers were expected to prepare weekly fieldnotes detailing their observations and interactions with children between the ages of five and twelve in this field experience. A website was designed for submitting, storing, and retrieving these reports.

Simple quantitative analysis was done to categorize the initial and final responses to two questions in this open-ended instrument – What is Teaching? and What is Learning? The belief survey was adapted from an instrument used at Michigan State University in their research on teacher education. It was modified for this study and has been used for three years with undergraduates at Appalachian. The value of this survey is based on the fact that it measures the attitudes of preservice teachers with regard to teaching and learning.

Qualitative analysis was used to examine the preservice teachers' fieldnotes submitted over a period of three months. These reflections gave insight into the daily events of The Fifth Dimension. Content of these fieldnotes included a description of the site, activities of the day, interactions with children, educational software selected for use, accomplishments in the lab, observations related to course content, reflections about their success with teaching, and documentation on the progress of the children.

We hypothesized that preservice teacher beliefs would be influenced by the course content and the connecting field experience.

Data Analysis

Data analysis included a comparison of the responses on the pretest and posttest on the belief survey consisting of two questions: What is teaching? and What is learning? The pretest was read to distinguish themes and to record the frequency of occurrence of these themes. The post test was read to determine whether or not identified themes on the pretest persisted and the frequency of these themes. The posttest was analyzed to determine any changes in the responses to these questions. Additionally, fieldnotes submitted by the preservice teachers were read and analyzed to distinguish themes and to determine the extent and kinds of changes that occurred as a result of interactions with children enrolled in The Fifth Dimension.

Three researchers examined the responses to the pretest and the posttest administered to the preservice teachers. Responses to the two questions were discussed and categorized. The charts below indicate initial and final explanations of teaching and learning.

What is Learning?

A total of 56 preservice teachers responded to "What is Learning?" at the beginning of the semester. The range of responses fell into the categories of passive/receptive, active, active and passive. The large majority of students (N=36) defined learning as"being able to take in new information" or the "ability to receive information" or "absorbing information" which clearly fit the passive/receptive category. Several responders, N=13, defined learning as an active process and explained further by saying "learning is receiving, processing, and using data" or "learning is having different experiences" in their explanations. Only seven students perceived learning as a combination of active and passive characteristics. Learning was described by this population as "integrating data from ones lived experiences…and assimilating the new information given them as best as their cognitive abilities facilitates" and "when some new concept is placed in your thought pattern… interacting with others and observing the events and things around."

A total of 58 preservice teachers responded to "What is Learning?" in the posttest. Following the CI-2800 course and its accompanying field experience in The Fifth Dimension, preservice teachers' ideas regarding learning revealed changes and new categories emerged. Four new categories were identified by the researchers. They included active and social, active and passive (combination) and social, constructing knowledge, and social only. A large number of respondents (N=15) maintained that learning is an active and a passive activity. Also, fifteen stated that learning is a combination of active and passive and social. Examples of their responses included "Learning is the process of retaining useful knowledge for your own educational benefit. Children learn better if they can see and touch. Students also learn from their peers in communities of practice." One defined learning as a process of constructing knowledge and said "children learn mostly by experiencing things—they like to work things out for themselves so that they can have a

working knowledge of something." Two saw learning as a social activity only and stated that "through the zone of proximal development, I can see how a competent guide can enrich the experience of the learner" and "I believe that for children to best retain their new knowledge, it has to be learned from a social context."

What is Learning?

Category	Pre	Post
Passive/Receptive	36	13
Active	13	10
Active & Social	0	2
Active & Passive (Combination)	7	15
Combination & Social	0	15
Constructing Knowledge	0	1
Social Only	0	2
Totals	56	58

Table 1: The responses to the pretest and posttest question "What is Learning?" are displayed in this table.

What is Teaching?

A total of 53 preservice teachers submitted responses to the pretest question "What is Teaching?" and seven additional responses were submitted for the posttest. The range of responses for the pretest were categorized into the areas of telling/transmission (N=33), helping (N=18), and strategies (N=2). The majority of responses identified teaching as a task of telling or transmitting knowledge and explained by stating that teaching is "passing of knowledge," "conveying information," "transferring all that you know," or "giving a person information." Several students submitted the idea that teaching is helping and explained by saying "teaching is helping a student understand" or "teaching is being able to help students learn." Two preservice teachers felt that teaching was "lecture and activities and experiments to get the students involved" and "methods ranging from field trips to guest speakers."

A total of 60 preservice teachers submitted responses to the posttest question "What is Teaching?" Five new categories including sharing (N=4), collaboration (N=3), zone of proximal development (N=2), and creating an environment (N=1) emerged. The majority of students consistently regarded teaching as telling/transmitting or helping at the conclusion of the study. In the new categories, four students defined teaching as sharing or "sharing ideas, thoughts, and facts in a way that the learners understand." Three students used collaboration as their definition and suggested that teaching is "collaborating in order to learn something and can occur between the teacher and the student, student to student, parent to student, or even parent to teacher." Two students explained that teaching is "expanding the child's zpd and getting the child to go beyond and do his best" and "teaching requires constructing zones of proximal development so children can reach their

potential and continue to grow and learn." One student focused on the environment and defined teaching as "creating an environment in which learning is possible."

What is Teaching?

Category	Pre	Post
Telling/Transmission	33	24
Helping	18	19
Sharing	0	4
Strategies	2	6
Making Children Understand	0	1
Collaboration	0	3
Z P D	0	2
Creating an Environment	0	1
Total	53	60

Table 2: The responses to the pretest and posttest question "What is Teaching?" are displayed in this table.

Conclusions

In this study university students enrolled in an introductory level teacher education course completed open-ended questionnaires to assess existing beliefs about teaching and learning and to determine if these beliefs would change over time. With regard to the question "What is Learning?" students initially held strong convictions that learning is a passive/receptive activity. These responses are consistent with the literature on preservice teachers' beliefs (Kagan, 1992; Holt-Reynolds, 1994). Although several students' responses revealed on the pretest and posttest that learning was passive, several began to restructure their definitions and began to perceive learning as a process that included a combination of activity and social interaction. The majority of responses revealed new or broadened definitions of learning.

Initial and final responses to the question "What is Teaching?" reveal some changes in the beliefs of preservice teachers. Teaching was initially perceived as a very one-sided, teacher directed activity. Although several responders maintained this definition evidence supports a change in the definitions of many. Preservice teachers began to address the role of the teacher as one who provides assistance, assesses the zone of proximal development of the learner, provides social interaction and collaborates in learning tasks. This reconceptualization is correlated with the principles of cultural historical activity theory instantiated in the CI-2800 course.

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Preschool Software: Developmentally Appropriate or Marketing Ploy?

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Abstract

This paper describes a study of software targeted to preschool children. Preservice teachers observed young children at work, reviewed the literature available on computers and young children, and interviewed early childhood and technology specialists, teachers, childcare providers, and parents regarding their beliefs about the appropriateness of computers with young children. Analysis is still in progress regarding specific software packages and their alignment with developmental benchmarks. Observations and interviews also focused on emerging gender stereotypes among young children.

Introduction

For a technology project in an elementary teacher education program at a mid-size university in the southwest preservice teachers investigated young children, three years old through Kindergarten age, and their use of the computer. Those working towards an early childhood endorsement or a reading/language arts specialization gathered data over two semesters for the teacher research project. The research question follow:

Questions:

The teacher researchers asked three questions for this project:

1. What are considered the major benchmarks of early childhood development according to teachers, childcare providers, parents, and experts in early childhood education?
2. Does computer software offer young children developmentally appropriate interactions?
3. What behaviors can be documented as young children interact with the computer? Are gender-based stereotypes evident at this age relevant to computer use?

Methodology/Investigation

Interviews with certified and non-certified teachers and specialists in early childhood, math, and science, was well as interviews with parents offered a large body of anecdotal information. Areas of inquiry included developmental benchmarks in young children, developmentally appropriate activities, gender preferences, time at the computer, and opinions and views about the software marketed for use with young children. In addition, preservice teacher researchers conducted a review of the literature on young children and computer usage and reviewed the NAEYC position statement entitled, *Technology and Young Children–Ages Three through Eight*. They also gathered over 120 hours of observational data of young children at the computer in a variety of educational settings, public and private.

Analyzing the anecdotal data from observations and interviews as well as data from the literature review, the preservice teachers constructed a rubric that included the constructs found in their collected data--age appropriate activities and abilities, preferences or interactions that appeared gender based, computer time, language interactions at the computer, and software characteristics. In addition, the commonalties among interview respondents were examined and summarized, noting similarities or discrepant information with the literature review.

Findings

Benchmarks for Early Childhood Development

Particular agreement among all respondents and the literature emphasized children's need for physical movement in daily activities. Respondents and the literature information emphasized that in physical actions, young children move through age appropriate skill development of fine motor, gross motor, social, and language abilities (Haugland 1996). Also, the development of self-identity and self-esteem at this young age were deemed important.

The characteristics by age in the development of young children have been well-documented and discussed in the literature. The chart on the following page illustrates some of the most common descriptors by age (NAEYC 1996).

The literature review and the degreed specialists had similar views about the benefits of monitored computer use for young children. Computer use should extend the child's learning and offer potential for growth in self-esteem, self-understanding, and problem solving (Samaras 1996). The common view in the literature, however, suggests a much shorter time frame for daily computer use than that discussed among the interviewees--20 minutes in the literature to 30-60 minutes by the interviewees.

Software and Developmentally Appropriate Interactions

Computer use in early childhood settings is both innovative and controversial. The two most common concerns are that computers are not developmentally appropriate for young children and that children working alone at a computer can become isolated and fail to develop social skills. At the same time there is agreement in the literature and among interviewees that computers offer important growth experiences for young children.

> Dr. S, a technology specialist, states that "*computers develop hand-eye coordination, abstract and cognitive thinking, problems solving, and exposure to vast information.*"

> According to daycare provider, Ms. L, "*Very young children have shown comfort and confidence using software. No longer do we need to ask whether the use of technology is developmentally appropriate.*"

> "*Computers should not take the place of experience, adult supervision is required, children should balance computer use with activities that use their five senses,*

Behaviors of Children Working with Computers

Observations of young children at the computer show a variety of interactions. In many situations, children worked amiably. At other times, the observed children worked at the computer in harmonius partnerships. At other times, observations showed conflict between partners, mostly stemming

	Physical Development	Social Development	Emotional Development	Cognitive Development
3 Years	Runs well, marches, stands on one foot, feeds self, puts on shoes and socks, unbuttons and buttons, pours from a pitcher	Enjoys being with others, takes turns knows if they are a boy or girl, likes to help in small ways	Likes to conform, has an easy going attitude, are more secure, has greater sense of identity, begins to be adventuresome, enjoys listening to music	Can say short sentences, great growth in communication, tells simple stories, wants to understands their environment, wants to answer questions, can count to 10, holds simple concepts, speech is usually grammatically correct.
4 Years	Skips on one foot cuts with scissors, can dress self, but not well, can throw a ball over handed	Engages in cooperative play, enjoys other children's company, plays loosly organized group games, is versatile	Seems to be sure of self, may be defiant, needs controlled freedom, seems to be testing self out.	Uses complete sentences, asks endless questions, learns to generalize, highly imaginative, dramatic, can draw recognizable simple objects knows his/her age, able to define common object in term of use and knows common opposites
5 Years	Hop and skip, dress without help, skate, print simple letters, tie shoes, girls small muscle developemnt is about one year ahead of boys	Has specilaized friends, highly organized, enjoys simple table games requiring turns and observing rules, feels pride in clothes and accomplishments	Selfpassured, well-adjusted, home-centered, likes to associate with their mother, enjoys responsibility, and likes to folow the rules.	Knows around 2072 words, can tell long tales, carries out directions well, asks the meaning of words and are beginning to know the difference Between fact and fiction, repeat sentences, can use description spontaneously, and can follow three commands given without interruption.

of the

mouse. In one observation, a five year old girl sat quietly in tolerance of the short-term partnership formed for a computer task until completion and then both boy and girl quickly dispersed to their gender groups. In boy/girl partnerships, observers noted cordial and conflicting partnerships. In some situations, the girl would defer to the boys leadership throughout the computer activity.

Emerging Gender Stereotypes

The existence of gender preferences in young children generated the most discrepant positions among the interviewees. Some see few if any differences between young girls and boys in behavior, play, or choices. Some see differences attributed to societal influences. And, some repsondents describe brain differences.

> While working in a threesome (two boys and a girl) on a computer lesson, the boys stated, "*Boys should be in charge because they work faster.*" Towards the end of the program being used there was a game format that the boys were interested in. After some patient waiting, the girl insisted that it was her turn at the keyboard. She went carefully through the remainder of the program and the teacher called the students back to a group activity with the group never getting to the game at the end. The girl walked away with a big grin.

The literature supports the view that in early childhood, there are few differences between genders in overall mental and motor development or specific areas of ability (Woolfolk 1998). Most research findings also agree that both boys and girls share an equal interest in computers at an early age. There does appear to be agreement that after approximately six years old, girls do not choose the computer as often as boys ( ).

Factors that appear to give boys the advantage when it comes to computer technology include 1) the software is often developed by males for males, 2) the boys' use of computer games outside of the classroom, 3) girls' deference to the boys during technolgoy based collaborative learning situations, 4) and the message girls receive that computer sciences and related fields are for boys (Aldridge 1999).

In one review, 36 software titles were reported for girls out of the thousands on the market, and none of those offered any appropriate math or sience instruction (Aldridge 1999).

To promote girls' involvement in technology, Aldridge (1999) suggests nine areas of focus.

- provide girls the opportunities for play and open-ended exploration on the computer,
- set rules for coed groups to ensure girls get equal opportunities to eprform the higher status computer based tasks,
- expose students to female roll models,
- give girls responsibilities for technology related situations,
- make sure that technology integrated lessons meet girls' social learning preferences,
- educate parents about the need to keep girls involved in technology,
- design lessons that challenge girls to think beyond the traditional language arts and into the domains of math and science,
- evalaute software and websites for appeal to girls, and
- involve girls in technology while they are still young.

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INSTRUCTIONAL SOFTWARE EVALUATION CRITERIA USED BY THE TEACHERS: IMPLICATIONS FROM THEORY TO PRACTICE

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Abstract: This study examines the perception of basic education school teachers on the theoretically developed educational software evaluation criteria from the viewpoint of actual users. Data was collected through structured interviews, group discussions and participant observation. The findings indicate that instructional adequacy is the most important criterion both from the theoretical and from the practical perspective.

Background

The age of technology carries with itself several requirements for all educational institutions to respond in order to keep up with it. On the other hand, evaluation of educational technology programs has its place as a particularly hard task among others. As there is an increase in the number of countries making efficient use of technology and developing technology plans and strategies to the aim of improving the quality of education and learning achievement, there rises the need for understanding the impact of technology on improving the student achievement.

The Ministry of National Education of the Republic of Turkey (MONE), like all other educational institutions, face the necessity of preparing students for the 21st century. Towards this objective, the Ministry has initiated a reform program, first step of which has been to extend the period of basic education from five to eight years. This reform program was legalized through the passage of the Basic Education Law No.4306 in 1997, which also enacted several additional revenues to finance the Government s Basic Education Program.

The Basic Education Program is the Government s action program to apply its new basic education strategy , the objectives of which are (a) to achieve universal coverage in an expanded eight-year basic education cycle, (b) to improve the quality of basic education, and (c) to make basic education schools a learning source for the community. The Program aims to achieve these objectives through (a) expanding the capacity of basic education schools throughout the country, (b) facilitating school attendance of children who are least likely to attend school, (c) reducing classroom overcrowding and double shifting, (d) improving training and incentives for teachers, (e) improving the supply of educational materials to basic education schools, (f) introducing computer-aided learning, and (g) increasing parental and community involvement in schools (World Bank, 1998).

Total estimated cost of this program is USD 11.2 billion for a total of three years. The aforementioned revenues would finance approximately 90% of the Program, and to respond to the remaining, a partnership has been established with the World Bank, which has mainly focused on the qualitative part of the Program. USD 300 million loan was received from the World Bank to finance the first phase of the whole Basic Education Program, which consists of renovation, rehabilitation and construction of additional facilities for 340 basic education schools in rural and slum areas, provision of instructional materials, textbooks, and stationary to those students in rural schools, and to provision of 2828 IT Rooms in 2451 basic education schools throughout the country. These 2451 schools have been selected from all provinces on the basis of at least two schools from each sub-province. The scope of the IT Component of the Basic Education Program will be expanded in the second and third phases to cover approximately 15,000 basic education schools located in Turkey.

To the aim of improving the quality of education, the Ministry of National Education has intended to provide all basic education schools with IT Rooms where children will become computer literate and work with computers to support their education (MONE, 1999). Since the objective is to put the technology into the use in all basic education schools, the IT Rooms have been designed to have, besides computers, overhead projectors

and some other technologies. In order to enable an efficient and full use of these technological equipment by the students and teachers, the Ministry has also aimed at providing all instructional materials to these schools, ranging from transparencies, educational video tapes, handbooks for teachers, and multimedia instructional software.

Amongst the Ministry s endeavor to create an effective learning environment for teachers and students, the provision of multimedia instructional software has had a very important place, since acquisition of software needs a very detailed examination and evaluation of the software submitted. The Ministry, as for the procurement of computer hardware and other technological equipment, has held an international competitive bidding for the procurement of multimedia instructional software. The preparation of the bidding documents, particularly of the technical specifications, has been done through a hard process, on the basis of a thorough literature review. The technical specifications, prepared in coordination with the specialists, have consisted of a detailed evaluation criteria based on national and international literature and applications, to be used for the procurement of educational software including multimedia instructional software in several subject areas between 1st-8th grades (English, German, French, Turkish, Science, Social Sciences, and Mathematics), electronic references, and educational games.

The criteria prepared by the MONE is based on four main areas; namely, (1) curriculum adequacy, (2) instructional adequacy, (3) programming adequacy, and (4) cosmetic adequacy. There are several items under each title, which are clearly defined and scored accordingly. The essential items within the criteria have consisted of consistency with the curriculum, adequacy to the pedagogical level of the students, ease of use, use of colors, etc, among which the consistency with the curriculum has been the primary one: Any software which could not respond to this item would not be taken to further evaluation.

Following the bid opening, the Ministry of National Education has established committees for technical evaluation of the multimedia instructional software submitted to the bidding. The committees consisted of subject area teachers who were currently working in the basic educational schools, subject area teachers who were currently working for the Board of Education of the MONE (a Board responsible for evaluating and approving any kind of instructional material to be utilized in primary and secondary education level), computer teachers, Turkish language teachers, and pedagogues. The committees have reviewed, evaluated, and scored accordingly a total of 230 instructional software within 6-month period. This period has also covered a fifteen-day basic training on multimedia instructional software evaluation. Those teachers participated in the technical evaluation committees were, then, asked for evaluating the criteria on which the technical evaluation has been based, and for providing recommendations from the perspective of practicing teachers.

The Study

The purpose of this study is to explore the applicability of the instructional software evaluation criteria developed for the acquisition of Multimedia Instructional Software by the Turkish Ministry of National Education. The study focuses on what teachers who have actively participated in the evaluation process have found most practical/feasible/applicable and what have found unnecessary or to-be- modified among those criteria developed on the basis of literature and theory.

For instructional software evaluation, there has been an crescent need for qualified human resources required, towards the provision of an efficient learning environment and the improvement of learning quality and achievement. This is also the case for Turkey. Besides, Turkey do not have a specific research institution specialized on software development or evaluation process. However, it is possible to obtain information from various researches on in-class use of technology (U.S. Department of Education, 1988) and other studies conducted by private software evaluation companies (Children Software Review, 1995). Among the features of a good instructional software, articles, dominantly, speaks of motivation, user control, Internet access, timely and efficient feedback, pedagogical adequacy, interactivity and instructional content (Hannefin & Pack, 1988; Alessi & Trollip, 1991; Comer & Geissler, 1998; Baumgartner & Payr, 1996; Persichitte, 1995; Caftori & Paprzcki, 1997; Abramson, 1998). Notwithstanding, the researches in this field, also forewarn the researchers about the application of a social science approach to the evaluation of multimedia products (Baumgartner & Payr, 1996; Reeves, 1993). Thus, it is essential to know how the literature-based educational software evaluation criteria differ from any other software evaluation criteria developed considering teaching experience and application of utmost importance and what the impact of such criteria on output is.

Instructional software evaluation criteria observed during the literature review have focused on the importance of instructional quality, which is one of the most significant among the Ministry s evaluation criteria.

The criteria observed have foreseen to support the instruction process through the use of several instructional strategies where computer use has the central role, via following such basic steps as stimuli, guidance, drill and practice, and assessment (Abramson, 1998).

Other essential issues emphasized in the literature, besides instructional content, have consisted of efficient and proper use of computers through the aim of related instructional objectives, being free of technical errors, and use of accurate engineering processes (Persichitte, 1995).

Some researches conducted as to the instructional software evaluation have been based on applying a supervision mechanism to some extent for the use of instructional software. Another relevant issue has been that some instructional software labeled as instructional or educational may not be instructional or educational at all, and those software may not serve to instructional or educational objectives. Hence, these researches point out the problem of evaluation and supervision, two important criteria in the use of instructional software. This brings another question: the necessity for taking into consideration some other criteria to enable the teacher to evaluate and supervise student use and achievement, along with student control (Caftori & Paprzcki, 1997).

Another problem taken into consideration in the researches concerned has been that the instructional software evaluation processes have not included professionals specialized on pedagogy. Similarly, those researches, which have revealed the problems encountered as to the instructional software evaluation methods, have recommended a social sciences approach to software evaluation process in order to overcome these problems (Baumgartner & Payr, 1996).

In view of these studies and researches, this study lays open to view the instructional software evaluation criteria prepared and utilized by the Ministry of National Education for the acquisition of off-the-shelf instructional software, through making use of qualitative research method. Information has been obtained from a group of those teachers participated in software evaluation process through interviews and open-ended questions. The study has also employed a variety of data collection methods ranging from documentary evidences to interpretation of the comments of the senior staff of the Ministry who are a part of the Ministry s education policy. Data analysis method used in this study consists of data examination, data reduction, data display, and finally conclusion drawing from specific to a more generalized (Miles & Huberman, 1994).

Results

As stated before, participants of this study are those teachers participated in the Ministry s multimedia instructional software procurement evaluation process. 10 volunteer participants were observed from the beginning of the evaluation process. Besides these observations, 10 participant teachers were asked to respond, in written, to four open-ended questions at the end of the evaluation. Responses to these questions have shown certain emphasis on certain issues as to the instructional software evaluation.

Responses to the first question, which is for determining the conditions, as a teacher, under which instructional software may be used, have pointed out that necessary physical conditions and hardware. Three of the participants have stated that it is essential to provide a computer per student for an efficient implementation of technology assisted instruction. Merely two of the participants have emphasized a re-arrangement of the curriculum, and an effective time management for technology assisted instruction. Quality of the instructional software, amount and variety of the instructional software to be used, and provision of in-service training to teachers on the use of instructional software to support educational activities are the factors disregarded by the participants.

The second question is related to criteria, to which instructional software has to respond, to be utilized for educational purposes. Participants responses to this question have concentrated on the criterion of being consistent with and supportive of the curriculum. The second factor mentioned has been that an effective instructional software should include examples from real life and simulations of abstract concepts in real life to allow the students these concepts with their actual lives. The criteria considered as having secondary importance have been the variety and number of exercises, aspect of developing students creativity and critical thinking capacity, presentation of accurate information, being free from scientific errors, individualizing learning, being in accordance with the pedagogical level of students, and being enriched through the use of a variety of sound effects, images, videos and animations. Content-related richness, motivation and technical features have only been emphasized by two participants.

The shortcomings observed in the evaluation process of the instructional software submitted for the Ministry s procurement process have included, primarily, consistency with the curriculum, being supportive to

the curriculum, proper use of Turkish language, proper use of audio-visual effects in required amount, and consistency with the pedagogical level of users. It has been stated that software s being free of technical errors shall prevent students disappointment and losing their motivation. It has also been emphasized that informing students of the objectives before the lesson shall have a positive impact on learning. In view of the fact that the participants have not mentioned about the provision of examples from real life and the use of effective simulations, which have been emphasized for the second question, it has been considered that the software submitted to the Ministry have responded well to these criteria.

The last question asked was related to the issues to be taken into consideration in the future phases of instructional software procurement and technology assisted instruction. Two answers to this question were emphasized much. The criterion of consistency with the pedagogical level of students has also been of utmost importance for this question. Another significant issue underlined by the participants has been the formal measures to be taken at the senior level and circulation or regulations to be issued by the Ministry. These participants have stated that the central Ministry should take necessary measures to ensure the efficient use of IT Rooms. Three of the participants have pointed out the necessity of strengthening local software production sector, supporting an increase in the number of software companies, and accordingly the number of software in the market, and ensuring competition among the software market. Issues having secondary importance have been stated as taking into consideration national conditions for software production, and as preparing the technical specification in more detail. Some participants have recommended as essential as having modern and contemporary content, ensuring interactivity with the student, and providing teacher training on the use of instructional software. Only one participant has emphasized the importance of having students views and comments during the software production and development process, since they are the actual users of the software. Another participant underlined the necessity of having a pilot application for efficient use of such a large-scale project.

Taking into consideration the socio-economic status of the participants and the schools where they were working, it has been observed that these participant teachers have been working in those schools attended by lower-middle-class children, and that, accordingly, they have not been familiar with technological applications. Hence, while participant teachers have been responding well to the efforts for technology assisted instruction, according to them, the provision of physical conditions and necessary hardware are the primary criteria for using technology in educational activities since they have had no opportunity for application. In parallel, participant teachers have stated that responsibility of expansion and of efficient implementation of computer literacy and technology assisted instruction has been of the Ministry, and emphasized the importance of teacher training and necessary formal measures for effective use of technology in education.

When we look at the Ministry s part, we see that the most essential criterion of an instructional software from the perspective of the senior staff of the Ministry has been the instructional content. Consistency with the curriculum, and at least being supportive of the curriculum, is of utmost importance for the central Ministry. The second important factor for the Ministry is the consistency with the national values of Turkish culture and presenting no deviation from the constitution of the Republic of Turkey. The written content and all other images, pictures and animation should also be respectful to these criteria. From the interviews, it has been seen that the senior Ministry staff considers teachers as the most essential factors and, believes in the importance of teacher training for an efficient implementation of technology assisted education. The provision of physical facilities and necessary hardware is of secondary importance to the Ministry because the Ministry assures that all physical conditions can be provided with no problem.

Conclusion

Those issues, received by the participant teachers both through observations and interviews, show no major deviation either from the literature or from the criteria prepared by the Ministry based on the literature. As stated in the literature, the participant teachers have emphasized most the importance of preventing the instructional and educational nature of the instructional software, of being supportive to the curriculum, of ensuring interactivity with the student, of motivating students, of reinforcing the students through the use of drills and exercises, and of having simulations to present abstract concepts to students.

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Correlations between Teacher Characteristics and Teacher Attitudes toward Multimedia Development among Teachers Utilizing the Multimedia Authoring Program, HyperStudio

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Abstract: This study examined possible correlations between certain teacher characteristics and teacher attitudes toward multimedia development among teacher creating multimedia projects in teacher-teams and with students, using HyperStudio. Information on personality type, age, gender, grade level, years of teaching, computer experience, and self-reported skill levels was collected from 123 teachers participating in a federally funded teacher training grant. This information was correlated with four separate constructs concerning teacher perceptions of the multimedia development process for both teacher-created and student-created projects. Analysis found few significant correlations between the attitude constructs and teacher characteristics. Only self-reported skill levels were consistently and positively correlated with teacher attitudes toward multimedia development. The conclusion is drawn that confidence in one's ability to utilize the software and hardware necessary to create self-authored multimedia projects is the primary factor in predicting attitudes and perceptions of multimedia development. It is suggested that such confidence can be fostered by proper training.

Introduction

This study (Sammons, 1999) proposed to examine the possible correlation between teacher characteristics – including personality type, demographics, self-reported computer skills, and computer experience in the classroom – with teacher attitudes and perceptions of self-authored multimedia. It has been suggested that integration of self-authored multimedia into the classroom will affect both student attitudes and student achievement, as students engage a subject by writing, recording, and illustrating in multimedia computer formats (Turner and Dipinto, 1992; Ayersman, 1996; Lachs and William, 1998). At least one study also suggests that the introduction of self-authored multimedia will influence teaching methods, with teachers working collaboratively as facilitators and mediators, with the students (Berg et al., 1998).

Subjects for this study were a group of more than 240 teachers who were participating in a federally funded Technology Innovation Challenge Grant obtained by the Blackfoot, Idaho, School District. The Challenge Grant has, as one of its goals, the training of teachers in the creation and integration of self-authored multimedia. The initial group of teachers represented teams from nearly 40 school districts within Idaho. Each team attended an intensive four-day training session in multimedia development in the summer of 1998. This training included sessions on flowcharting, storyboarding, authoring using HyperStudio software, as well as on using digital cameras, scanners, and image manipulation software.

Four attitude constructs were identified for this study; each of the four constructs were measured by means of an attitude survey distributed to the teams in the spring of 1999. These four constructs were (1) teachers' perceptions of the individual stages of multimedia development, based upon their development of multimedia projects within their teams; (2) teachers' perceptions of the individual stages of multimedia development, based on their integration of self-authored multimedia into their classrooms for student-created projects; (3) teachers' attitudes toward the cooperative activities required by the grant; and (4) teachers' attitudes toward integrating self-authored multimedia into their curricula. Additional information was gathered on teachers' gender, age, the number of years they have taught, the grade level they teach or area of responsibility within the school district, their previous computer and multimedia technology experience, and their self-reported skill level with the hardware and software provided by the grant. The

Myers-Briggs Personality Type Indicator (MBTI) was used to determine a personality type for each respondent. Each of the four attitude constructs were correlated with each of the demographic and computer experience variables.

Previous studies (Clark and Wheeler, 1994; Katch & Francis, 1995; Katz, 1992: Smith et al., 1995) have examined possible relationships between personality types and computer aptitude. Although none of these studies indicated that a certain personality type could be predicted to adopt computer technology more readily than others, Smith (et al., 1995) noted a tendency for Introverted/Sensing types to have more positive attitudes toward computer technology than other types. Clark and Wheeler (1994) noted a tendency, which was not statistically significant, for Judging types to achieve higher grades than Perceiving types on computer programming. They also noted that Sensing types had higher programming scores than did Intuiting types. The results of these studies encouraged us to examine whether personality types, as indicated by the MBTI, might be a factor in teacher attitudes toward self-authored multimedia programs, such as HyperStudio, and the development of multimedia projects.

Limitations of the Study

Because the study population was not selected at random, the results of this study cannot be taken as representative of the general teaching population nor even of teachers in Idaho. The study is also limited in that it does not account for every possible variable which might affect teacher attitudes toward multimedia development. Other factors which are not measured here might include support (or lack of support) for multimedia development from administrators and colleagues, personal and professional time available to development multimedia skills, individual cognitive styles, individual teaching styles, and the teachers' interactions with students.

However, by using grant participants as the study population, some external factors have been controlled. For example, the uniform nature and timing of the training provided by the grant lessens possible differences in basic skill levels or available technology among the participants. Each grant trainee was given the same suite of hardware and software, and each participated in one of six identical, week-long training sessions. Some participants may have greater skills levels, of course, but questionnaires during the first day of each session indicated that a majority of grant participants were completely novice to multimedia development and to HyperStudio in particular.

Another limitation of this study stems from the delivery and administration of the instruments. Because both the MBTI and the grant-created questionnaire were self-administered in the field, grant staff had little control over the timing, sequence, or environment of administration. A final limitation concerns the response rate. Although 244 MBTIs and surveys were sent to grant participants, only 117 MBTIs and 123 inventories were returned, a response rate of slightly less than 50%. The respondents are in some sense self-selecting and may not accurately represent the attitudes, perceptions, and experiences of the group as a whole. Thus, the conclusions of this research are confined to the respondents themselves. These conclusions are consistent with findings in previous research, however, (as summarized in Dupagne and Krendl, 1992, for example) and suggest possibilities for future research.

Method

Two instruments were distributed to the 244 teachers who participated in the grant's 1998 training sessions. The MBTI (Form G) and a grant-created inventory were sent to team leaders in the spring of 1999 with the request that the team leader oversee their completion and return. An equal number (123) of MBTIs and inventories were returned, but six of the MBTI forms were unsigned and could not be correlated with the inventory.

The grant-created inventory had six parts. The first part gathered demographic information from the participants: age, gender, years of teaching , primary responsibility in the school district, and grade level/subjects taught. Part II asked respondents to rate their skill level on each of the six computer skills relevant to multimedia development. Rating their skill level from *Low* to *Advanced*, participants were asked

to assess their capabilities with (1) their operating system, (2) Inspiration flowcharting software, (3) image manipulation software such as PhotoShop or PhotoStudio, (4) HyperStudio multimedia authoring software, (5) the digital camera, and (6) the scanner. All the software, the camera, and the scanner, as well as training in their use, were provided to the participants by the grant.

In Part III of the inventory, participants reported their experience with computer technology in their classroom (how many computers in the classroom, how many years had computers been used in their classrooms, how much time did students spend on computers at school) and their experience with multimedia authoring software. More than two-thirds of the respondents indicated that the grant training was their first experience with HyperStudio. In Part IV of the inventory, respondents were asked to assess the four stages of multimedia development as modeled for them during the summer training. First they were asked to rate brainstorming, flowcharting, storyboarding, and authoring (HyperStudio) as either simple/complex, easy/difficult/ and understandable/confusing based upon their development of multimedia projects within the teacher teams. Then they were asked to rate these four steps in terms of usefulness, effectiveness, and efficiency, based upon their integration of multimedia development into their classrooms for students projects. Part V of the inventory asked respondents to assess the cooperative nature of the teams' activities as determined by their perception of the team's collaboration on four team projects assigned by the grant. The final part of the inventory (Part VI) gathered information on the teachers' attitudes toward the importance of integrating self-authored multimedia programs into their classroom curricula.

Following receipt of the MBTIs and inventories, all forms were hand-scored and entered into spreadsheets by grant staff. MBTI categories were determined following scoring procedures provided by Consulting Psychologist Press, the publishers by the MBTI. Scores for the inventory were combined by constructs. In some cases, scores were grouped or averaged so that meaningful categories of responses could be obtained which would be suitable for chi-square analysis. For example, teacher ages ranged from 26 to 58. These data were grouped as 20-29, 30-39, 40-49, and 50-59 so that only four age groupings would be used for correlational analysis. Similarly, scores for the perceptions of the four stages of multimedia (a possible range of 1-4 on each construct for each stage for an overall possible range of 12-48) were also averaged and categorized as values 1 through 4. This grouping of data assured that there would be sufficient cases in each possible cell to warrant chi-square analysis.

Results

Descriptive Statistics

Results of the MBTI show that all sixteen personality types are represented among the grant respondents. The personality type that is most frequent, the ISFJ type, is over-represented in the grant population when that population is compared to normed general population samples as reported by Myers and McCaulley 91985). The ISFJ type is characterized as organized, dependable, and responsible. "ISFJs often choose careers where they can combine their careful observation and their caring for people," such as health professions or teaching (Myers and McCaulley, 1985, p. 27). Their tendency to be accurate and organized often places these individuals in supervisory roles. Previous studies (Smith et al., 1995; Clark and Wheeler, 1994) indicate that Introverted/Sensing and Judging types all display positive attitudes and aptitude for computer applications.

Demographic information from the respondents indicates that the typical respondent is between 40 and 49 years of age and is female. Most teachers in the group had ten or more years of teaching experience. While many of the respondents are elementary teachers (37.2%), most teachers among the respondents have middle or secondary schools responsibilities (48.9%, grades 6-12).

Descriptive statistics for each question, construct, and part of the grant inventory suggests that the teachers in this sample have a predominantly positive attitude toward the stages of multimedia development and toward integrating self-authored multimedia projects into their curricula. The respondents also had a strongly positive attitude toward the cooperative activities required by the grant and report that they too

would utilize a cooperative learning model in teaching or utilizing multimedia development in their classroom.

Inferential Statistics

Of all the correlations between the four attitude and perceptions constructs and the demographic and computer experience variables, most proved to be insignificant. There were, however, some very suggestive correlations which were found to be significant.

Teachers' perceptions of multimedia development, based on their team projects, did not demonstrate any significant relationship with personality type, gender, age, number of years teaching or grade level taught. The Sensing/Intuition preference scale, which is one of four scales along which the MBTI types are defined, shows a slight but definite positive correlation with this construct. Teachers' perception of multimedia development, based on their team projects, also correlated positively with self-reported levels of computer skills and with general computer technology experience.

Teachers' perceptions of multimedia development, based on their integration of self-authoring multimedia applications into their curricula, correlated with grade level taught. This correlation is moderate but definite, indicating that teachers in older grades (middle and secondary schools) generally found all four aspects of multimedia development to be more useful, effective, and efficient than did their elementary counterparts. This construct also correlated positively with self-reported computer skill ratings.

No relationship was found between any of the independent variables and the questions concerning attitudes toward the cooperative activities required by the grant.

Attitude toward integrating self-authored multimedia into classroom curricula did correlate slightly with number of years teacher and with general computer technology experience. Respondents who had taught ten years or less tended to demonstrate mixed responses to questions concerning multimedia integration. Respondents with 11 or more years of teaching tended to be more positive in their attitude. Respondents who had more experience integrating technology into their classrooms or who had more computers in their classrooms also tended to have more positive attitudes toward integration of self-authored multimedia. This construct also correlated positively with self-reported computer skill levels.

Conclusions

This study has provided evidence of positive correlations between teachers' attitudes toward the stages of multimedia development and toward multimedia integration, and teacher characteristics such as years of teaching, grade level taught, general computer technology experience, and self-reported computer skill levels. Of these variables, only the last correlates strongly with all three measures of teacher attitudes toward multimedia development.

Dupagne and Krendl (1992), in a summary of literature, found that most studies reported a positive correlation between attitude and experience. They also found that factors which negatively influence attitude include inadequate training. Cate and McNaull (1993) also found that level of training significantly affects attitude toward computer technology. Marcinkiewicz (1994, 1996) went beyond a simple correlation between training and attitude to infer that training fostered feelings of self-efficacy, and it was the sense of self-efficacy that improved attitude and performance. The results published here (also see Sammons 1999) support these previous studies. The strongest correlations occur between self-reported computer skills and attitudes toward multimedia development and integration. A majority of teachers rated their skill level as *High* or *Advanced* in all designated computer skills, except flowcharting software (Sammons 1999, Table 11). A majority of teachers also reported that they had less than a year's experience with HyperStudio and that they had learned multimedia development primarily through the grant training. How then did these teachers come to feel so comfortable with the different hardware and software necessary to author multimedia projects on their own and with students? It seems obvious that the answer to this question is: the training provided by the grant. Therefore, a logical inference is that positive attitudes toward

multimedia development and integration can be fostered by increasing practitioners' confidence in their ability to use the necessary programs and equipment. This confidence is increased by appropriate training.

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Integrating Technology at the Pre-Service Teacher Level: Examining the Process of Change

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Abstract: According to Shaw (1998) in his *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, "a large scale program of rigorous, systematic research on . . . educational technology . . . will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12). This paper provides a brief overview of a technology program designed to integrate emerging technologies into the teacher preparation curriculum at Texas Woman's University and then details the associated research (evaluation) endeavor. The program described below, as well as the accompanying research, is supported by a US Department of Education implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org).

Introduction

The Teacher Education Reform Movement has been at the forefront of debate in colleges of education for many years, and questions about how best to integrate technology into teacher education programs are often at the center of this debate. Recommendations range from efforts to convince student teachers to use e-mail to programs designed to infuse

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technology into every aspect of the teacher education curriculum. E-mail, listservs, and electronic dialogue journals are a few of the recent innovations tried by teacher education faculty in attempts to combat the isolation that preservice teachers often feel. Virtual workshops, out-of-field certification programs, and add-on technology courses have all been implemented with varying degrees of success. Finally, plans to integrate technology throughout the teacher education curriculum have been reported in increasing numbers over the past few years (Drazdowski, 1998; Parker, 1994; Shrum, 1998).

The efficacy of many of these efforts has been called into question. According to Shaw (1998) in his *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, "a large scale program of rigorous, systematic research on . . . educational technology . . . will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12 schools" (p. 115). In spite of these reservations, Shaw warns that "limitations in our current knowledge must not be used as an excuse to allow our schools to fall further behind other information-based institutions" (p. 125). Dusick (1998) and Roblyer (1998), among others, agree. While Dusick provides an egalitarian perspective arguing that computers must be placed in schools so that all students will have access (p. 12), Roblyer basically asserts that technology is here to stay whether or not we are prepared for it: "We have a multimedia future, the task at hand is to become fluent in our new native tongue" (p. 53).

An equally important task, as Shaw suggests, is the rigorous evaluation of the programs that we create in order to insure that our students achieve this fluency. However, it is difficult to assess and evaluate when there is no time to reflect, and as Blanchard (1999) claims, "try as we might, technology will not stand still long enough so it can be viewed and reviewed objectively" (p. 1). Since information technology is in constant flux, it becomes imperative to evaluate the use of educational technology as a process of change. A successful technology program is an adaptive one--one that adapts to individual as well as group differences in attitudes, skills, and availability, and one that can quickly accommodate emerging technologies.

This paper provides a brief overview of a technology program designed to integrate emerging technologies into the teacher preparation curriculum at Texas Woman's University and then details the associated research (evaluation) endeavor. The program described below, as well as the accompanying research, is supported by a U. S. Department of Education implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org).

The LINKS Program (Overview)

The Learning and Integrating New Knowledge and Skills (LINKS) program is designed to support the use of emerging technologies by pre-service teachers within an integrated context of meaningful learning. This context is the field-based teacher education program administered by the PDC, and the technology indicators are tied to specific requirements within that program. The five learner-centered proficiencies tested by the Examination for the Certification of Teachers (ExCET), the Texas Essential Knowledge and Skills (TEKS), and the Professional Development Appraisal System (PDAS) provide the framework for the field-based teacher education curriculum as well as the associated

technology requirement indicators. Competencies related to technology foundations, accessibility, productivity, and integration are documented through course portfolios, classroom logs, desktop conferencing, and professor validation. Students are introduced to specific technology indicators via whole group orientation to the TechTrek Website completing much of their coursework online, and these technology indicators are summarized in the Technology Passport. The Technology Passport assists students, as well as their professors and mentors, in determining and documenting progress toward and mastery of the required technology proficiencies.

The three strands of the LINKS program address the technology needs of future teachers by supporting their development as well as the associated development of mentor teachers and university faculty. Students in professional coursework receive specific instruction on campus as Interns I, II, and Residents as well as extended experience in the field. In field settings, LINKS personnel train technology resource personnel and mentor teachers how best to assist Interns and Residents with technology competencies. Professors of courses leading to certification are provided with technology support and training in the LINKS Center technology lab on the TWU campus. Students may use both university and school technology resources and training opportunities to advance their technology competencies.

The Research (Purpose and Instruments)

The LINKS Program research effort provides for the assessment of individual attitudes and competencies of pre-service teachers, mentor teachers, and instructors. These assessments, in turn, help program developers to refine the four cornerstones of the TechTrek program--foundations, connectivity, productivity, and integration.

Six instruments will be used during the course of this research in order to gather quantitative and qualitative data. These six instruments are (a) the Basic Technology Competencies for Educators (BTCE), (b) the Self-Evaluation Rubrics for Basic and Advanced Teacher Computer Use, (c) the Technology Needs Assessment Survey, (d) the Stages of Concern Questionnaire (SoCQ), (e) the Levels of Use Interview (LoU), and (f) the Open-Ended Statements of Concern.

As previously suggested, a successful technology program is a flexible one; therefore, studying the process of change becomes imperative as pre-service teachers adopt and adapt to the use of educational technology to meet the needs of their 21st century students. Three of the instruments listed above address this need.

The SoCQ, the LoU, and the Open-Ended Statements of Concern are all products of the Concerns-Based Adoption Model (CBAM) Project of the Research and Development Center for Teacher Education, University of Texas at Austin, and have been heavily used in the change literature (Fullan & Stiegelbauer, 1991; Fullan, 1993a; Fullan, 1993b, Hord et al, 1987). The CBAM accepts that change is a process and that the successful adoption of any innovation (in this case educational technology) depends on the attitudes, preceptions, and efforts of the individuals who are expected to use the innovation.

All of the instruments used in this study except the Levels of Use Interview will be administered electronically. Quantitative data will be imported into SPSS for analysis, and NUDIST will be used to facilitate the analysis of qualitative data.

The Basic Technology Competencies for Educators (BTCE)

The BTCE is a self-report summated rating scale which is divided into nine competency domains: (a) basic computer operations skills; (b) setup, maintenance, and troubleshooting of equipment; (c) word processing;
(d) spreadsheets; (e) database; (f) networking; (g) telecommunication; (h) media communication; and (i) social, legal, and ethical issues (Flowers, 1997). Within each domain five items are given. The fifth item is a summary for that dimension. This instrument measures basic technology competencies (foundations) and will be used as a repeated measure to evaluate participant and group progress.

Self-Evaluation Rubrics for Basic and Advanced Teacher Computer Use

The Self-Evaluation Rubrics for Basic and Advanced Teacher Computer Use involves seven dimensions that address basic computer use and ten dimensions that address Internet use. Each dimension includes four levels of performance. These dimensions variously represent basic teacher computer use (productivity), Internet use (connectivity), and advanced teacher computer use (integration). These rubrics will be repeated and used to assess progress. They can be found in *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms* (USDE, OERI, 1998), and permission to freely copy and use these rubrics is given.

The Technology Needs Assessment Survey

The Technology Needs Assessment Survey is also available from *An Educator's Guide to Evaluating the Useo of Technology in Schools and Classrooms*. It encompasses one hundred items divided into four areas: (a) personal technology background, (b) staff centered technology, (c) student centered technology, and (d) staff development activities. This measure will be administered only once with each group of participants.

The Stages of Concern Questionnaire (SoCQ)

The *Stages of Concern Questionnaire (SoCQ)* consists of 35 items that use a seven point Likert response form. Analysis of the data results in a profile of the subject's varying intensity of concern at seven distinct stages: (0) Awareness, (1) Informational, (2) Personal, (3) Management, (4) Consequence, (5) Collaboration, and (6) Refocusing (Hall, Wallace, & Gossett, 1973). These seven stages of concern reflect broader categories of self, task, and impact concerns, and the typical progression for the adoption of any innovation is from more intense informational and personal concerns (self), to more intense management concerns (task), and finally, to more intense consequence and collaboration concerns (impact). The individual is most vulnerable, and thus the innovation at greatest risk of failing, when personal concerns are intense. This questionnaire will be administered repeatedly in order to create individual and group profiles and evaluate progress toward innovation adoption.

The Levels of Use (LoU)

The *Level of Use (LoU)* data are collected by individual focused interviews. Analysis of the interview data results in the assignment of a Level of Use rating for each subject. These ratings are closely related to the seven stages of concern. There or three levels of *non* use—Level 0 (Non-Use), Level I (Orientation), and Level II (Preparation)—and five levels of use—Level III (Mechanical Use), Level IVA (Routine), Level IVB (Refinement), Level V (Integration), and Level VI (Renewal). Again, the typical progression for most individuals who are non-users at the introduction of an innovation is from less sophisticated behaviors focused on learning how to use the innovations and/or how to more efficiently manage the innovation to more sophisticated behaviors that reflect a concern for the effects of the innovation on one's students. This interview will be conducted twice in order to describe any behavioral changes.

The Open-Ended Statements of Concern

The Open-Ended Statements of Concern is essentially a writing prompt that provides participants with the opportunity to describe their concerns. They are requested to respond to the following question: When you think about educational technology in the classroom, what are your concerns? Since the SoCQ provides information on the intensity of certain concerns but not on the nature of those concerns, this qualitative procedure is used to increase the investigators' depth of understanding about particpants' concerns and will be administered along with the Stages of Concern Questionnaire.

Participants and Procedures

Participants will be the pre-service teachers enrolled in the normal curriculum of TWU's PDC as Interns or Residents, their mentor teachers in the field, and their University instructors (professors, graduate teaching assistants, adjuncts, and liaisons). All pre-service teachers will be expected to participate since self-evaluation and course evaluation are course requirements. Instructors from all parts of the campus who teach courses in the interdisciplinary program or in the education specialties and professional development sequence and all mentor teachers in the PDC's 11 consortium school districts will be invited to participate in this research.

30-40 mentor teachers and 15-20 instructors will be recruited each semester beginning in Spring 2000. Over the 5-semester course of the Preparing Tomorrow's Teachers to Use Technology implementation grant, 150-200 mentor teachers and 75-100 instructors will be involved. Participants will receive whole group, small group, and one-on-one assistance with their technology needs. In addition to advancing their own technology skills, both mentors and instructors will acquire an increased awareness of state-mandated teacher competencies.

Pre-service Teachers

Pre-service teachers will complete four measures: (a) the Basic Technology Proficiencies for Pre-Service Teachers; (b) the Self-Evaluation Rubrics for Basic Teacher Computer Use, for Advanced Computer Use, and for Internet Use; (c) the Stages of Concern Questionnaire; and (d) the Open-Ended Statements of Concern. Students will complete all of these measures at the beginning of each semester as they progress through the field-based teacher education program (three semesters). They will also complete all measures at the end of their final semester, resulting in a total of four repeated measures for each student. Profiles will be developed and evaluated each semester, and those students with high anxiety profiles (i.e., intense Stage 2 Personal concerns) will be contacted and offered appropriate one-on-one interventions. The overall program will be adjusted based on the aggregated results of these analyses. At the end of the three-semester program, ANOVA will be used to assess the overall effectiveness of the program.

University Faculty

Instructors will complete the SoCQ and the Open-Ended Statements of Concern, and they will be interviewed concerning their LoU. The SoCQ and the Open-Ended Statements of Concern will be adminstered during whole group training sessions once at the beginning and once at the end of the semester, and the Levels of Use interviews will be scheduled during these whole group session.

Involved instructors will participate in five whole-group professional development sessions, and if they choose, additional one-on-one sessions which meet their individual needs can be scheduled. The initial whole-group session will consist of an introduction to the LINKS Program and thus to the high levels of technology proficiency expected of pre-service teachers. The second session will be an exploration of the Internet in general, and the final three sessions will cover the use of BLACKBOARD--the University's Web-based course delivery template.

After initial data collection is complete, SoCQ profiles, LoU ratings, and Statements of Concern will all be reviewed in order to determine whether or not planned interventions are appropriate. After final data collection is complete, Wilcoxon Signed RanksTests will be run on the SoCQ and the LoU data in order to assess the practical and statistical significance of any changes. In addition, to the extent possible, these instructors will be followed for an additional semester to determine the scope of their use of the targetted innovation.

Mentor Teachers

Mentor teachers will complete all six measures. The procedures for collection and analysis of SoCQ, Open-Ended Statements of Concern, and LoU data will mirror those used with the instructors. In addition, mentors will complete both the Technology Needs Assessment (once) and The Self-Evaluation Rubrics (twice--once at the beginning and once at the end of the semester).

Mentor teachers will participate in six whole-group professional development sessions in which they will experience the four cornerstones of the LINKS Program—foundations, productivity, connectivity, and intergration—via a WebQuest. Individual needs

identified by Stages of Concern profiles and Open-Ended Statements of Concern will be addressed as needed.

The data from the Technology Needs Assessment will be analyzed along with the initial data from the SoCQ profiles, the LoU interviews, and the Open-Ended Statements of Concern in order to determine whether or not planned interventions are appropriate. If necessary, the overall program will be adjusted based on the aggregated results of these analyses. After final data collection is complete, Wilcoxon Signed Ranks Tests will be run on the SoCQ data, the LoU data, and the Self-Evaluation Rubrics in order to to assess the practical and statistical significance of any changes.

Significance

Concerns about individual attitudes and perceptions have been the focus of many recent research efforts. Medcalf-Davenport (1999) contends that pre-service teachers question the emphasis on technology integration instruction in their teacher preparation courses because they are often times not "exposed to the uses of any technology in the school classrooms as they observe and do field experience" (p. 1424). Medcalf-Davenport further contends that because of a lack of technology-trained faculty, many pre-service teachers do not have an opportunity to have teaching with technology modeled.

Pre-service teachers, in-service teachers, professors, instructors, and liaisons are busy people, and insufficient time is often cited as the reason for the slow integration of technology into the classroom or curriculum. When time is such a crucial element, interventions that do not address specific needs for specific groups of individuals fail. Each participant's concerns and needs must be assessed and promptly addressed in order to make the change process successful. According to Hall and Hord (1987), "the first step . . . is to develop a picture of how each staff member, as an individual, experiences the change process. Only then is it appropriate to aggregate the individuals and plan the change process for all involved staff' (p. 10). This research endeavor attempts to insure that the changes proposed by the LINKS Project are successful.

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Preservice Teachers' Perception of the Teachers' Role in the Classroom with Computers

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Abstract: This study investigated preservice teachers' perceptions of the teachers' role in the classroom with computers. The teachers' role was measured as teacher-centeredness and student-centeredness. The findings of the study showed that there was no significant difference between preservice teachers' perceptions of teacher-centered roles and their perceptions of student-centered roles in the classroom with computers. The preservice teachers perceived that they would likely to engage in teacher-centered activities and student-centered activities on a equal basis while teaching in classrooms with computers. Nevertheless, there was a significant difference between the preservice teachers' perceived teacher-centered computer use and the student-centered computer use. The preservice teachers would more likely to use the computer as a teacher-centered tool than as a student-centered tool.

Literature Review

In response to the challenge of the introduction of computers in educational settings, teacher education started to offer computer training courses to prepare preservice teachers for the successful use of technology in their future teaching practice. "College of education must have program requirements to insure adequate preparation for students to use the computer as a tool in their teaching" (Bitter, 1989; p. 34).

The successful use of technology in teaching practice, however, involves more than mastering computer skills. "Equally important are the beliefs and perceptions about computers in education that these future teachers take from their training" (Byrum & Cashman, 1993; p. 260).

Preservice teachers' beliefs and perceptions play a crucial role in shaping their teaching styles. Therefore, "understanding the belief structures of teachers and teacher candidates is essential to improving their professional preparation and teaching practices" (Pajares, 1992; p. 307). With computers becoming a part of the learning process in classroom settings, it is imperative to investigate preservice teachers' beliefs and perceptions of the teachers' role while teaching in the classroom with computers.

'The teachers' role' has been the major focus of the on-going discussion whether the computer could have an impact upon schools. Numerous reports recounted the failure for technology to bring changes to our educational system. "Computers by themselves did not lead to the restructuring of education" (Riel, 1980; p. 180). There has been an increasing awareness that "teachers' use of technology often forces it into traditional teaching paradigms that have

existed for decades" (Sprague, 1995; p. 52). To fulfill the potential of technology, there is a need to redefine the teachers' role and change existing teaching practice. "For computers to make a difference in how students experience schooling will require teachers and administrators to modify their concepts of appropriate and inappropriate teaching behaviors, to reprioritize the value of different types of instructional content, and to change habits and assumptions that guide their classroom and school management strategies (Becker, 1991; p. 8).

Teaching with computers requires a shift from the traditional teaching style. Computers changed the arrangement of classrooms (Chin & Hortin, 1993-94), social organization of student learning (Becker, 1985), and interactive patterns between teachers and students (Riel, 1989). Classrooms need to be arranged in a way so that students and teachers could move around for individual and group work. Computers facilitated more independent learning. Students assisted each other completing the learning task and solving problems collaboratively often with their teachers as partners. Students participated in the evaluation process and frequently evaluated each other' work. Teachers worked with individual students and small groups rather than directing the attention to the whole class. (Becker, 1985; Keirns, 1990; Riel, 1989; Sandholtz, 1990). "The direction of their change was toward child-centered rather than curriculum-centered instruction" (Dwyer, 1991; p. 50). The concurrent agreement is that the teachers' role has been shifted from an "information dispenser" to a "coach" (Sheingold & Hadley, 1990); from a "centralized authority" to a "decentralized facilitator" (Chin & Hortin, 1993-94), from a "sage on the stage" to a "guide at the side" (Cifuentes, 1997). "Technology forced a re-evaluation of the authoritative teacher role" (Chin & Hortin, 1993-94; p. 83).

This shift of the teachers' role has been a daunting task on the part of the teacher, which involves frustration and uneasiness at times. "In large part, teachers' uncertainty is based on lack of knowledge, but more significantly, on the fact that using computers will require some changes in the ways they've been teaching" (Preskill, 1988; p. 25). The shift of the teachers' role "brought deeply held beliefs about real schools into conflict with emergent awareness about instruction and learning" (Dwyer, Ringstaff, & Sandholtz, 1991; p. 50). Teachers had to confront their traditional beliefs about teaching and learning. As one teacher acknowledged: "As you work into using the computer in the classroom, you start questioning everything you have done in the past and wonder how you can adapt it to the computer. Then, you start questioning the whole concept of what you originally did" (Dwyer, Ringstaff, & Sandholtz, 1991; p. 50). Even with teachers who are willing to experiment with innovative technology. The change is slow, and sometimes includes temporary regression (Sandholtz, 1990; p. 35).

The discussion of the teachers' role shift has significant implication to teacher education. "The way that teachers teach is a product of their own schooling, training, and experiences as teachers" (Becker, 1991; p.8). It raises a key issue on how teacher education shall prepare preservice teachers for their future role teaching in the classroom with computers. "To realize any vision of smarter schooling by using technology, ...college of education must prepare teachers to use the technology...adequate teacher preparation is probably the most important determinant of success. (Hancock & Betts, 1994; p. 29). The challenge that faces

teacher education is to provide effective instructional technology (IT) training to preservice teachers so that they will develop appropriate teaching styles to function well while teaching with computers.

Up to date, research on preservice teachers in the field of educational computing primarily focused on their computer attitudes and computer competence (Beaver, 1990; Liu, 1990; Overbaugh & Reed, 1992; Reed & Overbaugh, 1993; Reed, Ervin, & Oughton, 1995; Savenye, 1993; Savenye, Davidson & Orr 1992). Nevertheless, it is imperative to investigate the beliefs and perceptions of preservice teachers in terms of the teacher's role in the classroom with computers. "There are good reasons why attempting to understand the beliefs of preservice teachers is essential to teacher education" (Pajares, 1992; p. 328). This study was designed to investigate preservice teachers' perceptions of the teachers' role in the classroom with computers.

The Purpose of the Study

This study investigated the following questions: (1) What are the preservice teachers' perceptions of the teachers' role in the classroom *with* computers? The preservice teachers' perception of the teachers' role is to be measured as teacher-centeredness and student-centeredness. (2) What are the preservice teachers' perceived computer use once placed in the classroom with computers? The preservice teachers' perceived computer use is to be measured as the teacher-centered computer use and the student-centered computer use. (3) Do the preservice teachers' perceptions of the teachers' role in classrooms *with* computers differ from their perceptions of the computer use in terms of teacher-centeredness and student-centeredness?

Method

Sample

This study was conducted at a public university in a territory of the United States in the Pacific Rim. The sample for this study was all the preservice teachers (N=78) who had completed all their course work and were ready for student teaching in the Fall 1999. All the 78 students participated in the survey. Out of 78 questionnaires, four were deemed not usable because of missing items.

Instrument

The data collection instrument for this study was a survey questionnaire adapted from the one originally developed by Bichelmeyer, Reinhart and Monson at the Indiana University to measure teachers' beliefs about the teachers' role teaching with technology (1997). The survey questionnaire contains three sections; (1) demographic information; (2) preservice teachers' perception of the teachers' role in the classroom with computers; (3) preservice teachers' perceived teacher-centered computer use and student-centered computer use.

Section 1 contained six items collecting subjects' personal information: (1) gender; (2) major; (3) birth date; (4) number of years at the university; (5) years of computer experience; (6) grade levels likely to teach.

Section 2 included 12 items on a likert scale (1-5) measuring preservice teachers' perception of the teachers' role in the classroom *with* computers. Six items dealt with teacher-centeredness while the other six items student-centeredness. Teacher-centeredness defined the teachers' role primarily as (1) planning instructional activities for the whole class; (2) being the main directing force in conducting the class; (3) keeping order and quiet in the classroom; (4) presenting lectures; (5) attending the class as a whole; (6) being the main resource in the student learning process. Student-centeredness defined the teachers' role primarily as (1) collaborating with students in planning lesson; (2) providing individualized learning objectives; (3) using authentic assessment methods; (4) evaluating students on individual basis; (5) including students in the evaluation process; (6) creating student sub-groups for class projects.

Section 3 collected data on preservice teachers' perception on how they will use computers specifically if once placed in the classroom with computers. Six items in this section were the teacher-centered computer use and six items were the student-centered computer use. The teacher-centered computer use was defined as teachers using computers to: (1) create instructional materials; (2) find resources; (3) communicate with others; (4) keep track of students' grades; (5) present information to the whole class; (6) provide computer enrichment activity. The student-centered computer use was defined as students using computers to (1) create learning resources; (2) find resources for learning activities; (3) communicate with others; (4) present information; (5) complete class projects; (6) engage in computer hands-on learning activities.

Data Analysis and Results

Data was analyzed by using SPSS (Statistical Package for Social Sciences).

(1) What are preservice teachers' perceptions of the teachers' role in the classroom *with* computers? Paired-sampled *ttest* was used to compare the means of preservice teachers' perceptions of the teacher-centered role and the student-centered role in the classroom with computers. The comparison showed that there was no significant difference ($t=.48$ $p>.05$) between preservice teachers' perceptions of the teacher-centered role ($M=4.1227$ $S.D.=.598$) and their perceptions of the student-centered role ($M=4.0926$ $S.D.=.672$).

(2) What are the preservice teachers' perceived computer uses? Means for the preservice teachers' perceived teacher-centered computer use and the student-centered computer use were compared. The comparison showed that there was a significant difference ($t=9.7$ $p<.05$) between preservice teachers' perceived teacher-centered computer uses ($M=4.0137$ $S.D.=.677$) and their perceived student-centered computer uses ($M=3.3659$ $S.D.=.718$).

(3) Do preservice teachers' perception of the teachers' role in the classroom with computers differ from their perceptions of the specific computer use? Paired-sampled *t test* was used to compare the means of preservice teachers' perception of teachers' role in classrooms *with* computers and their perceived computer uses. The test showed that preservice teachers' perception of the teacher-centered role did not differ significantly from their perceived teacher-centered computer use ($t=1.05$ $p>.05$). Preservice teachers' perception of the student-centered role differed significantly from their perceived student-centered computer use ($t=6.5$ $p=.000$).

Discussion

There was no significant difference on preservice teachers' perceptions between the teacher-centered role and the student-centered role in the classroom *with* computers, which indicated that these future teachers would likely engage in teacher-centered activities and student-centered activities on an equal basis while teaching in the classroom *with* computers. The preservice teachers did not take an exclusive stance on the teachers' role in the classroom with computers leaning towards the teacher-centered role or the student-centered role. It appeared that the preservice teachers considered that both roles were important and the two roles were complementary rather than exclusive to each other.

However, when tested on their perceived computer use, these preservice teachers shifted to the teacher-centered computer use. The data indicated that these preservice teachers would more likely to use the computer as a teacher-centered tool than a student-centered tool, thus creating a discrepancy between the perception and the practice. This discrepancy might be due to the fact that these preservice teachers became uncertain of the teachers' role in terms of the specific computer use. "Since classroom use of computers ...is still a relatively new idea, preservice teachers do not have many models from which to base their ideas on how to use computers and other technologies in their own classrooms" (Poole & Simonson, 1996; p. 145).

The preservice teachers' perception of the computer use might reflect the IT training they have received in teacher education. Although these preservice teachers have completed university IT courses, their IT training courses might expose them to more teacher-centered computer uses than student-centered computer uses. The student-centered computer use requires different strategies including scheduling the computer use, utilizing different classroom management skills, designing curriculum-related activities, and developing evaluation methods accordingly. These preservice teachers might not be feeling comfortable using the computer as a student-centered tool since it required strategies they had not yet developed.

The findings of this study touched a fundamental issue on IT training in teacher education. For years, teacher education has been wrestling with the issue of what counts for an effective IT training. "The issue now is how to structure the computer experience to prepare teachers to use computers most effectively" (Dugdale, 1994; p. 250). Teacher education have since adopted a variety of IT training models from offering the computer core course to integrating

the computer training into methods courses. Each model contributes to the preparation of preservice teachers' use of technology (Wang, in press).

Nevertheless, "Few courses relate teachers' delivery styles to what types of materials and activities they select and it is even more difficult to find courses that are addressing teaching styles and how they impact the use and misuse of technology" (Flake & Molina, 1995; p. 337). Teaching styles is an neglected component in IT training. IT training courses should explore and foster appropriate teaching styles involving the use of technology and present examples and models of the student-centered computer use. It is helpful to make it explicit the distinction between the teacher-centered computer use and the student-centered computer use. Preservice teachers' perception of the teachers role can be shaped and changed via intervention. Stuhlmann, Taylor, & LaHaye (1995) found that preservice teachers changed their traditional perception of the teachers' role by participating an innovative technology project. One participating student observed: "I have never had a teacher, in all of my grammar and high school, who did not stand up in the front and talk. Ms. LaHaye (the school teacher involved with the project) is the only teacher I have seen that didn't do that. It's wonderful the way she just stands in the back or on the side and watches us work" (p. 275).

Preservice teachers' IT training should be grounded in practice. There is a sizable gap between the university classroom and the real world. Teacher education should make efforts to seek connections with the real world. "Most schools of education offer coursework intended to prepare their graduates for using information technologies. While these courses are having a positive impact on later classroom practice, seeing technology used in a few university courses is insufficient for preparing knowledgeable consumers of technology. Students must have many models of effective technology use" (Hunt, 1995).

Field experience offers such a connection and should be an integrated component of IT training courses. Parkinson (1998) suggested that IT training courses should be taught through university-based component and the school-based component. "It needs to be borne in mind that the influence and importance of the school-based component is beyond dispute..." (p. 69). Students perceived that observation and participation in technology use in real classroom settings played a strong role in preparing them for the computer use in teaching practice (Handler, 1993). Opportunities should be created for students to visit school computer labs, observe computer use in real classroom situations and collaborate with classroom teachers to implement ideas of integrating the computer into the curriculum. Dugdale (1994) described a successful computer course incorporating field experiences. Students were required to design curriculum unit integrating the computer and implement their projects in the real classroom setting. Both students and practicing teachers considered the experience worthwhile and valuable.

Conclusion

This research provides baseline data on preservice teachers' perception of the teachers' role in the classroom in the Information Age. Teachers often teach the way they were taught. The goal of teacher education is not simply to produce graduates to fill up the pool of the teaching profession, but to produce qualified graduates who can make an impact on the extant educational system. Teacher education needs to restructure IT courses, exposing preservice teachers to innovative models of using technology and grounding IT training in practice so that the future teachers can be equipped with appropriate teaching styles to function effectively in the classroom with computers. "Our challenge is to provide a clear vision of how computers and technology can transform classroom instruction" (Wetzel, 1993; p. 335).

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Student Teachers' Perception and Practice of the Computer Use during the Practicum

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Abstract: This study investigated the student teachers perception and practice regarding the computer use during the practicum in terms of their teaching styles. The student teachers' teaching styles were measured as teacher-centeredness and student-centeredness. The result of the study showed that there was no significant difference between student teachers' perceptions of teacher-centered roles and their perceptions of student-centered roles teaching in the classroom with computers. The student teachers indicated that they would engage teacher-centered activities and student-centered activities on a equal basis while teaching in classrooms with computers. Nevertheless, the test showed that there was a significant difference between the student teachers' teacher-centered computer use and their student-centered computer use during the practicum. The student teachers used the computer significantly more as a teacher-centered tool than a student-centered tool.

Literature Review

It is a long and complicated process to prepare prospective teachers using technology in their future teaching practice. For more than a decade, teacher education has been offering computer training courses in the hope that the newly graduates would be confident and competent computer users once they are on job. "To realize any vision of smarter schooling by using technology, ...college of education must prepare teachers to use the technology. Adequate teacher preparation is probably the most important determinant of success" (Hancock & Betts, 1994; p. 29). Nevertheless, research indicates that the computer use of the newly graduates was low. When the newly graduates did use computers, their use fell into the traditional teaching practice and related to low level of instructional activities (Novak & Knowles, 1991; Olive, 1994).

It is far from an adequate training by simply teaching prospective teachers computer skills. The study by Diem (1989) found that the prospective teachers seemed to have mastered the necessary technical skills, however, they had difficulties incorporating computers in instructional activities. "They could identify parts of the computer....However, they could not delineate how the computer fit into their subject matter content areas" (p. 35). Dunn and Ridgway's studies (1991a, 1991b) yielded the same result. They found that prospective teachers could not embrace the wide range of instructional uses of computers although the majority of them reported that they did not experience problems technically while using the computer.

In order to successfully integrate computers in the teaching practice, it is imperative that prospective teachers develop appropriate teaching styles where computers can fit in to impact

student learning. Researchers were concerned about the prospective teachers' perception of the role of the computer in the learning process. The prospective teachers during the practicum (Dunn & Ridgway, 1991a, 1991b) did not consider the computer's role as a one to develop students' higher order thinking skills as much as a one to develop students' computer skills and they adopted the Noah's Ark' teaching style and would send students in pairs to get their "weekly dose of the computing" which were not related to their learning task.

Teaching with computers requires a shift from the traditional teaching style. Computers changed the arrangement of classrooms (Chin & Hortin, 1993-94), social organization of student learning (Becker, 1985), and interactive patterns between teachers and students (Riel, 1989). Classrooms need to be arranged in a way so that students and teachers could move around for individual and group work. Computers facilitated more independent learning. Students assisted each other completing the learning task and solving problems collaboratively often with their teachers as partners. Students participated in the evaluation process and frequently evaluated each other' work. Teachers worked with individual students and small groups rather than directing the attention to the whole class. (Becker, 1985; Keirns, 1990; Riel, 1989; Sandholtz, 1990). "The direction of their change was toward child-centered rather than curriculum-centered instruction" (Dwyer, 1991; p. 50).

Educators are aware that there is a need to redefine the teachers' role and revise extant teaching practice in order for computers to have an impact upon school curriculum. "Technology forced a re-evaluation of the authoritative teacher role" (Chin & Hortin, 1993-94; p. 83). Research found that technology-enriched classrooms tend to be more student-centered rather than teacher-centered. The concurrent agreement is that the teachers' role has been shifted from an "information dispenser" to a "coach" (Sheingold & Hadley, 1990); from a "centralized authority" to a "decentralized facilitator" (Chin & Hortin, 1993-94), and from a "sage on the stage" to a "guide at the side" (Cifuentes, 1997).

The discussion of the teachers' role shift has significant implication to teacher education. The instructional technology (IT) training in teacher education should reflect and lead the trend and edge in the field of educational computing. What are prospective teachers' perceptions of the teachers' role in the classroom with computers? How will they use computers when they are placed in the classroom with computers? The answers to these questions will help teacher education to adjust and improve their IT training courses accordingly.

Student teaching is a crucial period for education majors. Their experiences in this period help prepare their future teaching style. "It is in these experiences that education majors become acquainted with the realities of life in elementary and secondary classrooms, look for real-world connections to content presented in their university foundations and teaching methods classes, and develop their instructional and managerial skills" (Hunt, 1995; p. 37).

Research is scarce on student teachers in the field of educational computing. A few studies were conducted to examine this crucial period (Diem, 1989; Dunn & Ridgway, 1991a; 1991b; Downes, 1994; Wang & Holthaus, 1998-99). These studies mainly focused on student teachers' computer training adequacy and the frequency of their computer use during the practicum. While these research did attempt to investigate the pattern of the student teachers' computer use, the pattern was more often than not described by the types of software involved.

"Questions remain unanswered on the nature of student teachers' computer use" (Wang, 1999-2000). Up to date, no study has ever been conducted to evaluate the student teachers' perception of the teachers' role in the classroom with computers and their computer use in terms of teacher-centeredness and student-centeredness. This study was conducted to gain insight into student teachers' teaching style and their computer use during the practicum in terms of teacher-centeredness and student-centeredness.

The Purpose of the Study

This study investigated the following questions: (1) What are the student teachers' perceptions of the teachers' role in the classroom *with* computers? The student teachers' perception of the teachers' role is to be measured as teacher-centeredness and student-centeredness. (2) How did the student teachers use the computer during their practicum? The student teachers' computer use is to be measured as the teacher-centered computer use and the student-centered computer use. (3) Are there any differences between the student teachers' perception of the teachers' role and their practice of the computer use during the practicum?

Method

Sample

This setting for the study was at a public university in a territory of the United States in the Pacific Rim. The sample for this study was all the student teachers (N=48) who have completed student teaching in May 1999. A survey questionnaire was the data collection instrument for this study. The survey was adapted from the one originally developed by Bichelmeyer, Reinhart and Monson at the Indiana University to measure teachers' perceptions of the teachers' role in the classroom in the information age (1997). It contains three sections: (1) demographic information; (2) student teachers' perception of teachers' role in the classroom *with* computers; (3) student teachers' computer use during the practicum.

Instrument

The data collection instrument for this study was a survey questionnaire adapted from the one originally developed by Bichelmeyer, Reinhart and Monson at the Indiana University to measure teachers' beliefs about the teachers' role teaching with technology. The survey questionnaire contains three sections; (1) Demographic Information; (2) Student Teachers' Perception of the Teachers' Role in the Classroom with Computers; (3) Student teachers' perceived teacher-centered computer use and student-centered computer use.

Section 1 contained six items collecting subjects' personal information (1) gender; (2) major; (3) birth date; (4) number of years at the university; (5) years of computer experience; (6) grade levels likely to teach.

Section 2 included 12 items on a likert scale (1-5 points) measuring student teachers' perceptions of the teachers' role in the classroom *with* computers. Six items dealt with teacher-centeredness while the other six items student-centeredness. Teacher-centeredness defined the teachers' role primarily as (1) planning instructional activities for the whole class; (2) being the main directing force in conducting the class; (3) keeping order and quiet in the classroom, (4) presenting lectures; (5) attending the class as a whole; (6) being the main resource in the student learning process. Student-centeredness defined teachers' role as (1) collaborating with students in planning lessons; (2) providing individualized learning objectives; (3) using authentic assessment methods; (4) evaluating students on individual basis; (5) including students in the evaluation process; and (6) creating student sub-groups for class projects.

Section 3 collected data on the student teachers' computer use during the practicum. Six items in this section were teacher-centered computer use and six items were student-centered computer use. The teacher-centered computer use was defined as teachers using computers to (1) create instructional materials; (2) find resources; (3) communicate with others; (4) keep track of students' grades; (5) present information to the class; and (6) provide computer enrichment activity. The student-centered computer use was defined as students using computers to (1) create learning resources; (2) find resources for learning activities; (3) communicate with others; (4) present information; (5) complete class projects; and (6) engage in computer hands-on learning activities.

Data Analysis and Results

Data was analyzed by using SPSS (Statistical Package for Social Sciences).

(1) What are student teachers' perceptions of the teachers' role in the classroom *with* computers? Paired-sampled *ttest* was used to compare the means of student teachers' perceptions of the teacher-centered role and the student-centered role in the classroom with computers. The comparison showed that there was no significant difference ($t=.48$ $p>.05$) between student teachers' perceptions of teacher-centered roles ($M=3.8704$ S.D.=.856) and their perceptions of student-centered roles ($M=3.8407$ S.D.=..864) in the classroom with computers.

(2) What was the student teachers' computer use during the practicum in terms of teacher-centeredness and student-centeredness? Paired-sampled *ttest* was used to compare means for the student teachers' teacher-centered computer use and the student-centered computer use. The comparison showed that there was a significant difference ($t=7.48$ $p=.000$) between the student teachers' teacher-centered computer use ($M=3.2037$ S.D.=.1.113) and the student-centered computer use ($M=2.1905$ S.D.=.1.096).

(3) Do the student teachers' perception of the teachers' role in the classroom with computers differ from their practice of the computer use during the practicum? Paired-sampled *t test* was used to compare the means of the student teachers' perception of the teachers' role and their computer use during the practicum. The comparison showed that there was a

significant difference between student teachers' perceptions of the teacher-centered role in classrooms with computers and their teacher-centered computer use ($t= 3.62$ $p=.001$). There was a significant difference between student-teachers' perceptions of the student-centered role in classrooms with computers and their student-centered computer use during the practicum ($t= 8.78$ $p=.000$).

Discussion

The student teachers in this study perceived no significant difference between the teacher-centered role and the student-centered role in classrooms with computers. The data indicated that they would likely to engage teacher-centered activities as well as student-centered activities in classrooms with computers. These student teachers seemed to prefer a combined teaching-style which balanced teacher-centered activities and student-centered activities rather than a dichotomous teaching style leaning towards teacher-centeredness or student-centeredness. They considered the two types of teaching styles are complimentary rather than exclusive to each other.

This result was confirmed by Bichelmeyer's study (1997). Bichelmeyer's study measured the practicing teachers' perception of the teacher' role in the classroom with computers. Her study showed that teachers perceived no significant difference between the teacher-centered role and the student-centered role in the classroom with computers. The participants in both studies did not appear to share the popular belief that the availability of technology in the classroom changes the teacher-centered teaching style completely to the student-centered teaching style.

Although the student teachers perceived no significant difference between the teacher-centered role and the student-centered role in the classroom with computers, their computer use during the practicum revealed quite a different picture. There was a huge gap between the teacher-centered computer use and the student-centered computer use. These student teachers used the computer significantly more as a teacher-centered tool than a student-centered tool. There are several possibilities that might explain this discrepancy.

One possibility was that these student teachers lacked strategies to use the computer as a student-centered tool. Although these student teachers had completed university IT courses, their IT courses might get them to the level of using computers as a teacher-centered tool, but not a student-centered tool. The student-centered computer use requires different strategies including scheduling the computer use, using different classroom management skills, designing curriculum-related activities, and developing evaluation methods accordingly. Their computer use might reflect their IT training orientation which exposed them adequately to the teacher-centered computer use, but not the student-centered computer use. "Few courses relate teachers' delivery styles to what types of materials and activities they select and it is even more difficult to find courses that are addressing teaching styles and how they impact the use and misuse of technology" (Flake & Molina, 1995; p. 337).

The student-centered computer use develops through practice. Downes (1993) observed the student teachers' computer use throughout three practicums and noticed there were shifts in the way student teachers' using computers with students. Student teachers' computer use with students progressed from Practicum 1 to Practicum 3. University IT training courses should be grounded in practice. Parkinson (1998) suggested that IT training courses should be taught through university-based component and the school-based component. "It needs to be borne in mind that the influence and importance of the school-based component is beyond dispute - certainly with student teachers" (p. 69). Field experience should be an integrated component of IT courses. Prospective teachers should be offered opportunities to observe how classrooms teachers use computers with students and be able to practice computer uses in real classroom settings.

Practicum school environments play a central role influencing student teachers' computer use (Downes, 1994; Pakinson, 1998; Wang & Holthaus, 1998-99). Student teachers need a supportive practicum environment to be able to use computers with students. "Practicing teachers are role models for student teachers. Student teachers learn from their cooperating teachers as well as other practicing teachers they observe" (Wang & Holthaus, 1998-99). Student teachers are facing many challenges as they are trying to cope with their first experience in the real classroom setting. Often they are mentored into the culture of the practicum school. "Pressure existed on student teachers to conform to the instructional patterns of their cooperating teachers. If the cooperating teachers did not use the computer as part of their instruction, the student teachers did not have models to follow" (Diem, 1989; p. 35).

Hardware and software resources in practicum might be another reason why the student-centered computer use was low in this study. Although the abundance of hardware and software does not necessarily determine the student teacher' computer use, using computers with students is demanding on the availability and convenient access to computer hardware and software. Most practicum schools in this study have limited computer resources. On one hand, limited resources present difficulties that hinder the student teachers' computer use. On the other hand, it is a challenge to teacher education to prepare prospective teachers how to utilize limited IT resources in schools to its maximum to enhance the quality of teaching and learning.

There was a discrepancy between the student teachers' perception of their teaching styles and the practice of their teaching styles. This discrepancy might also be an indication that student teachers would take a balanced approach in terms of the teacher-centered computer and the student-centered computer use if they were not constrained by external circumstances. On the other hand, it might indicate that student teachers would always perform lower than they themselves expect due to "external circumstances or those over which they have no control unless they are extraordinarily motivated" (Marcinkiewicz, 1994-95; p. 194).

Conclusion

This research is the first attempt to investigate the student teachers' perception and practice of the computer use during the practicum in terms of their teaching styles. The findings of this study have important implications to teacher education IT programs. IT courses at the university should lead the trend and edge of IT practices in the classroom instead of lagging behind it. Teacher education needs to offer IT courses that emphasize the appropriate teaching styles regarding the computer use and expose prospective teachers to strategies and models

of student-centered computer use. It would be a nightmare if our graduates have to undo what they have been trained in teacher education programs once placed in classrooms with technology.

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Attitudes of prospective high school mathematics teachers towards integrating information technologies in their future teaching

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Introduction

Hundreds of papers are published nowadays arguing that computers have become an integral part of our lives and, as such, should be integrated into educational systems as well (Cf. Eden, Eisenberg, Fischer and Repenning, 1996; Edelson, Pea and Gomez, 1996; Flake, 1996). Since such integration requires a change in teaching methods, teachers play a central role in such a transition. Of course, this is also true in regard to teaching of mathematics.

There are many benefits in using computers in our math classes (Cf. Sfard and Leron, 1996). However, as it turns out, the number of high school mathematics teachers who integrate computers into their math classes remains relatively low.

This paper tries to explain why this is so, by analyzing the attitudes of prospective high school mathematics teachers towards integration of computers in their future math classes.

Background

Data presented in this paper have been collected during these past three years (1996-1998). During that time, I have been teaching courses about integrating computers in the teaching of mathematics for prospective high school mathematics teachers. In the course, the prospective teachers work with, and experience, both general computational environments (such as the Web), and mathematical software tools (such as dynamic geometry environments). Since no one can guaranty that the specific computational environments that the prospective teachers meet in the course will be used in the future, emphasis is placed on general principles and ideas of integrating computers in math learning and teaching.

The course takes place in a computer lab. Most of the time, the prospective teachers work on activities in pairs in one of the computational environments, guided by worksheets I prepared in advance. Each class session ends with a class discussion and reflection of what was learnt during the lesson. On the one hand these discussions address mathematical topics, and on the other hand, they address pedagogical issues (mainly, cognitive and social ones). Assignments in the course include planning of activities for high-school pupils in the various computational environments, reading papers and submitting theoretical discussions.

Data presented in this paper was gathered from four classes of prospective high school mathematics teachers (total of ninety-four prospective teachers). The issue of pros and cons the integration of computers into mathematics classes was the subject of written questionnaires and of class discussions.

Results

The analysis of the prospective teachers' pro and con arguments about integrating computer activities in their future teaching of mathematics, revealed the following two-dimensional theoretical framework:

	learner	teacher	mathematical content	learning environment	class atmosphere
cognitive factors					
affective factors					
social factors					

In what follows I present the arguments according to the five categories which represents the class's components, that is: the learners, the teacher, the learning material, the class atmosphere and the learning environment. I briefly explain what each category means and present pro and con arguments in each category, in relation to most of the psychological aspects, as presented by the prospective teachers. For reasons of space limitation, I only present a sample of the arguments here. Additional arguments will be presented in the talk.

Arguments focused on the learner: In this category there are arguments the subject of which are: pupils' ways of thinking, pupils' system of learning-values, and students' attitudes and behaviors.

SAMPLE OF PRO ARGUMENTS	*SAMPLE OF CON ARGUMENTS*
Cognitive aspect: Learners can conjecture, check their conjectures, improve their solution without being embarrassed when making a mistake, work in teams conducting a "mathematical conversation", and explore mathematical ideas guided by the extent of their curiosity. All this is done when learners know that the teacher is in the class if additional help is required.	***Cognitive aspect:*** Some of the may progress without understanding previous stages. ***Affective aspect:*** Some students may feel they have too much freedom.

Arguments focused on the teacher: Interestingly, in this category most of the prospective teachers' arguments were *con* arguments. A plausible explanation for this fact is that the prospective teachers do not feel secure in this mode of teaching. Indeed, in the table below we can see that most of their worries deal with the teacher's role in a class that learns with computers. In my opinion, the imbalance between the pro and con arguments presented in this category is significant, and may partially explain avoidance of the part of some teachers of integrating computers in schools in general and in mathematics classes in particular.

SAMPLE OF PRO ARGUMENTS	*SAMPLE OF CON ARGUMENTS*
Cognitive aspect: The teacher becomes a guide and is not the focus of the lesson anymore. Moreover, being released from his or her traditional centered role, the teacher can follow the work of the students by looking at the computer screens.	***Cognitive aspect:*** The computer becomes the class's "brain". The teacher's role is simply to navigate, guide, and connect students' knowledge with official mathematical knowledge. ***Affective aspect:*** The computer is conceived as being more clever than the teacher because of its numerous abilities and the fact that it does not make mistakes. ***Social aspect:*** Lessons in computer labs are not carried out in the traditional manner and traditional obedience is replaced with some noise. As a result, teacher control and authority are lost.

Arguments focused on mathematical content: In this category there are arguments whose focus is on mathematics. The fact that the prospective teachers present *mathematics* as the subject of their arguments is important since such arguments deal with abstract ideas and topics.

SAMPLE OF PRO ARGUMENTS	*SAMPLE OF CON ARGUMENTS*
Cognitive aspect: The way mathematical ideas are represented	***Cognitive aspect:***

on the computer stimulates the pupils' thinking, leads them to connect among mathematical topics and enables them to think broadly without being distracted by technical problems. Moreover, the fact that computers may serve as cognitive partners influences the kind of activities suggested to pupils, such as multi-solution problems. Such problems encourage pupils' creativity, motivation and inventiveness and improve their mathematical thinking.	Since learning with computers emphasizes learning processes over final results, it is much more difficult to assess pupils' knowledge.

Arguments focused on the learning environment: Arguments in this category deal with the nature of learning with computers and with the barriers and opportunities one encounters when learning with computers.

SAMPLE OF PRO ARGUMENTS	*SAMPLE OF CON ARGUMENTS*
Cognitive aspect: Computers provide a world of mathematical experiences, personal experience for all students and an ability to see, feel, move, construct and manipulate "things".	***Social aspect:*** These kinds of problems are mainly connected with the school system: Sometimes computer labs are not available; in other cases – there are not enough computers and it is necessary for five pupils to share one computer.

Arguments focused on the class atmosphere: The prospective teachers' arguments in this category refer to those things going on during a lesson based on computer activities.

SAMPLE OF PRO ARGUMENTS	*SAMPLE OF CON ARGUMENTS*
Social aspect: Computers provide: - A possibility to communicate with pupils around the world. - An opportunity for classmates to work in teams and to collaborate.	***Social aspect:*** Since computers are expensive, not all pupils may be able to afford them. Thus, those pupils who have computers at home may progress faster than pupils who do not, and therefore will have an advantage over those who do not own PCs.

Discussion

The above analysis describes prospective teachers' attitudes towards the integration of computers in their future teaching of mathematics. From the prospective teachers' answers we can learn that they refer to the main participants of the lesson: Learners, teachers and the learning material, and to the interaction among them: the learning environment and the class atmosphere. Moreover, we can see that the presented arguments deal both with cognitive, social and affective aspects. It is interesting to

note that in many of the written responses, after specifying the pro arguments and the con arguments, many of the prospective teachers have added a remark in the following spirit: *It is worth integrating learning with computers together with learning and teaching without computers*. Such a statement indicates that the prospective teachers do not take it for granted that computers would solve all problems embodied in the complexity of learning and teaching processes, but rather that, the integration should be given serious thought in each individual case. In regard to this, one of the prospective teachers wrote: *The computer can supply information, but we may lose its potential if we do not educate our pupils to use that information. Many databases are accessible now but our target should be the analysis of this data and not just getting it.*

Another interesting observation is that both in the teacher and in the learning environment categories, the number of pro arguments is significantly lower than the number of con arguments. Moreover, the situation is reversed in the learner and the mathematical content categories (that is, the number of pro arguments is significantly higher than the number of con arguments). This can be explained by the prospective teachers' lack of teaching experience. Thus, it is reasonable to assume that in addition to their anxieties as new teachers, they express concerns which stem from the integration of computers. These concerns are especially expressed in the teachers and the learning environment categories. The question to be asked now is: Why do they see the benefits when they think about the learners and the mathematical content? Based on the class discussions, in which the prospective teachers' arguments were elaborated, we can learn that prospective teachers are faced with a conflict. On the one hand, they believe that teaching and learning with computers may improve the learning of mathematics. This belief is reflected in the number of pro arguments in the learner and the learning material categories. On the other hand, they feel that such integration may change the traditional teachers' role, a role which they are familiar with from their experience as school pupils. These concerns are reflected in the number of con arguments in the teacher and the learning environment categories.

It is known that motivated employees introduce positive changes into their organization, while unmotivated employees are satisfied with existing situations in their organization (Inamori, 1985 in Senge, 1997, p. 147). Looking at schools as organizations, we should ask ourselves questions such as: How to motivate the

prospective teachers towards integrating computers into their classes (in those cases in which it is appropriate to do so), regardless of anticipated difficulties? How to help them cope with their worries from the expected change in their role in the class and in the class atmosphere?

One of the outcomes of the research is a set of activities currently under development. The aim of the activities is, on the one hand, to help the prospective teachers cope with their concerns, and, on the other hand, to encourage them to be guided by their beliefs when they feel that the integration of computers in mathematics classes may improve the learning of mathematics on the part of their pupils. One activity is based on simulation games, i.e., playing situations that may occur in classes learning mathematics in computer labs. The idea is to let the prospective teachers play unfamiliar situations, and thus let them get a sense of such situations in a supportive environment.

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Perceptions of Teachers at Miami Shores / Barry University (MSBU) Charter School of Using Computers in their Classrooms for Teaching

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Abstract: This study is about the perceptions of middle school teachers of using computers in a classroom environment for teaching. A purposive sampling technique is used to select the school and the teachers involved in this study. A constructivist approach is used to understand the perceptions of the teachers about computers and computer related applications in their classrooms. All participants were interviewed about their perceptions of computers and observed about how they use them in their classrooms. Kvale's six steps of analysis method was used for the interview analysis. The data analysis revealed an overlying theme of using computers as tools for different purposes. Computers are perceived as teaching tools, classroom management tools, and communicative tools.

Introduction

"I see them [computers] as excellent tools that is very necessary in conveying the main math concepts. In a society in which everything is computerized, I feel it is very necessary to have them in the education unit, in your classroom, exposing students to what is around them. They're in their homes, therefore they should be in the classroom as well to emphasize and further explore all the advantages of using a computer" said Ms. Smith, one of the math teachers at the Miami Shores/Barry University Charter School, during her interview. With almost 12 years of experience, she was one of those teachers who dedicated herself to her profession and students. During our interview, she showed me her classroom, her computers and some of the projects her students done in the past. It was obvious that she was able to integrate computers into her teaching activities very successfully and she was using them as "excellent teaching tools" in her classroom. Then, I wondered how many teachers perceived computers as she did, and how many are able to integrate them into their curricula successfully.

Purpose of This Study

The main purpose of this study is to understand and explore the perceptions of middle-school teachers about computers and computer applications in a classroom setting. The study focused on the following research question: "What is the perception of middle-school teachers of using computers and computer applications in their classrooms for teaching?"

For the purpose of this study, teachers at the Miami Shores/Barry University (MSBU) Charter School have been selected. MSBU Charter School, established in 1996, is a middle-school in Miami Shores, FL.

Background

The promise of today's government for the future of our schools is that "every classroom in America must be connected to the information superhighway with computers and good software and well-trained teachers" (President Clinton, State of the Union, January 23, 1996). Since 1996, schools all around the nation have been

actively trying to connect to the information superhighway with computers. In their book, *Fostering the Use of Educational Technology*, Glennan and Melmed (1996) indicate that the growth in use of technology by schools is strong; schools are adding equipment and developing connections to the national information infrastructure at a high rate. The expended penetration of computers in schools is projected to continue, they say.

A nationwide survey, conducted by the National Center for Education Statistics in 1994, shows that there was about one computer for each 125 students in the nation's public schools in 1983. By 1995, there was a computer for each nine students. In the same year, schools spent $3 billion on computer and network-based technology. There is no doubt that computer and computer related applications would be part of classroom teaching activities. As the backbone of our school system (Fullan, 1991), teachers will be the most influential people in using computers in classrooms and connecting their classroom with the information superhighway. However, studies show that there have not been many studies about teachers' perceptions of using computers. Without a clear understanding of teachers' perceptions of these new technologies, it is very difficult how to place them in a classroom. Some studies show that computers have not been used effectively because of the teacher-related issues.

Despite the rapid growth of computers in schools, surveys suggest that the average school make limited use of computers (Glennan & Melmed, 1996). The limited usage of computers in the classrooms may be related to several factors. A study on teacher perceptions and attitudes toward computers and computer-related teaching skills showed that level of experience and educational level of teachers are among the most important factors that shapes and affects perceptions of computers in teaching (Green, Kluever, Lam, Staples, & Hoffman, 1997). This study concluded that the teachers with the knowledge of computers and computer applications have a positive attitude toward computers in classroom teaching. Teachers with knowledge are able to see what computers can be used for and how to integrate it into classroom activities.

Perceptions of teachers of computers and computer related applications might be different form school to school and from state to state. A nationwide survey showed that 97% of the Florida's teachers see computers as powerful motivators to improve learning in comparison to 67% of teachers said the same thing in California. The same study indicates that computers are perceived as teaching tools and powerful motivators in schools. The level of knowledge, experience, and educational level of teachers are important factors that affect teachers' perceptions of computers.

Method

A constructivist approach is used to understand the perceptions of the teachers about computers and computer related applications in a classroom setting. The purpose of a constructivist inquiry is "understanding and reconstruction of the constructions that people initially hold, aiming toward consensus but still open to new interpretations as information and sophistication improve" (Denzin & Lincoln, 1998). Computers and computer related applications have been invading classrooms during 1990s and this invasion, as Glennan and Melmed indicate (1996), will increase in the future. Teachers have to find ways of integrating these new technologies in their classroom activities. Computers will bring new ways of teaching and learning activities. Teachers will have to understand and reconsider the way they teach and administer their classroom activities. They will have to reconstruct their teaching methods including these new technologies. From this perspective, to use a constructivist approach seemed appropriate for this study.

A purposive sampling technique is used to select the school and the teachers involved in this study. Miami Shores Barry University Charter School and teachers at this school are selected for this study. The school is established in 1996 with 60 sixth grade students. The student-computer ratio is 3.5 and this is a high ratio comparing to other schools in Florida. Three teachers were selected based on their use of computers in their classrooms from among the 12 teachers. The first participant was a female math teacher with 12 years of experience. The second participant was a male social studies teacher with two years of teaching experience. The third participant was a science teacher with six years of teaching experience.

Initially, the participants were asked verbally if they would volunteer in the study. Once they said yes, the researcher prepared a consent form to inform them about the purpose, process and conditions of the study.

The interviews were conducted during their teacher planning time in their classrooms. There were not students and other school personnel in the classrooms during interviews. Each interview took approximately 45 minutes. During this time, the researcher focused on the following question: What is your perception of using computers and computer related applications in your classroom for teaching? The interviews were tape-recorded and transcribed verbatim, and then the tapes were erased.

Data Analysis

Kvale's *six steps of analysis* method was used for the interview analysis. In the first step, the participants described how they perceived using computers in their classrooms. They talked about their feeling and experiences. In the second step, the researcher condensed and interpreted the meaning of what the interviewee described. For example, when one of the participants said she made her students to use a computer program to demonstrate their research findings, the researcher interpreted these comments as using computers as a visual tool to communicate the data. The interviewee agreed and said that was exactly what she meant. In the third step, the participants realized they have been using computers for several purposes in their classrooms. One of them mentioned that he never thought about computers as being classroom management tools, but he has been using them to keep track of his students' grade, attendance and other records. In the fourth step, the researcher interpreted the transcribed data alone. During this process, the researcher categorized data under different concepts and then looked relationships among these concepts. The fifth step (re-interview) and the sixth step (action) were not applied to this study because of the time limitations.

Results

The data analysis revealed an overlying theme of using computers as *tools* for different purposes. Computers are perceived as *teaching tools, classroom management tools, and communicative tools.*

Computers as teaching tools

It was obvious that computers have been perceived as teaching tools more than anything else by the teachers in this study. When asked, they gave detailed descriptions of how they used them as teaching tools. "I see them as an asset…as a teaching tool…as a method of research for students" said one of the participants. "I find that in my particular class, I am a math teacher, I find that without computers, it is hard to convey some visual concepts that computers allow you to do" said another participant.

The math teacher showed me some of the software she had downloaded on the workstations in her classroom. She was using Math Blaster as a "practice tool", as she described it. After she teaches main subject concepts, she asks her students to open the program and do the practice questions. "That makes my class more

Another participant describes how he uses tutorials for teaching: "We have tutorial programs that the students can use them to better their skills in grammar, spelling and punctuation…The computer has a lot to offer and the students can learn from the computer by using it as often as possible". His perception of computers as a teaching tool was based on using them as tools, which guide and help students to learn by themselves. He believes that computers can help students to learn by themselves with little help from teacher.

Computers as classroom management tools

While computers have been perceived as teaching tools, they also have been perceived as classroom management tools. The participants seemed fully aware of the potential that computers can bring them in managing their classroom activities. "It [computer] lets you to keep records of grades, lets you keep track of the students' work" said one of the participants. She had her own workstation by her desk and students were not allowed to use her computer. On that computer, she kept works of her students in different folders. She called these folders "electronic portfolios".

At Miami Shores/Barry University Charter School, teachers are required to contact parents periodically to report the progress of their child. One of the participants mentioned that she used electronic mail to inform parents who had electronic-mails at their homes about their child's progress. However, she calls parents and lets them know that she sent e-mail. It was a nice way of combining two media to report the progress of the students.

Computers as communicative tools

Each classroom had an Internet connection to the World Wide Web (WWW) at MSBU Charter School. Teachers are encouraged to use them as much as they can to integrate classroom activities with materials on the

World Wide Web. The school administration especially emphasizes the importance of communicating with other students around the nation and world via Internet. Teachers seemed to understand the potentials of using the Internet for classroom activities. "Nowadays, with the Internet, the students can access various areas and do research for projects that they are working on…that opens a wide range of doors for them as far as interacting with a lot of information" said one of the participants. He was requiring his students to go on the Internet and do some search for their research projects.

With the doors opened to schools via World Wide Web, it was not surprising to see them being used as communicative tools in the classrooms. They can let students and teachers interact across the miles and share information. It seemed that social science teachers have more opportunities for their students to communicate over the Internet with other students around the nation.

Computers are also perceived as a means of communication tool between the teacher and students in the same classroom. One participant expressed his future vision of using computers as follows: "You can probably use them as a means of communications. For instance, if you have them [students] to write a term paper, you can ask them to e-mail it to you instead of having a hard copy. You can have them to communicate with you using the Internet if they have questions. You can do all of it by giving them access to an e-mail account".

Although the MSBU Charter School did not have a Local Area Network (LAN) yet, the perceptions of teachers about using computers as a communication tool were very obvious and clear.

Discussion

According to the Teachers and Technology Survey, conducted on behalf of the Tenth Planet Explorations, Inc., by Field Research Corporation, an independent market and opinion research organization located in San Francisco, California, 97% of Florida teachers say that they see computers as "powerful motivators to DiCamillo, 1998). Kluever, Lam, Staples and Hoffman (1995) indicate that computers are perceived as instructional tools and used in many different ways for this purpose, from drill and practice activity to simulation of events.

This study found out that teachers perceived computers as teaching, classroom management and communication tools. When put together, these three findings are tools to improve learning of the students. Computers have a direct impact on teaching activities of teachers and their teaching methods. They have to find new ways of integrating these technologies into their curriculum. That forces them to develop new instructional methods, combining their knowledge with the power of these technologies. This way, computers will be used as instructional tools to improve learning.

The findings of this study may help teachers and school administrators to see computers as powerful tools of teaching. When properly used, computers are powerful tools to motivate students to learn. As classroom management tools, computers make it easier for teachers to keep track of their students' work by creating electronic portfolios. As communication tools, computers have the potential of allowing teachers, students and parents to communicate with each other over the Internet.

To conclude, I would like to mention that the teachers at MSBU Charter School have strong support from their school administrators. School administration provides all the equipment, hardware and software, for teachers to use in their classrooms for teaching. That may have an affect on the perceptions of the participants of this study. During the interviews, participants mentioned how their administrators supported and encouraged them in using computers. That brings us to another research question: What are the factors that affect the perceptions of teachers of using computers in the classroom for teaching? That is a subject to be investigated in the future.

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Databases Linked to the Web: Facilitating Collaborative Inquiry in Teacher Education

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Abstract: This paper describes the rationale for using a web page linked with a database to share perceptions among diverse stakeholders in a field-based teacher education setting. The efficiency of the web as an inquiry tool can make applied and empowering research possible despite severe time constraints. The second section of the paper and gives an example of how this idea was tested in practice. The perceptions of college faculty members, K-8 teachers, and teacher education students in a new field-based program were shared, analyzed, and commented on using easily constructed web-pages linked with a database.

Introduction

The difficulties inherent in establishing comprehensive teacher education partnerships involving K-12 teachers and faculty from colleges of education are daunting. Whether these difficulties can be overcome in a specific setting is largely a function of communication. This point is made clearly in a recent article by several faculty members at Brigham Young University which describes, in candid detail, the challenges, successes and failures that accompany the building of long term partnerships with schools. "Even with a stable university faculty and low turnover, communication was poor. Too many schools, too many students, too many cooperating teachers created this problem. Disappointment followed. One teacher educator posed the dilemma this way: 'There are more opportunities to communicate and build relationships than ever before, but you don't have time to pursue and develop them, you only end up with hurt feelings and miscommunication'"(Bullough, 1999, p. 381).

The Need for Communication

The rationale for partnerships between K-12 schools and colleges of education for the purpose of simultaneously improving education has been convincingly made (Goodlad, 1994). Building and sustaining these partnerships requires meaningful and sustained communication. Informal and formal meetings, telephone and e-mail conversations and memos are all essential elements of communication, and each serves well in meeting specific types of communicative needs.

Bringing the spirit of effective and ongoing inquiry into the school environment is perhaps the most essential contribution the college partner brings to the table. Effective inquiry holds promise not only for improving teacher education, but also for helping teachers and schools improve the practice of K-12 education. Recognizing that the inquiry aspect of the partnership may be the one most at risk when the school and college cultures clash, it is particularly important to ensure that communication mechanisms are in place for inquiry-related activities.

Inquiry models that treat school personnel as *subjects* rather than an co-researchers, can be efficient in terms of time, but are not likely to serve well in a partnership (Lincoln & Guba, 1995). However, communication intensive collaborative research is very demanding of time, which is very likely to be a rare commodity among teachers and faculty involved in school partnerships.

Potential of the Web-Database

Recent software advances allow relatively non-technically oriented users to create databases that are linked to web pages. This offers a powerful means to efficient and collaborative inquiry. A web site linked with a database allows information to be collected, analyzed, and reported with an ease unimaginable a few years ago. The simplicity and speed of collecting, analyzing, and reporting data thus has the potential to greatly facilitate collaborative inquiry.

One way to make use of the web-database combination is in gathering, summarizing, and sharing perceptions using a survey or questionnaire. Thoughtfully used technology can overcome some of the drawbacks traditionally encountered in survey research. Low response rates, due to the time and expense involved in sending out, completing and returning forms can be avoided. Lack of follow up communication can similarly be avoided as the cost and time involved in sharing results with all respondents becomes minimal. Using a web-based survey, respondents can easily submit their perspectives and participate fully in receiving and interpreting the overall results. With the technology of a database linked to the World Wide Web (WWW), the implementation of a well-designed survey as a means to gather and share the collective perceptions of a diverse group of individuals becomes possible and efficient.

Theory into Practice

In the early Fall of 1999 an opportunity to explore the methodology and effectiveness of inquiry using a database linked to the web presented itself at Lewis-Clark State College in Lewiston, Idaho. For nine years, the Lewis-Clark State College teacher education programs had worked very closely with partner schools. However, beginning with partial implementation in the 1998-1999 school year, and with full implementation in the 1999-2000 school year, year-long internships placed students in one school site for their final two semesters, intensifying the college/K-12 partnership. This new program required supervising faculty members to work on a daily basis with a small number K-12 teachers. Exploring the perceptions of teachers, students, and college faculty regarding this work in progress was of significant interest to those involved.

Getting Started

A formal study was initiated six weeks into the full-scale implementation of the year long internship. It began with the general question: *do the cooperating teachers, college faculty, and student interns share common perceptions about the early benefits and problems of the year-long elementary (K-8) internship program?* To develop specific survey items, members of the college faculty were consulted by phone and e-mail, asking them which issues they would most like to know about. The result was a 20 item survey, plus four biographical questions (school site, number of semesters involved in new program, affiliation, e-mail address).

The Questions

All 20 questions were multiple choice items which asked the respondents to share their perceptions on specific issues related to the year-long internship. The exact wording of the response choices varied, but in general they were: none, low, medium, or high. The topics addressed in the survey were:

1. Does the presence of the intern students benefit the K-8 students?
2. Does it appear that the internship experience is likely to be superior to the more traditional student teaching experience?
3. Is the amount of time spent in the schools properly balanced with time on campus?
4. How critical is the need for instruction on campus in each of these areas: classroom management, lesson planning, methods instruction?
5. How prepared are the internship students to teach each of these: special needs students, reading, math, writing, speaking and listening, science, art, music, PE, health
6. How prepared are students to develop lessons requiring integration of subject areas?
7. How prepared are students to use computer technologies in the classroom
8. How aware are you of the new standards the teacher education program has adopted?
9. How important is your voice in guiding the direction of the teacher preparation program?

1. Based on what you have directly observed, is the presence of LCSC students in the classroom benefiting K-8 students? A. not that I can tell B. possibly, to a limited extent C. definitely yes, there is some benefit D. there is clearly a very significant benefit	◯ A ◯ B ◯ C ◯ D

2. Based on your experience so far, does (or will) participation in the internship year make LCSC students more ready to work as full time teachers when they complete their program? A. not that I can tell B. possibly, to a limited extent C. definitely yes, there will be somewhat more ready D. they will clearly be more ready	◯ A ◯ B ◯ C ◯ D

Figure 1: Two sample survey items (of 20) shown in a web browser.

Preparing the WebPage and Database

From a methodological perspective, the key question of this study was *how much time and effort will it take to prepare the survey and analyze the results?* The process of developing the individual questions was similar to that of developing a paper and pencil survey: drafts of the proposed questions were shared with all faculty members involved in the internship and feedback was invited and received (this process was done primarily by e-mail). Once developed, the questions were placed into a *Claris Homepage* document (see Figure 1) , a process which took less than an hour. The major development work involved creating a *FileMaker Pro* database to store and analyze the survey data. Creating fields needed to input the data was relatively simple: 24 fields were created for that purpose, which took the author less than 30 minutes to complete. The next task was to create fields that would calculate the percentages for each response. This involved creating approximately 200 additional fields, a somewhat tedious process that took about 3 hours. Each question required four fields in order to determine whether the response was a, b, c, or d. For each of these 80 fields, a summary field was created to add up the total number of responses for that field. Finally, a calculation field was created for each of the 80 basic fields to calculate the percentage of responses for each item (see Figure 2).

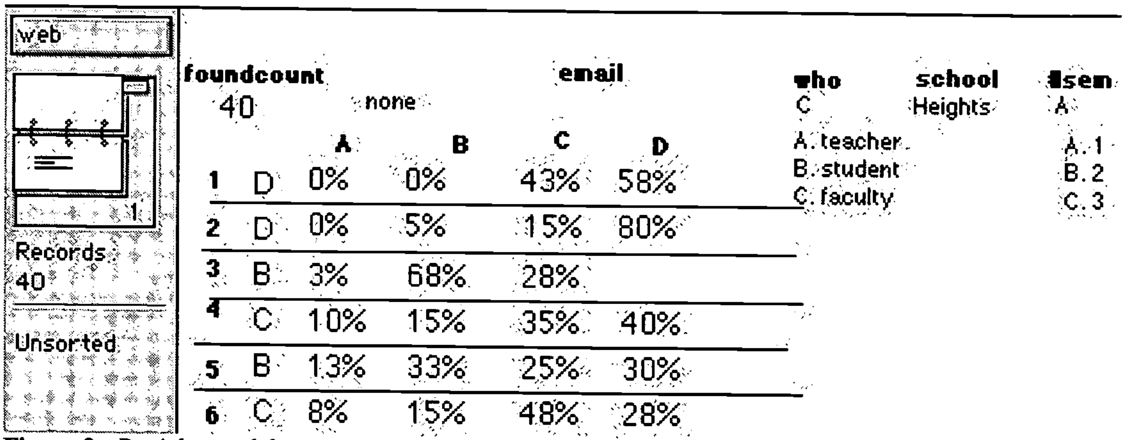

Figure 2: Partial record from the database showing one respondents demographic data (teacher, school name, semesters of involvement), that person's responses to the first six items (D,D,B,C,B,C) and the summarized totals for all 40 respondents for the first six items.

Round 1

Once the survey was placed on the Education Division's web server, faculty members were contacted and asked to fill out the survey as well as to request that they ask their K-8 colleagues and students to also fill out the survey. The initial request was to fill out the survey within one week. After 4 days it became apparent that more time for responding and an additional appeal would be necessary. For that reason, requests were e-mailed to 2-4 cooperating teachers in each of the nine internship sites and the faculty were reminded to ask their students to fill out the questionnaire. The deadline for completing the survey was extended an additional week.

At the two week deadline, 40 surveys were received, 20 (of 30) from K-8 teachers, 15 (of 30) from interns, and 5 (of 6) from the faculty. It appeared that the relatively low response rate from interns was a matter of communication -- many of them were rarely on campus and used individual (home) e-mail accounts other than their college accounts (which is why they were not contacted by e-mail directly). As the surveys were submitted via the web the results were automatically summarized in the database. These results were not immediately made available via the web (although they could have been).

Round 2

After two weeks the results were made available on a results web page, which replaced the original web survey at the same site (see Figure 3). It would have been simple to display the overall results for each question by calling those results directly from the database. However, since a major purpose of this particular survey was to look for discrepant perceptions among the three groups (faculty, teachers, and interns), results for each of those groups were calculated by doing simple searches for each group's results and then entering those results *manually* into the web page. In a similar way, the results were analyzed in terms of the number of semesters (1,2, or 3) the respondent had been involved with the year long internship program. The entire summarizing process took approximately 3 hours for the author to complete.

Each respondent was then sent an e-mail message, telling them that the results were available for their viewing, and encouraging them to comment on the results within the next week. As comments were received they were added to the results page to be shared.

Somewhat surprisingly, very few comments were received. Comments were made via e-mail immediately after the survey was completed (before the group results were available) and other comments were made verbally after individuals had viewed the group results, but for the most part, respondents did not choose to share their comments and interpretations via e-mail. Two reasons for this were readily apparent in hindsight.

1. It would have been preferable for the respondents to be able to add comments right on the web site as they were reviewing the results (which could have been easily done). Instead, they had to e-mail their responses separately, a less convenient option..
2. A shorter survey and/or less analysis for respondents to react to would have been better. With 20 questions each analyzed along two different dimensions, the amount of data appeared to be somewhat overwhelming.

3. Overall, how well is the need to spend time on the LCSC campus balanced with the need to spend time in K-8 classrooms?

A. Too little time is spent in the college classroom

B. Just about the right amount of time is spent in the college classroom

C. Too much time is spent in the college classroom

	K-12 teachers	LCSC interns	LCSC faculty
A	5%	0%	0%
B	60%	67%	100%
C	30%	33%	0%
no response	5%		

	1st semester	2nd semester	3rd semester
A	5%	0%	0%
B	85%	38%	71%
C	5%	62%	29%
no response	5%		

comment 1: Once students begin their internship they should be here all of the time. Continuity is hard to develop when interns are only here part of the time. Take the days that you need to have them at LCSC and then have them attend intership full time for longer than a semester. Attend the school site during the first week of school, however.

Figure 3: Excerpt from a web browser showing results from one of the 20 items, including a follow-up comment from one of the respondents.

Lessons Learned

First, it is very clear that using a web-based survey with a database is time efficient. The amount of time needed to create, disseminate, analyze, and receive comments was very low compared to any other option. The database-web vehicle does enable people to easily share their points of view and to comment on the points of view of others -- a great need in collaborative inquiry. Improvements that should be made to the process and cited in this example are consistent with the principles of good survey research: keep the number of questions to a minimum, and make it as easy as possible for respondents to participate.

An area to be explored further is finding ways to balance the need to openly share data with all respondents with the need to keep the results from being too detailed. For example, all the results were shared with the respondents. If, instead, only results that showed a somewhat significant difference of opinion between the three groups had been shared, a useful collaborative discussion would have occurred more easily. Further trials with this strategy are needed to determine whether limiting data in this manner maintains the integrity of the group's reactions while eliminating the need to wade through redundant data.

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Technology Integration and Teaching Expertise

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Abstract: This paper reports on a study that investigated the relationships between technology-use and teaching ability in the practice of elementary teachers. Case study data from exemplary technology integrators, representing various levels of teaching and technology-use ability, led to the formulation of assertions about ways these teachers taught with technology. Differences observed among technology-use practices were associated with individual levels of teaching expertise. The paper concludes by proposing a theoretical definition of technology integration, along with specific recommendations for the professional development of both preservice and inservice teachers.

Introduction

As computer technology reinvents the ways in which we create, find, exchange, and even think about information, school districts are forced to bow to societal pressure to fund technology. Unfortunately, purchases are often approved before implementation plans are in place, a lack of foresight which leaves disparity between teachers who are attempting innovative integration and other users and non-users. The existence of success in isolated pockets prompted this study of how teachers at various levels of technology-use and teaching abilities used technology and how technology-use practice related to general teaching practice.

The history of studying experts in various disciplines has repeatedly identified a series of expert characteristics, (e.g., Glaser, 1990) that include having a highly structured and accessible knowledge base and efficient domain-related routines. It has been shown that pedagogical expertise develops with comparable characteristics. Expert teachers set goals during planning based on their previous knowledge about students and past teaching events (Berliner, 1994). They make a greater number of contingency decisions and consider management and instructional strategies ahead of time (Livingston & Borko, 1989; Westerman, 1991). With an organized store of knowledge, experts employ a set of routines to automate recurring teaching practices (Berliner, 1986; Leinhardt & Greeno, 1986). Past experience supplies insight into student learning needs, confidence to incorporate student input to tailor lessons, and the ability to critically analyze classroom situations to propose solutions (Gonzalez & Carter, 1996; Sabers, Cushing & Berliner, 1991).

Integrating technology into the curriculum is becoming an inseparable part of good teaching. Research on exemplary technology-using teachers has reveals that these individuals spent a good deal of personal time working with computers, had more extensive computer training and teaching experience (Becker, 1994), and had high levels of innovativeness and confidence (Marcinkiewicz, 1993). They were surrounded by colleagues who used computers for meaningful activities, enjoyed school and district level support for technology use (Becker, 1994; Hadley & Sheingold, 1993), and had sufficient staff development opportunity (Office of Technology Assessment, 1995; Ritchie & Wiburg, 1994). Common teaching practices included planning for regular computer use, consistently using technology as a tool in a variety of instructional projects (Evans-Andris, 1995), maintaining higher expectations for student learning, and shifting the focus toward activities that were student-centered (Hadley & Sheingold, 1993) with less whole-group instruction and more independent work (Waxman & Huang, 1996). Finally, these

teachers made conscious decisions to alter established curriculum, allowing student choice in learning activities and promoting varied grouping schemes (Becker, 1994).

The review of literature on expert teaching and exemplary technology use led to a series of research questions: What role do exemplary technology-using teachers perceive for the computer technology in their classrooms for themselves and their students? In what ways do they plan for computer use, and what routines do they establish to facilitate and manage the use of computers in instruction? What strategies do they use to teach with and about computers, and how is learning assessed? And finally, in what ways are the practices of exemplary technology-using teachers comparable to indicators of pedagogical expertise?

Methods

The initial research questions indicated qualitative case study methods. Sixteen elementary teachers from a school district known for a commitment to technology were identified as exemplary technology-users by the Director of Technology, two Teachers on Assignment for technology, school media specialists, and principals, and were observed for a half-day screening interview. It soon became clear that although these teachers had all been recommended as exemplary technology-users, the group was not homogeneous, representing instead a range of combinations of levels of teaching abilities and technology-use abilities. The goal of the study therefore changed from examining only those teachers who were exemplary technology users to comparing individuals at different levels of technology use and teaching abilities. A framework loosely intersecting composite levels of teaching expertise (Berliner, 1994) and stages of teacher technology adoption (Dwyer, et al., 1991) proved an effective way to investigate the variety in the this sampling pool and at the same time gain a richer insight into the relationship between teaching abilities and technology-use abilities. One teacher was finally selected as the best representative of each category. Data from two in-depth interviews, classroom observations, planning "think-alouds", computer-use logs, and technology-related documents were collected during approximately one month per case study classroom over the course of one school year. Through repeated readings of the entire data record, potential themes of teaching and technology-use practice were informally noted and then grouped into larger, related categories.

Interpretation of Findings

This study was designed to understand how teachers at various levels of technology-use and teaching abilities used technology, as well as how technology-use practice related to general teaching practice. Through interpretive analysis, emerging patterns in the data led to the formulation of five assertions that illustrated the ways these teachers taught with technology:

- *Assertion 1*: The ways technology was used determined the teachers' personal definitions of technology integration.
- *Assertion 2*: Teachers at the lower levels of either technology use or teaching ability altered their planning habits when planning for technology inclusion.
- *Assertion 3*: Teachers taught with and about technology according to their own personal learning strategies.
- *Assertion 4*: Teachers' individual definitions of technology integration directed their management of student computer use
- *Assertion 5*: Teachers at the lower levels of either technology-use or teaching ability altered their perspective on assessment when assessing student use of technology.

The comparisons drawn among the strategies these three teachers employed when teaching with technology versus teaching without technology proved most interesting. Evidence presented in this study suggests that these variations in technology use were closely linked to the teachers' respective levels of general teaching expertise.

Exemplary Technology-Use/Adequate Teaching Ability: Steve

Steve's reliance on textbook planning, his teacher-centered approach, and his lack of motivation to modify teaching practices demonstrate his settling into a state of "experienced non-expertise" (Bereiter & Scardamalia, 1993) in which experience is not capitalized on to continue developing knowledge or a fluid level of expertise. In some respects, teaching with technology prompted positive change in Steve's teaching. He gave more thought to lesson planning and taught with enthusiasm. His plans and teaching demonstrated, however, how his technical expertise did not automatically result in quality teacher performance. Many experts in a particular domain are not able to instruct others effectively because they cannot articulate how they do what they do (Berliner, 1994; Bransford, Brown, & Cocking, 1999). Steve's advanced technology skills were developed prior to his teaching skills, and as his teaching had remained somewhat stagnant past his initial pedagogical learning, he had thus far been unable to link his technology expertise to his teaching. Consequently, technology remained a separate activity with regards to planning, management, and assessment, and it furthermore was not connected in a pedagogically sound way to other learning opportunities. Future progression along this line would not likely result in Steve using technology in any concerted or meaningful way to improve the learning of his students.

Exemplary Teaching/Adequate Technology-Use Ability: Jill

Jill had in place established routines and highly organized mental schema for what she considered to be "teaching." She was able to recognize patterns across different subjects and was able to use such knowledge to present fluid, flexible lessons. However, in spite of her interest in learning about technology, she did not recognize technology as being similar to other tools she typically used in her teaching. Expert knowledge has been shown to be contextual and domain specific (Berliner, 1994). Perhaps Jill needed to recognize the place of technology use as related to her general teaching practices before it could become an integral component of her teaching repertoire. By perceiving technology use as a practice distinct from her teaching practices, Jill essentially slipped back into novice teaching habits when teaching with technology. Her plans for technology use remained conscious, deliberate thoughts that were largely separate from other subject matter plans. Others have suggested that expertise is not directly transferable to other situations (Berliner, 1994; Huberman, 1985) and, in fact, must be "reinvented or adapted" (Huberman, 1985, p. 256). The adaptation process for Jill involved seeking ways to utilize technology within the framework of her prior knowledge about teaching.

Exemplary Teaching/Exemplary Technology-Use Ability: Sheila

Because technology was used so pervasively in Sheila's classroom, there were few notable distinctions between the ways she viewed planning, management, and assessment of technology use and her comparable strategies for more traditional learning activities. She made conscious decisions, based on her knowledge of both the content and her students, to use or not use technology tools under certain circumstances. Routines facilitated much of the student computer use, making Sheila available for novel circumstances requiring her attention. On the whole, Sheila's uses of technology were not only the most prolific of the three teachers, but such teaching practices were also the most closely aligned with the content-area curriculum. Using technology so that it is truly a part of what is practiced by an expert teacher with curriculum, rather than as an activity that has its own set of rules, was the meaning of integration to this teacher.

Discussion

Findings from the present study demonstrate how the term *technology integration* can connote very different concepts for different teachers. Perhaps schools are so eager to have teachers begin using

technology that they use the term too freely, mistaking simply having and turning on a computer as *integration*. While it may not be possible to arrive at one indisputable definition of a term so dependent on educational beliefs, technological availability, and even community expectations, the use of research and national standards could help such a concept to be locally defined so that it can be planned for, implemented, assessed, and generally understood by all stakeholders. To aid this understanding, I propose a theoretical definition of technology integration derived from the literature on expertise in teaching. Researchers (Berliner, 1986; Leinhardt & Greeno, 1986; Shulman, 1986; Wilson, Shulman, & Richert, 1987) agree that expert teachers possess both *content knowledge* and *pedagogical knowledge*, the intersection of which is described as *pedagogical-content knowledge*, or knowledge about specific learners and useful ways to represent specific curriculum. The findings of this study suggest adding to the model *technological-knowledge*, which would include not only basic technology competency, but also an understanding of the unique characteristics of technology that would lend themselves to particular aspects of the teaching and learning processes. A teacher who effectively integrates technology would be able to draw on extensive content knowledge and pedagogical knowledge, in combination with technological knowledge. The intersection of the three knowledge areas, or *technological-pedagogical-content knowledge*, would define effective *technology integration*. Figure 1 illustrates the possible relationships between the types of teacher knowledge.

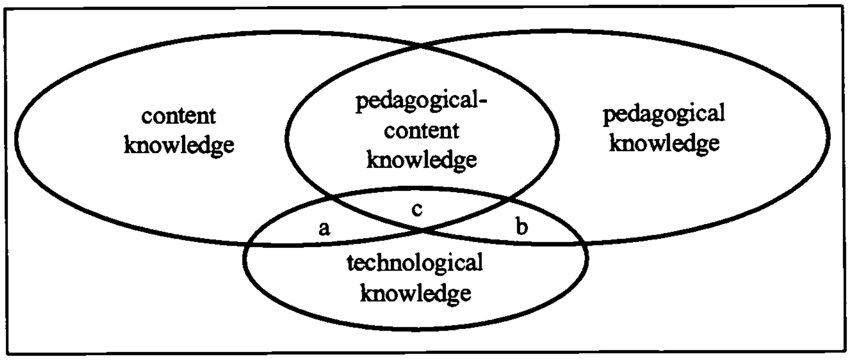

Figure 1: Relationship among content, pedagogical, and technological knowledge. Section (a) represents knowledge of content-related technology resources. Section (b) represents such knowledge as the methods to manage and organize technology use. Section (c) represents the intersection, or *technological-pedagogical-content knowledge*, which is *technology integration*.

Recommendations

This study raises important issues for preservice teacher education and school districts professional development programs.

Recommendations for Preservice Teacher Education

1. If the use of technology is seen as an additional skill that teachers need to acquire once they begin their first teaching assignment, the time necessary to integrate technology into their teaching repertoire will be delayed. Preservice teacher education programs must address this need by designing appropriate program sequences that involve future teachers in using technology for meaningful purposes throughout all subject methods instruction.
2. The relationship between teaching ability and technology-use ability must be made explicit early in a new teacher's education. Rather than have each subject methods component taught separately, college

of education faculty must work together in interdisciplinary teams to coordinate efforts of teaching in general and teaching with technology tools.

3. Attention should be given to the methods that teachers at different levels of teaching ability and technology-use ability employ. Specific communication routes need to be established among preservice students, expert technology-integrating teachers, and teachers who are novices at using technology for instruction.
4. Beginning teachers need valid models of technology integration from the outset, rather than learning to teach and then tackling the challenge of integrating technology later and out of context.

Recommendations for School Districts

1. "One-shot" inservice trainings do not explicitly demonstrate technology connections to other teaching methods that would allow teachers to situate technology use within their rich content and pedagogy knowledge structures. Experienced teachers need time for reflection and collaboration in order to envision technology use in relation to established practices and in multiple contexts.
2. In addition to technology professional development, ongoing efforts must address issues of general teaching improvement. Inservice trainings should not be solely applications-based, such as how to use a particular piece of software, but instead should be problem-based to assist teachers in identifying all of the ways to solve particular teaching problems using a range of tools that include technology.
3. Professional development must view teachers as individual learners, and therefore must be varied and focused on what the learners know, what the content demands, and how assessment and community needs impact learning.
4. If the definition of technology integration is not clear, teachers may believe that any use of a computer is acceptable as technology integration. The devising of a district framework or rubric that outlines the range of ways in which different ability-level teachers might use technology could make professional development efforts more focused and meaningful.
5. Teachers would benefit from release time to witness exemplary technology integration practices from teachers in their own district, with similar student populations and available technology. They might also benefit from videotaped case examples that could be viewed, studied, and repeatedly discussed.

Conclusion

More important than teachers who know how to use computers are teachers who know how to effectively use all of the tools at their disposal for the learning benefit of students. The proposed definition of technology integration suggests that technology in the hands of a merely adequate teacher will lack the experienced and thoughtful motivation necessary to embed it within a context of sound teaching practice. Conversely, technology in the hands of an exemplary teacher will not necessarily result in integrated and meaningful use. Unless a teacher views technology use as an integral part of the learning process, it will remain a peripheral ancillary to his or her teaching. True integration can only be understood as the intersection of multiple types of teacher knowledge and therefore is likely as rare as expertise. Educational leaders would be well served to focus efforts on creating environments that are conducive to continued growth in pedagogy as well as in technology use.

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Faculty Development Model: Addressing the Disparity between Pre-service and In-service Educators in Technology Integration of the Public School Classroom

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Abstract: Northeastern State University requires all education majors to enroll in EDUC 4823, Technology in Education. Pre-service teachers are introduced to the use of technology in the classroom. However, graduates report a vast disparity as they enter public schools because in-service teachers have limited training in technology integration. A faculty development model was created to address this need.

EDUC 4823 students secured a public school in-service teacher for participation. Students meet two hours with the instructor and one hour with in-service teachers weekly. Students taught in-service teachers technology integration techniques learned in the college classroom. These in-service teachers' posttest scores were compared with posttest scores of a school district participating in traditional in-service training. Both groups of in-service teachers increased posttest scores. In order to determine if the faculty development model increased scores significantly more that traditional in-service training, an analysis of covariance must be preformed.

Research Background

"[These instruments are] not uncommon, but are little resorted to by the teacher...the teacher knows almost as little how to use it as his pupils." (as quoted by Dockterman, 1998, p.10). While similar statements have been made addressing computer technology in this decade that was not the reference of this quote. Neither did this quote reference overhead projectors, television or moving pictures. This statement was made in 1840 and therefore predates all common technologies of this century. The technology of reference was the chalkboard!

In 1980, Dr. Seymour Papert of Massachusetts Institute of Technology stated in his influential book, Mindstorms, "I believe that the computer presence will enable us to so modify the learning environment outside the classroom that much if not all the knowledge schools presently try to teach with such pain and expense and such limited success will be learned, as the child learns to talk, painlessly, successfully and without organized instruction." (Papert, 1980, p.9). The current challenge computer technology presents to educators of this century is similar to the challenge of the chalkboard in 1840. Integrating technology, whether computer or chalkboard, into the teaching and learning activities of the classroom requires training and the reduction of anxiety on the part of the educator.

In a recent analysis of current uses of technology in public schools (kindergarten through twelfth grade), only a small proportion of teachers were evaluated as major computer users (Becker, 1994). In a similar study, teachers reported a reason for this lack of computer use is the absence of hands on training and time needed to incorporate the use of computers into the curriculum (Honey, Henriquez, 1993). Furthermore, research indicates that computer anxious individuals learn less about computers when instructed and use computers less then non-anxious individuals.

Obviously, pre-service teacher education institutions are the logical place to begin reducing computer anxiety and training educators in the appropriate use of technology in the classroom environment (Office of Technology and Assessment, 1995). Currently, Northeastern State University located in Tahlequah, Oklahoma requires all education majors to enroll in EDUC 4823, Technology in Education. During this three credit hour class, pre-service teachers are introduced to the use of technology in the classroom. The students demonstrate the use of technology as a tool for presentations, learning, assessment and personal productivity.

As the Northeastern State University graduates enter the public school classroom, a vast disparity becomes apparent. While public schools across the state of Oklahoma conduct annual in-service training for faculty, the topic of this training is not always technology integration. As a result, many in-service teachers have limited training in this area. Even traditional in-service instruction addressing technology integration is not adequate to keep educators current with the application of technology in their specific classroom setting. In general, in-service educators have limited training and experience opportunities in the use of technology integration (Simonson & Thompson, 1997, p. 12-13). The results of a case study conducted in 1996 reported the most effective way to assist educators in using technology in course content is one-on-one mentoring where individual needs and anxieties can be addressed (Thompson, Hansen & Reinhart, 1996). Reflecting on these studies, and as the instructor of the Technology in Education course, this researcher developed the following faculty development model to address this expressed need of both the pre-service and in-service education communities during the fall semester, 1999.

The purpose of this study was to determine if the newly created faculty development model would reduce computer anxiety of in-service teachers as reflected by the Computer Anxiety Index. Furthermore, could the faculty development model reduce anxiety more efficiently than traditional in-service training provided by school districts?

Operational Definitions

Technology integration is using computers effectively in content areas allowing students to apply computer skills as a means of learning, assessment and communication. The curriculum content drives the use of technology (Wentz,C. & Wentz, P., 1995). This process organizes the goals of curriculum and technology skills into a coordinated learning experience for students (MacAuthur & Pilato, 1995).

Computer Anxiety is defined as the fear or apprehension felt by an individual when using a computer or when considering the possibility of computer utilization (Simonson, Montag, Maurer, Oviatt & Whitaker, 1992, p. 12).

CAIN is an abbreviation for the Computer Anxiety Index, entitled the Computer Opinion Survey to minimize the possibility of answer bias. The CAIN can be used at the beginning and the end of a computer learning experience to identify the changes produced in anxiety as a consequence of the learning

experience. This is a norm-referenced instrument published by the Iowa State University Research Foundation, Inc (Simonson et al., 1992).

In-service teachers are educators currently certified by the Oklahoma State Department of Education. The participating teachers are currently employed by an Oklahoma public school and have computer access on their local school campus. The schools are located in the northeastern portion of Oklahoma.

Pre-service teachers are Northeastern State University students who have been admitted to the teacher education program and currently enrolled in EDUC 4823, Technology in Education during the fall semester, 1999.

Methodology

The in-service teachers are not randomly assigned, therefore, this is a quasi-experimental study (nonequivalent control group design). The researcher enlisted the control group and the EDUC 4823 students recruited the experimental in-service participants. Participation requirements were established in an effort to equate the control and experimental groups (employed, certified educators in the northeastern portion of Oklahoma with access to computers on respective campuses). Seventeen in-service participants comprised the control group. 46 participants comprised the experimental group. Both groups of in-service teachers were given a pretest, administered a treatment and given a posttest. The posttest was given to each group twelve weeks after the pretest was administered in order to control the time-lapse variable. The quasi-experimental design was as follows:

- O X(1) O
- O X(2) O

Control Group Treatment

The Northeastern State University instructor (researcher) conducted a traditional in-service training for a public school district in the northeastern portion of Oklahoma. The faculty completed the CAIN as a pretest, thus establishing a baseline for the control group. The instructor then conducted the traditional three-hour in-service session addressing the effective use of technology in the classroom (treatment one). Twelve weeks after the treatment, the faculty completed the CAIN as a posttest.

Experimental Group

Each pre-service teacher secured a public school in-service teacher for participation. In-service teachers met the established requirements for participation to insure equivalent groups. The in-service teachers completed the CAIN as a pretest, thus establishing a baseline for the group. The pre-service teachers met with the Northeastern State University instructor (researcher) two hours each week for instruction and thirty minutes each week with an in-service teacher. This model continued for twelve weeks. However, six of these weeks were spent collecting information about computer operating systems, interviewing in-service teachers, reviewing/practicing new computer skills and fall breaks. Actual time spent instructing the in-service teachers was three hours. During these three hours, the pre-service teachers taught the in-service teachers technology integration techniques they learned in the college classroom (treatment two). At the end of the twelve-week program, the in-service teacher completed the CAIN as a posttest measuring the faculty development progress.

Statistical Analysis

There were no identifying codes used, so participants were guaranteed complete anonymity. The mean gain/difference was computed for each group. The Control Group scored an average of 11.411 on the

CAIN pretest and 13.666 on the CAIN posttest. This reflects an average gain of 2.254 points. The Experimental Group scored an average of 14.5 on the CAIN pretest and 15.631 on the CAIN posttest. This reflects an average gain of 1.1315 points.

Before the two groups' posttest scores can be analyzed correctly, the performance of the two groups on the pretest must be examined. Because both groups were not relatively equal on the pretest, the posttest scores cannot be directly compared using a *t* test. As a result of this difference, an analysis of covariance must be preformed. This will adjust posttest scores for initial differences on the pretest related to performance on the dependent variable as reflected by the CAIN posttest.

Preliminary Results

The initial result of this study indicates that technology training reduces computer anxiety. Both the Control Group and the Experimental Group showed reduction in anxiety levels as reflected in the score increase on the CAIN posttest. These results answer the research question affirmatively. The faculty development model reduced computer anxiety of in-service teachers as reflected by the CAIN.

There is a difference in the CAIN posttest scores between in-service teachers who participate in the faculty development model and in-service teachers who participate in traditional faculty technology integration training. Further statistical analysis must be completed to determine if there is a significant difference.

This paper was submitted to the Society for Information Technology and Teacher Education conference for inclusion in the Proceeding Papers. The previously mentioned statistical analysis was formally presented at the SITE 2000 conference. If unable to attend the presentation, contact the researcher for final statistical analysis.

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Programs That Prepare Teachers to Integrate Technology Into Instruction In Meaningful Ways: How Successful Are They?

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Abstract: This paper is a report on the findings of a two-part study undertaken to determine how teacher education programs prepare pre service teachers to use technology in their instruction, and to determine the influence of decade of initial teaching degree on a teacher's willingness to use technology. The teacher education faculty from four institutions with teacher education programs were surveyed to determine the method of technology introduction currently being used. In the second part of the study, teachers from a small Pennsylvania school district were surveyed to determine the decade of initial teaching degree and the technology that these teachers were using in the classroom. According to the results of this study, decade of initial teaching degree is not a sound indicator of a teacher's willingness to use technology.

Introduction

Throughout the country, teacher education programs have been undergoing a restructuring process that is, in part, aimed at preparing students to teach in the twenty-first century (Barker, Helm & Taylor, 1995). Efforts are being made to provide future teachers with the expertise that they will need to use the technological resources that have become available in recent years. Among these new technologies are audio, video, computers, telecommunications, distance learning, and multimedia. As additional research is presented citing the benefits of technology on teaching and learning, it has become increasingly important for teachers to have exposure and experiences that will lead to their competence in these areas.

Review of Research

Resent research has shown that many areas of education can benefit from new technologies. Johnston (1997) completed a study of the changes in verbal abilities of kindergarten students when exposed to interactive CD ROM storybooks. He demonstrated that when these storybooks were used with students for as little as 50 minutes per week, their verbal abilities improved. In 1989, Reed was able to show how composing process software could improve the quality a student writer's creative writing. Later, in "The Effect of HyperCard Authoring on Knowledge Acquisition and Assimilation", Reed and Rosenbluth (1992) determined that students creating HyperCard programs showed dramatic increases in their ability to interrelate knowledge. In a later study, Higgins (1996) determined that the use of hypermedia study guides was an important factor in the retention of factual and inferential information presented to remedial students. Research into specific technologies, such as speech recognition computers, has shown promise when used with learning disabled students (Wetzel, 1996) and programs such as KidPix and Writing Center have been effective in helping even very young children with the task of creative writing (Wetzel & McLean, 1995). The area of mathematics has benefited from selected hypermedia programs that have been used successfully to improve mathematical problem-solving skills (Babbitt & Miller, 1996).

Beyond the findings of recent research, additional incentives to add technology to teaching programs have come about as a result of the National Council for Accreditation of Teacher Education (NCATE) concern for the state of technology programs being offered to the nation's teachers. NCATE, a national organization that accredits teacher preparation programs, suggests that "education schools should be required to incorporate technology into their programs in order to be accredited" (Bradley, 1997). As a result, more college and teacher education programs now include some form of computer training in their programs to satisfy this requirement for certification. Most teachers now exit the teaching programs with some knowledge of computers and technology and their various applications.

Generally, pre-service teacher education training programs are approaching this technology training in one of two ways. One approach, the competency model, offers students technology training in a core computer

literacy course. Instructors with specific skills and computer knowledge teach these classes, and they have the advantage of being planned so those students will exit the class with predictable general technology skills. The other approach, the integration model, introduces the core course competencies within the methods and content courses. The integration of the technology is theoretically introduced in meaningful ways and is applied to the methods being taught. It is assumed that the instructors of these methods courses are competent users of the available technology (Wetzel, 1993).

Purpose of Survey

To determine how local teacher education institutions are introducing technology training, an informal e-mail survey was sent to teacher education faculty of four colleges and universities located in Pennsylvania and West Virginia. These institutions were chosen because they offer known teacher education programs and because the faculty e-mail addresses were readily accessible from the institution's WEB sites. When choosing the institutions to be included, an attempt was made to include schools with both large and small teacher education programs. This determination of size was made after comparing the number of faculty associated with each program. The larger programs were designated University #1 and University #2. The smaller programs were from College #3 and College #4.

In this survey, instructors were asked to respond to four questions. Question one asked the instructor to identify the classes he/she was currently teaching. The second question asked if a core computer course was required within the teacher education program. The third question asked the respondent if he/she included any technology training within the classes being taught, and the final question asked for an explanation of how technology was being integrated into the courses to make it a meaningful presentation.

Results

Responses to the survey were received from each institution. College #3 sent one reply that was initiated from the Dean and was meant to be a statement of college policy regarding computer and technology. The other three all gave detailed and individual information about their teacher education programs and how technology was being integrated into their classrooms. Eleven individual replies were received from University #2, two were received from College #4, and eleven were received from University #1.

From these survey returns, the following information was gathered: University #2, College #3 and College #4 each presents technology directly through the use of required courses. They rely on the competency model of computer and technology training for their instruction in these areas. Though they represent different regions and are of varying sizes, they have chosen the same model for this instruction.

University #1 is the only one of the four surveyed institutions using the integration model of computer and technology training within the teacher education program. This university is the largest of the surveyed institutions with an undergraduate enrollment of approximately 15,000 students. At University #1 technology is introduced within the education classes being taught, following the integration model. Instructors introduce and present technology applications from within the methods and content courses. Most, but not all of these classes have some requirements that students use word processors, and many of the instructors use e-mail with students on a regular basis. However, while this integration of technology is a mandatory inclusion in the program, not all faculty are at ease with computers and the requirement to include computer technologies into the curriculum is apparently often ignored.

TECHNOLOGY AND THE PUBLIC SCHOOL

Some of the nation's school districts, recognizing the need to train computer literate students, have spent millions of dollars to bring technology to the classroom (Toroian, 1998). However, this massive expenditure on hardware may be ill spent if it is not used correctly or to its full capacity. Education Week (Coley, 1997) reported that currently the use of computers in classrooms is meager, and that many students in American public schools spend less than an hour a week (or 2%-3% of instructional time) at the keyboard. This article continued by pointing out that the computer applications commonly used are unimaginative and often inappropriate, and are usually limited to word processing and remediation activities. Even among the schools that have adequate multimedia capability, it is unusual to find schools that are using technology for much more than "drill and practice" exercises. Wetzel (1993) claims that at least from a holistic view, "drill and practice" is actually an inappropriate use of computer technology. Yet, this is usually the primary emphasis of many

computer programs and is the main purpose for Title I programs that supply computer technology for remediation (Coley, 1997).

The Minnesota Department of Education addressed the question of computer competency of public school teachers after conducting a statewide survey of teachers that pointed out that few teachers had any more than the "most rudimentary computer skills" and were unable to pass on any computer knowledge to their students (West, 1990). Despite their lack of computer skills, the survey also showed that these teachers were curious about how to use technology in more effective ways. The survey also indicated that short term training programs for teachers were ineffective and that teachers needed five or more years of experience with computers before they began to use them for more than the most basic instructional applications (West, 1990).

The inability to use the technology creatively is often blamed on the lack of teacher training and the hesitancy of the classroom teacher to use the hardware and software available to them in appropriate ways. Possibly, older teachers who never received technology training lack the skills necessary for creative integration. Currently, new teachers are being taught many of these skills within their teacher education programs (Fulton, 1998). These programs now recognize the need for technology training and are making efforts to include this knowledge, but many new teachers still exit the programs unwilling to use technology for any but the most basic uses. Wetzel (1997) suggested that teacher education programs are at fault and that the method of instruction should be a combined form of the integration and the competency models rather than the current trend of using only one model. He believes that the core classes are needed to teach students basic skills but that the integration model is necessary for prepare students to integrate technology into their classrooms.

The Study

The second part of this study was undertaken to determine how teacher descriptions of their use of technology in the classroom vary according to the decade in which they were certified to teach. In an attempt to answer this question, a survey was developed to explore attitudes related to computer use of teachers in a small school district in Pennsylvania. Following administrative approval the survey was distributed to teachers in a small Western Pennsylvania school district. This district is comprised of eight schools. Five of the schools are located in rural areas and the remaining three are within the city limits.

The questions in the survey pertained to the use of technology in the classroom, personal feelings about computer technology, and how technology is being integrated into the instruction. Specifically, the survey was designed to determine the year of original teaching degree, the teacher's familiarity with computers and other technology, the instruction they had received from college or university courses into the uses of technology, and ways in which they were able to apply technology within their own teaching situations. The results were tabulated to provide information in two ways. District totals for all teachers were counted to determine overall technology usage and then these counts were separated according to the decade of the teacher's original teaching degree.

Data Collection and Analysis

The survey and a stamped, self addressed, return envelope were distributed to 235 teachers in the district. One hundred twenty-three (52%) of the surveys were returned by the cut off date indicated. All were usable for tally purposes and 84 (68%) included comments that were useful in determining actual computer and technology usage within the classroom.

Teachers who had graduated within the past 8 years comprised the most recent graduate group and it was determined that this group would be the most helpful in determining how teaching programs currently train students. Therefore, all questions were divided into groups representing information from teachers graduating within ten-year time frames. Also, the year of original teaching degree was used as an indicator of the age of the teacher. Dates of original degrees ranged from 1962 to 1997, and were divided into decade groups for comparisons. Interestingly, fifty percent (N=62) of the respondents received their degrees between 1970 and 1979 and only eleven percent (N=14) had graduated within the past eight years. Responses to remaining survey items were tallied and percentages were calculated.

Year of Original Degree	Respondents	Percent of Total
1962- 1969	37	30%

1970- 1979	62	50%
1980-1989	10	08%
1990-1998	14	11%

Results

Fifty-five percent of the surveyed teachers indicated that they had used computer applications or instructional technology in their classroom in the 1998-99 school year. There was little difference between those who had graduated in the 1960s and those who were recent graduates in this specific area. Fifty nine percent of the 1962-1969 graduates had used computers or instructional technology, and fifty seven percent of those graduating between 1990 and 1997 reported using it. For the most part, the actual technology used was the TV/ VCR, (62%) but thirty seven percent indicated that they included word processors, twenty five percent used instructional software, twenty-two percent used drill and practice software, and twenty-one percent reported using video presentations. Almost exclusively, the technologies used could be considered passive learning experiences, meaning those experiences that required no construction of knowledge by the student.

When teachers were asked about their personal computer use, sixty-nine percent indicated that they have a computer in the home. When broken down into decade of original teaching degree, there was very little difference in percentages between those graduating in the 1960s and those more recent graduates about which group was more likely to own a computer. When asked about how they rated their proficiency with computers, sixty-one percent rated themselves as beginner or novice users, twenty-nine percent indicated that they were intermediate users, and the remaining nine percent rated themselves as advanced or expert users. One failed to respond. When these numbers were broken down by decade of original degree, the percentages were much the same, with no one age group rating themselves as more proficient than the overall average. There was however, a noticeable difference between decades when answering this question about attitudes towards technology. Twelve percent of the teachers admitted to hating or barely tolerating computers, thirty-six percent rated them as OK, and fifty percent stated that they liked or loved using computers. The 1962-1969 graduates reported that forty-six percent of them liked or loved computers, but the 1990-1997 graduates reported that sixty-four percent had the same attitude. Those more recent graduates were more likely to like or love computers, when compared to those who had graduated in the 1960s or 1970s.

The questions about computer classes taken and feelings about preparation for using computers and technology in the classroom may be related to why teachers are not using these technologies in the most appropriate ways. These questions showed that the percentage of those taking a college level computer class has risen from thirty-eight percent of the 1962-1969 graduates, to ninety-two percent for the 1990-1997 graduates. It also points out that only 50% of those 1990-1997 graduates rate their college or university experience as having prepared them to integrate technology into their classrooms.

Discussion

This survey indicated that eighty percent of the teachers in this district received their initial teaching degrees between 1962 and 1979 and only twelve percent of them have graduated within the past seven years. If initial degree can be used as an indicator of approximate age, over all, the teachers in this district are between the ages of 40 and 55. Therefore, most received their teacher training before computers and other current technologies were included in the teacher training programs. Only thirty -three percent of those 99 who graduated between the years 1962 and 1979 reported having ever taken a college level technology or computer class. Surprisingly, though few had any college level classes in computers, there was very little difference in their reports of technology use within their classrooms when compared to the more recent graduates.

The possible conclusion drawn from this survey is that age of the teacher, as determined by date of college graduation, may have little to do with how likely the teacher is to use technology within the classroom. Also, age seems to have little bearing on how users rate themselves in computer proficiency, or how likely they are to have a computer in the home. Age does appear to be related to rating personal interest in computers. Age may also be related to how individuals feel about their college training in preparing them to integrate technology into their instruction. Of those graduating in the 1960s, only eight percent stated that they have been adequately prepared, while fifty percent of the most recent graduates feel prepared. Those more recent graduates are also far more likely than their older colleagues to indicate that they enjoy using computers. If the results from these surveys can be taken as an indicator, it appears that teacher education programs may have little effect on a teacher's willingness to use computers and other technologies within the classroom.

Interestingly, those teachers graduating in the 1960s were more likely to rate themselves as using computers in meaningful ways in their instruction than those who had graduated within the past ten years. (59% vs. 36%)

The most meaningful and insightful parts of this survey were gathered from the handwritten notes that many respondents attached. From examining these notes it was determined that many teachers attributed the inaccessibility of computers and other technology for their failure to use them in meaningful ways. Many responded that the technology was not available to them or was not available in sufficient numbers to be useful. Two teachers actually reported that they had computers in their rooms but that they were still in the box. One explained that only 'certain people' were permitted to remove and set up the computers and that those persons were not yet available to them. Teachers also wrote about inadequate training in the use of available technologies, lack of priority for computers and other equipment being included in the budget, lack of time within the school day for including computer usage, and a lack of priority by the school district in recognizing the importance of the role of technology in education. Another complaint reflected in the handwritten notes was that technical help was not available for keeping the equipment maintained and in operating order. The overall feeling gathered from these surveys was that budget constraints largely determined the minimal integration of technology for other than remedial and passive learning situations.

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Levels of Computer Literacy of School Teachers and Students: Case Studies

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Abstract: The paper reports two case studies conducted at three schools in California. The first case study investigated computer literacy levels of thirty-five teachers at two schools. Findings indicate that teachers do not fully use software available to them and that they need technology training, especially small group or one-on-one training. The second case study examined the levels of twenty 5th grade students at a school. Results indicate that students do not have sufficient computer skills and more training needs to be provided. The case studies reveal that computer skills of both teachers and students need to be enhanced.

Introduction

Technology has become an ever-increasing factor in today's classrooms, and computer usage in the classroom is on the rise. Along the trend, we have been seeing President Clinton and Vice president Gore promoting technology use in education, business sectors donating money to institutions, schools receiving federal or state grants for upgrading technology on sites, and decision makers investing a tremendous amount of money into computer technology. While all of these are happening simultaneously, training our teachers and students to be technology literate to improve the quality of education is the ultimate goal.

The literature indicates a close relationship between the training a user has on technology and his/her comfort level of using the technology. Chiero (1997), in her study of teacher computer users, noted that the more training the teachers received, the more likely they were to be comfortable users of the technology. Walters and Necessary (1996) studied business school students and found strong correlation between the number of computer classes a student had taken and the positive attitudes those students had about computer usage in general. These studies indicated that if users have more

training, they feel more comfortable of using technology. Do our teachers have adequate computer experience and training to be comfortable users of computers in classrooms?

Mowrer-Popiel, Pollard, and Pollard (1994) found that many preservice teachers did not have much computer experience upon entering the classroom and concluded that districts should invest heavily in teacher technology inservice training. The preferred method of learning new technologies in their study was in the following order: a tutor, a class, own experimenting, and instruction manuals. Marcinkiewicz (1994 & 1995) found that preservice teachers had much more experience with computers than did their inservice teaching counterparts. This indicated that although schools are investing in computer technology, either not enough is invested into training or that the training is not being utilized to its fullest.

The following two case studies examined levels of computer literacy of school teachers and students. Research methods and results are reported. Suggestions are provided to educators.

The Case Studies

Computer Literacy of School Teachers

The study is intended to discover whether teachers at two schools, that are well equipped with modern computers, are as computer literate as one would expect. The focus was on one elementary school and one middle school in a school district in Southern California. Both schools have fast access to the Internet, and each classroom has at least one computer hooked up to the Internet. Teachers have received extensive training in a variety of software applications, and each school has had a technology mentor residing at the school for the past two and one half years. Has the training that the teachers have received over the past couple of years benefited them? The goal of this study was to examine the current use of computers among teachers at these two technologically advanced schools.

The instrument used for this study was a survey. Thirty-five teachers at the two schools responded to the survey on their use of technology. The survey asked specifically about the teachers' use of computers, related software, and the Internet. Surveys were to remain anonymous to aid in the truthfulness of respondents. The survey was meant to discover teacher knowledge of their own computers, to ascertain the software usage and frequency of use, and to discover what type of training they would like to see in the future.

Results indicated that teachers had several programs available to them. The two schools belong to the San Bernardino County Open Mail (Omail) system. Both schools rely heavily on email for communication, and it is understandable that this percentage of use is high. Of the 88.57% of the teachers who said they had access to the Omail software, 93.55% of the respondents said they used it at least once a week. In a related question, it was found that actually 100% of the teachers used Omail at least once per week. Some teachers were just not aware that they used the Omail software as their e-mail system.

Three word processing programs were available to the teachers. Of the teachers that had access to various word processing programs, the usage dropped to only 50 percent of the teachers using them at least once a week. As to the use of a grading program, sixty percent of the teachers had a grading program at their disposal and yet only 57 percent of those teachers utilized this program on a regular basis. Many teachers had software available to them but did not seem to utilize it as much as they could.

A vast majority of teachers said they were comfortable using a computer. Sixty three percent of the respondents stated that they had moderate computer experience and 20 percent of them expressed that they had a lot of computer experience. The teachers who stated that they had a lot of computer experience utilized software more often and to a higher degree than did others who rated themselves with moderate computer usage or little computer usage. These high-end users also tended to use a larger variety of programs than did other users.

Respondents overwhelmingly (91 percent) wanted to see more technology inservices within the district. Eighty six percent felt that small group or one-on-one instruction would be the most beneficial way of having future inservices. One teacher stated, "I find I am particularly slow in the large group training sessions. Most others are way ahead of me and if I make a mistake the leader sometimes will not get around to help me for 20 minutes, and I am lost." Several teachers felt the smaller group setting would be more advantageous for teachers to build up their self-confidence especially when coupled with follow-up training within 3 to 5 weeks after the initial training.

Overall, the results indicated that the teachers, who felt they were moderate computer users, did not have the confidence that this could instill in them. Teachers did not use the available software in great numbers with the exception of the high-end users. The findings validated Chiero's study (1997), which found that a small group of high-end users utilized most of the programs available to them and were considered to be "exemplary computer users", while lower-end users got by with the basics. Marcinkiewicz (1994 &1995) found that districts often invested in computer training inservices, but often that training, which was done in large group settings, seemed to benefit the high-end users the most. Since high-end users made up the smallest group of computer users within the district, the money for these training inservices did not seem to be utilized the best way possible. Teachers of this study also stated they would like to see more inservices, but at a smaller scale. It is recommended that school districts provide small group inservices training. In this inservices training, teachers may get one-on-one help without feeling intimidated by high-end users who are often moving at a more rapid pace. Since the preferred method of learning new technologies, according to Mowrer-Popiel, Pollard, and Pollard (1994), was via tutor, it would make most sense to provide this type of one-on-one instruction. Teachers would get what they wanted, and districts would probably get more long term technology users for the money they spent on inservices.

Computer Literacy of Students

The study was intended to examine whether there was a discrepancy between what students perceived to know and what they actually could do with the computers. The study was conducted in a 5th grade class at an elementary school. In January of 1999, the 5th grade class was given 5 computers. These computers were going to be wired to the Internet later this year. The school district was studying whether students would do better on writing prompts that the district used if they used computers. The school district had made the assumption that the 5th grade students could use computers and could understand how computers worked. The researchers attempted to examine the assumptions—students' computer literacy levels.

Subjects of the study were a convenient sample of ten boys and ten girls in a 5th grade class at the school. Students were mostly Limited English Proficient students (LEP). The school has been designated an underachieving school by the school district. The school scored in the 19% in the Stanford-9 and had been ranked as the lowest school out of 23 elementary schools. The social economic status of the student population was low; Eighty seven percent of all of the students received free lunch based on the criteria set up by the state.

The survey consisted of 15 simple yes or no questions to gauge the students' computer skills. The questions ranged in level of difficulty from basic to more complex, like whether they knew how to turn on a computer, print a document, or change font in Microsoft Word. The students completed the survey in class. They were not given a time limit for completing the survey. One of the students was given assistance in translating some of the questions from English to Spanish.

A few days later, the students' practical performance was tested based on the same survey. The students were called over to the computers two at a time. They demonstrated the skills addressed in the survey and were graded. The researchers tabulated and compared the scores of the students' perceptions and the scores of their demonstrations.

The results indicated that although the students had often been exposed to the computers and had five computers in the class, the students did not have the skills needed to comfortably use the computers. The students tested higher than perceived with questions such as "Do you know what a monitor is?" "Do you know how to eject a CD from the computer?" and "Do you know how to use HyperStudio?" They tested lower than perceived with questions such as "Do you know how to turn on a computer?" or "Do you know how to save your file to a disk?" Many students had also problems navigating through Microsoft Word.

The results also showed that the boys had higher confidence on using computers than girls. All of the boys perceived that they could draw a picture using the paint tool from HyperStudio. When tested, 100% of the boys succeeded drawing the picture. The girls on the other hand were more conservative on their perceptions. Forty percent of the girls perceived that they could eject a CD from the computer. However, when tested, 100% of the girls were able to complete the task. Both groups tested lower than they perceived on the use of the spell check while typing something. Seventy percent of the girls perceived that they could use the spell check. Only 40% of the girls knew how to use it. The boys on the other hand perceived that 100% of them knew how to use the spell check. When tested, 60% of the boys could use it. It was noted that the girls tested higher than the boys on only one item out of 15. On the question about changing the font using Microsoft Word or Works, the girls tested 80% while the boys tested 70%.

The results showed that the students needed to enhance their skills of how to operate computers. Before meaningful instruction via computer can be achieved for these students, the students will have to feel comfortable with the basics covered in the survey. Teachers will have to be aware of the difficulties which the students have in using computers, and will have to be aware that the students will not be able to judge their own abilities quite correctly. Extra time for teaching these basics was necessary.

Conclusion

The results of the studies revealed that computer literary levels of teachers and students need to be enhanced and that technology training must be provided. In addition to large scale training sessions, teachers, especially teachers who do not have advanced computer skills, prefer small group training or one-on-one instruction. As to students, there might be a discrepancy between what they think they know about computers and what they really know. When evaluating students' computer knowledge, it is helpful to have students demonstrate their skills using computers. In the Information Age, computer skills are becoming necessary skills for every citizen. Training teachers to be computer literate to enhance education quality and helping students to be computer literate to face their future challenges are one of the important missions of our nation. We can only imagine the positive impact of the training on our society.

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CyberJive: The Origins of Information Technology Jargon with Implications for Instruction

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Abstract: Preliminary surveys conducted by the authors suggest that students at the secondary school level are likely to feel much more at ease with the vocabulary of information technology than the pre-service teachers who will soon be expected to integrate technology into their teaching. We present a discussion of our survey instruments and first results and we explain why we feel teachers should understand the sources of technology jargon, which we call "CyberJive."

The Special Nature of Technological Jargon

Although software designers have long promised intuitive interfaces and "transparent," easy-to-use devices and software agents, we have good reasons to believe that technology is getting more, not less complex (Fowler and Zhang, 1994). We also doubt the claim that a new generation of pre-service teachers will be technologically sophisticated, as part of a "Nintendo" or otherwise-labeled generation. Although we would like to concentrate on the applications and curricular integration of instructional technology, we find preservice teachers don't understand the tools well enough to apply them to instruction.

We have evidence that preservice teachers are hampered by the terminology related to the tools we want them to use. Lacking the necessary vocabulary, novice users simply don't know what is going on. Not only do most preservice teachers not possess the requisite terms and expression, most of them do not want to know the terms.

Unlike the jargon of many other areas, for example the terms of physiology or traditional mathematics, where the terms have a certain linguistic consistency, based on Latin and Greek roots, the jargon of instructional technology is a hodgepodge of expressions of different sources. For example, we have acronyms, marketing terms, and desktop metaphors often mixed into the same sentences as part of an overarching explanation.

As Fellenz, Parkkinen and Shubin (1998) point out,

"Metaphors can help users achieve their goals in using a system. The desktop metaphor has been very successful in making computer systems accessible to the general public. On the other hand, metaphors can lead users astray, especially when they are mixed together in one user interface. Users find it difficult to determine which controls apply to which part of the application.... This has created confusing environments for users. Advances in technology, such as frames and dynamic HTML have further added to the complexity of the situation, creating potential pitfalls for designers and ultimately usability problems for users."

We assert that most terms used in instructional technology come from one of the following sources:
1. Fundamental technologies, such as development of computer operating systems and low-level languages;
2. Variations on the "desktop" metaphor
3. Variations on the "Web" metaphor
4. Marketing labels and slogans derived from the above and from science fiction sources.

Most readers are familiar with the distinction between declarative and procedural knowledge. A simple example often given describes procedural knowledge as knowing how to carry out a task--for example how to ride a bicycle--without being able to explicitly describe what is necessary to carry out the procedure. There may be no special disadvantage to the ordinary task of riding a bicycle without knowing the names of any of the parts of the machine. On the other hand, to repair a bicycle, or more emphatically to teach someone to repair a bicycle, one needs to know the names of the components. Therefore to establish a foundation for a smooth communication

Although we once thought that by now our various instructional technologies would be "seamlessly" integrated, and the use of computers would be as simple as riding a bicycle -- without knowing any special terms, other than a few obvious "desktop" metaphors--this has not happened.

The increasing complexity is reflected in the terminology of instructional technology, not just in the increasing size of the vocabulary, but in the strange mixture of terms that have come together from various sources to comprise the strange language we call *CyberJive*.

We have appropriated the term "jive" in the dictionary definition: "a special language of difficult or slang terms." We feel that this term, used with this sense, comes closest to describing the way we speak when we try to convey the complexity of technology to our preservice teachers. We conjoin the terms "cyber" and "jive" because *cyber* is one of, perhaps the central, term from which our present-day array of neologisms develops.

A Preliminary Assessment

We presented the following survey to two groups. The first group was a set of high school juniors enrolled in a summer course in computers and business management. The second group was a set of preservice teachers enrolled in a course in instructional technology.

Our purpose was to establish a preliminary comparison of preservice teachers and secondary school students by asking them to make a self-appraisal in terms of their understanding of terminology commonly encountered in the use of computer technology. Participants were asked to rate their understanding of the list of terms by circling the appropriate number:

1- Understand this term 2- "Sort of" understand this term 3- Don't understand this term

We selected twenty terms in each of four categories:
- Technical vocabulary: *asynchronous, bit, byte, CD-ROM, ...* .
- Desktop metaphor: *copy, cut, paste, window, ...* .
- WWW vocabulary: *browser, link, search engine, home page, ...* .
- Science fiction and marketing: Cosmo, Cyberspace, Cyberstudio, Firewire, ...

The survey results have been analyzed using a t-test for paired samples. We set the level of significance at α=.01 for two tail t-test. The self-perception survey included 80 terms. The result shows preservice teachers' average understanding as 45.03% and high school students' averaged as 78.84%. In comparing

the means of the two groups, the data produced a t statistic of t = -15.41. The difference is significant because in the t distribution table for df=79 and a=.01 for two-tailed test, we find a critical value ± 2.660. Thus, a t statistic more extreme than -2.660 would be significant.

The mean scores for the two groups show a significant difference, and encourage us to explore more sophisticated instruments for measuring content knowledge. Even allowing for over-estimation of knowledge by the younger participants, the results imply that this group has a much higher comfort level with the vocabulary.

We believe that it would be useful to present our pre-service teachers with background information on the sources of technical terms, as outlined in the following description.

From Steersman To Mirror Shades

The term "cybernetics" was coined by the mathematician Norbert Wiener, as an over-arching term to describe the work of a group of mathematicians, physiologists, engineers and scientists working on related problems in control and communication theory. The intersection of various research paths connecting theories of automatic gun control with studies of nervous system disorders are described in the introduction to Wiener's book, *Cybernetics, or Control and Communication in the Animal and the Machine* (Wiener, 1961). A central theme in these studies was the concept of feedback. The notions of steering, piloting, or control were ideally described by a Greek term for one who steers a vessel. As Wiener describes it:

> "After much consideration, we have come to the conclusion that all the existing terminology has too heavy a bias to one side or another to serve the future development of the field as well as it should; and as happens so often to scientists, we have been forced to coin at least one artificial neo-Greek expression to fill the gap. We have decided to call the entire field of control and communication theory, whether in the machine or in the animal, by the name Cybernetics, which we form from the Greek cybernetes, or steersman." (page 11).

Few neologisms have proliferated to such a degree. Perhaps only Buckminster Fuller's term "synergy" has been so enthusiastically appropriated. Wiener and company were closely associated with the development of computing machinery, which in the late 1940's was still implemented in vacuum-tube-based hardware. Even then, the computer had captured the imagination of the public as well as scientists. The notion of a "thinking machine" fit naturally with the notion of "robots," a term coined by Karl Capek in 1923. Although "artificial intelligence" was not officially designated until 1956, when John McCarthy, Herbert Simon, Marvin Minsky and Allen Newell used the term in a conference at Dartmouth, Groff Conklin had already assembled an anthology of short stories speculating on the possibilities of machinery with cognitive capabilities (Conklin, 1954). In a preface to one of the stories, Conklin wrote: "The idea of the less inhibited *cyberneticists* [emphasis added] is that every function of a repetitive nature that man now has to perform should eventually be taken over by machines." Thus "cybernetics," and increasingly, the root *cyber-* became associated with computers, especially computers with higher-level cognitive abilities.

Wiener would probably have been fascinated to see the collision of neologisms with the resulting designation "cyberpunk" for a genre of science fiction that developed during the 1980s, characterized by integration of visionary stretches of technology combined with street gangs, mega-corporations and international alliances of hustlers. The style itself is accurately described in Bruce Sterling's anthology, *Mirrorshades*. (Sterling, 1986). In the center of the cyberpunk movement, characterized by Sterling as the author of the "prototypical cyberpunk novel," is William Gibson. In his novel, *Neuromancer*, Gibson (1984) imagined an international network of scientific, governmental and commercial computer systems loosely connected into a system called The Matrix. The Matrix may originate in various forms of hardware, but somewhere along the line The Matrix becomes something else:

> "Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts...A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding..." (Gibson 1984, 51).

From Academic Concept To Amazon.Com

Cyberspace provided the background for a series of novels and stories in which "cowboys" accessed the matrix through direct neural connections and engaged in illegal and dangerous attempts to extract information from proprietary computer systems. By 1991, Michael Benedikt, a professor of architecture at the University of Texas at Austin had published a collection of essays on the implications of Gibson's concept, extrapolating the writer's ideas into the domains of architecture, film and video entertainment, sociology and "virtual reality" (Benedikt, 1991). Ted Nelson's term "hypertext," taken from his notes on Vannevar Bush's "Memex" concept, was well-established by this time, and several authors in Benedikt's collection envision some means for constructing an actual cyberspace by using hypertext links.

As we all are aware today, the practical means for constructing the system was invented by Tim Berners-Lee, who decided to call the system a world-wide web. This system seemed close enough to Gibson's cyberspace to deserve the name. Once the National Science Foundation left the Internet free for commercial development, the equivalence between "The Web" and "The Matrix" was established in most peoples' minds. There may, after all, be a thin line between shared metaphor and "consensual hallucination."

Descriptions of the technical structure of Berners-Lee's system contain references to computer "protocols," "URLs," graphics file specifications, and "HTML," the subset of the generalized mark-up language that is used for description of a web "page" The metaphor of a web, with its associated images of spiders, spinning and strands, underlies some of the product names now used for creating web documents, such as *Spider Writer*. (http://www.spiderwriter.com/scriptwiz.html.) Other components of the Web, for example the web page generate their own names, *e.g.*, "PageMill." We also have marketing terms such as "Web Whacker," or the unlovely "DogPile" that provide practically no functional description. Such terms add to the confusion of the novice user.

We note that fiction, if not always science fiction, continues to provide terms as metaphors for technology. A popular graphics program running on the LINUX operating system is called GIMP, an association with the mysterious figure in Tarantino's film *Pulp Fiction*. The graphics add-on called *Shockwave*, traces its name to a science fiction novel by John Bruner. Neal Stephenson's novel *Snowcrash* has helped popularize the use of "avatar" in reference to web agents acting in virtual environments.

Why Kids Get It So Quickly...And Preservice Teachers Don't

We would like to suggest three conjectures concerning the technology gap between students and preservice teachers:

Perhaps one of he advantages that younger users of technology possess is their lack of concern with the mixing of metaphor. The older user of technology, trying to find a consistent pattern through the acronyms, information-processing jargon, desktop and web metaphors and outlandish marketing terms gets hopelessly boggled, while the young users simply keep track of the names and labels they need and enjoy the process of using the system.

Perhaps the younger users are living in a significantly different culture than those a few years older. Certainly popular fashions change quickly -- couple this with the 18-month technology development cycle, and it is possible that we are living in a time when an insoluble culture inequality exists between students and teachers.

Perhaps the students who want to become teachers are motivated by an interest in the human service side of teaching, and see computer technology as an antisocial force. In fact, web-based communication gives us great potential for human interaction, once we understand the uses of the system. Pre-service teachers who are not immersed in the internet have not experienced this. Hence, they reject the tools.

Conclusion

Learning to use instructional technology means confronting a confusing, even contradictory collection of metaphors. Understanding the history of technology helps us sort out the different metaphoric strands. A good start for instructional technology teachers would be to include a video series such as *The Machine that Changed the World*, and the accompanying text (Palfreman and Swade, 1991).

Finally, we note that most instructional technology conferences, whether regional, state, or national, include at least one "futurist," to tell us where technology is headed. Perhaps the field is reaching a state of maturity where we can begin to profit from the thoughtful analysis of the origins of our present technology and the language we have inherited with these tools.

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Terminology of Educational Technology: A Quantitative Study Based on SITE Conference Proceedings

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Abstract: This paper is a report on the findings of a quantitative study of the Educational Technology (ET) terminology conducted on the materials of SITE 99 Conference. These findings allowed us to single out different technologies used in education, give a formal definition of ET, and identify its areas. A model of ET area is developed. The list of the most frequent terms is presented.

Introduction

Terminology of a specialty field or an area is like a human body's vital signs: its parameters can reflect its current status and help derive interesting and useful conclusions relating to the field itself. Our quantitative analysis of Educational Technology (ET) terminology is based on the Proceedings of the SITE 99 10th International Conference that took place in San Antonio on February 28 - March 4, 1999 (3). In all we processed 986,619 word forms that yielded 26,972 different words. Some of the findings are presented in this paper.

Technologies in ET

What is ET of today? It is a rapidly developing field embracing a wide range of areas. It covers a number of topics from General Education, Pedagogy, Methodology of Teaching and Learning, Psychology, Social Constructivism, and Information Technologies. Educators now participate in the development of new forms of technology-assisted/supported/mediated/based or related teaching, training, instruction and learning (e.g. Computer-Assisted Learning – CAL, Computer-Assisted Instruction - CAI, Computer-Based Instruction – CBI, Web-based Instruction (WBI), Distance Learning (DL), Asynchronous Learning (AL), Teleteaching, Webtraining and so on).

Technology of today can be simply Educational (ET) or even Advanced-Educational (AET), Teaching, Training, Instructional, plain face-to-face Learning and Distance Learning, Computer (CT), Microcomputer, Supercomputer or just Computerized, Electronic, Digital, Informational (IT), Delivery, Communications and Telecommunications (TT), Active, Interactive, Media, Multimedia and Hypermedia. New terms were coined in Europe for the ET areas: Educational Informatics – the Science of Education based on Informational Technologies, and Telematics – Telecommunications-Based Education.

It is natural that due to the ET rapid development there is some confusion in the use of its terminology: thus, in the general term "technology" different authors include various technologies, devices, their parts, and techniques, e.g.: telecommunications technologies, wireless technologies, telephone communications, teletext, video, computers, CD-ROM, CD-players and even multimedia applications.

At the SITE 99 Conference, 85 various technologies were named (Appendix 1). It is doubtful that all the "technologies" presented by the speakers could be actually called technologies, for instance, "audio tape", "chat", "discussion list", "hand-held", "preservice", "spreadsheet-based", "text-based" and other technologies. I suggest that we differentiate between technologies, like Information, Computer, Telecommunication, Educational Technologies, and techniques, for instance, how to use ET in training preservice teachers, or how to apply spreadsheet in teaching accounting. Here we agree with R. Heinich

who wrote: "a teaching technique is not technology… some prestigious reports represented seating chart as technology in the classroom. This trivializes technology" [1].

It is necessary to cut a dividing line between technologies, tools, applications and methods. Thus, there is Communication, Instructional and similar technologies, and tools, such as harware tools: CD-ROM, laser disk, audio tape; software tools: word processor, database, teletext, etc., and educational tools: courseware, computer courses and tests, educational computer games, teleconferencing, etc. Then come applications of these tools and techniques, and methods of their use in teaching and learning.

Definition of Educational Technology

What, actually, is ET? It is a set of specific educational tools and their applications in teaching and learning. (NB: It is remarkable that Pedagogy is differentiating between non-machine and machine didactic tools and corresponding technologies.) What tools does ET deal with? – Today in the inventory of pedagogic tools we include technical (hardware), programming (software), didactic (courseware, textbooks and other materials), and methodological (methods and techniques) tools. These tools are used by the people (teachers) and for the people (students) to deliver new information and provide the building and development of a general and particular professional knowledge and skills. Application of ET has for the goal an increase of efficiency of teaching/learning processes, of educational research and of the administration of educational institutions of all levels.

ET can be defined as *a system of technical, programming and didactic tools that are used in education together with human and informational resources to construct individual and group general and specific professional knowledge, to provide meaningful interaction between students, teachers and teaching/learning materials, to mediate communication and collaboration among people involved in the educational process, and to develop particular competencies and skills on the basis of related sciences, technologies and techniques with the goal of improving the efficiency and quality of teaching, training and learning, of pedagogical research and school management* [2].

Areas of ET

To single out the areas of ET, we analyzed the structure of the SITE 99 Conference and found out that there were 24 separate sections at the Conference with 414 papers presented and published in the Proceedings. The most active sections were: Distance Education - 44, Research - 38, Graduate and Inservice - 34. Three telecommunications sections pulled together 35 papers. So, it was clear that the primary topic of the last conference was Telecommunications Technology in education and Distance Learning as a specific form of education based on this particular technology.

Our study allowed us to define 3 major ET areas: Computer, Telecommunications and Non-Computer Technologies, the latter embracing audio, video, audio-visual, TV, projection and other technologies. An important part of ET terminology field is the area of General Educational terminology that relates to all other areas and includes major educational terms associated with ET.

Table 1. Structure of the ET Terminology Field

Terminology Areas	General Education	Computer	Tele-communication	Other Technologies
Number of Terms	536	598	628	160
Total Frequency of Usage	25067	16788	17238	1973

The majority of different terms, as follows from Table 1, are related to the Telecommunications Technology area, though the General Educational terms make up the largest part of the field.

Model of ET Area

We developed a model to describe an ET area that consists of 10 components:

1. Technology Area
2. Hardware 2.1. Types 2.2. Names
3. Software 3.1. Types 3.2. Names
4. Programming 4.1. Tools 4.2. Activities
5. Technological tools (e.g. word processor, database)
6. Processes and operations
7. Forms of technology-using education
8. Educational tools (courseware)
9. Design and development
10. Applications (activities, strategies and techniques)

The Most Frequent Terms

Very significant is the list of 47 most frequent words (with the frequency ≥1000) (Appendix 2). These terms fall into 5 distinct subject groups (some words fall into two groups - e.g. program, information, communication):

1. *Technology*: Technology, computer, software, Web, Internet, online, support, tool, site, system, (computer) program, environment, e-mail, information, communication;
2. *Education*: Education, learning, instruction, teaching, training, course, class, curriculum, process, activities, development, knowledge, skills, information, resource, design, system, level, (course) program, material, communication;
3. *School*: School, university, classroom;
4. *Research*: Research, project, study, data, experience, need;
5. *People*: Student, teacher, faculty, professional, group.

These words allow us to determine the general focus of the conference reports.

Compound Terms

There is a tendency to create new compound terms that denote the level and character of technology use in education. They typically combine an extension with one of the four major terms - technology, computer, Internet and Web. The extensions are varied: accessible, administered, aided, assisted, based, controlled, connected, delivered, driven, enhanced, equipped, enriched, facilitated, focused, generated, infused, integrated, intensive, mediated, networked, oriented, related, rich, supported, and using. The table below shows current preferences in the use of compound words. We used the extensions the frequency of which is 10 or higher.

Table 2. Compound Terms

Term / Extension	Technology-	Computer-	Internet-	Web-	Total
-assisted	-	14	-	-	14
-based	64	74	62	497	697
-enhanced	-	-	-	21	21
-mediated	22	104	-	-	126
-related	34	29	-	-	63
-rich	34	-	-	-	34
-supported	19	13	-	-	32
-using	10	18	-	-	28
Total	183	252	62	518	1015

It is clear that the most frequently used compound words are formed with the terms 'Web', then The most frequent extensions used for that is, certainly, *-based* that points out to the tendency in today's application of technology: if only a few years ago we often used the compound terms CAL, CAI, etc. that demonstrated the supportive role of technology in education, now we mean education *based* on technology. This shift in our perception of technology is very remarkable.

Reduction of Compound Terms

The research also showed that there is a tendency to eliminate a dash in a number of compound words thus reducing them to one word: on-line - online (833-1021), pre-service - preservice (316-847), in-service - inservice (193-323), web-page - webpage (11-34), web-site - website (18-154), though in two words the most use is traditional with the same tendency: e-mail - email (726-357), cd-rom - cdrom (147-14). 'Off-line' was found to be used only in one form.

Neologisms

We recorded quite a few neologisms which is natural for our fast developing field. To mention just a few, we will present a list of terms based on the stem 'tech': techlearning, technofear, technophobia, technophobe, technophile, techno-poetry, techoutcome, techreform, techtrend, techuse, and so on.

Conclusions

Terminology of a science or a special field like ET is a set of laws that regulates the correct use and comprehension of its notions, units, relationships, and reflects its structure. So, the function of terminology is not only to mirror the status quo in the field, but also to organize it, structure, differentiate between its areas and units, standardize and make it exact and, so, efficient. Incorrect terms or their improper use may lead to the misunderstanding or misinterpretation of the real situation in the field.

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Appendix 1. Technologies used by SITE 99 Conference participants

Active	Internet
advanced	Internet-based
all-purpose	knowledge building
alternative	laser disk
applied	learning
assistive	low-end
audio tape	media
audio	multimedia
audio-visual	NASA
CD-ROM	network
chat	networking
classroom	online
CMC	optical fiber
collaborative	presentation
communication	preservice
communications	print
computer	school
computer-based	soft
computer-related	software
computing	software applications
convergent	spreadsheet-based
course	supercomputer
curriculum	supporting
CyberSpace	telecommunications
database	telecomputing
digital	telelearning
discussion list	telematic
distance	text-based
distant	two-way asynchronous
education	two-way interactive
Educational	undergraduate
electronic	video
hand-held	videoconferencing
hard	video disk
hardware	videotape
high	voice-recognition
IBM	VR
Information	Web
infrared	Web-based
Instructional	Web CT
Instructional Systems	wideband channel
interactive	writing
interactive audio/video	

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Appendix 2. The most frequent words (f ≥1000)

Student	- 10901	faculty	- 1626
technology	- 9672	instructional	- 1623
teacher	- 9286	software	- 1572
education	- 5204	instruction	- 1423
learning	- 5056	study	- 1417
computer	- 4513	internet	- 1410
course	- 4469	process	- 1391
school	- 3783	class	- 1386
classroom	- 2946	skills	- 1382
teaching	- 2749	curriculum	- 1358
Web	- 2318	tool	- 1311
development	- 2184	support	- 1294
educational	- 2183	site	- 1256
university	- 2118	level	- 1250
information	- 1978	design	- 1241
research	- 1916	knowledge	- 1233
design	- 1911	system	- 1225
online	- 1854	environment	- 1203
experience	- 1827	activity	- 1166
need	- 1792	communication	- 1135
project	- 1778	data	- 1106
training	- 1648	e-mail	- 1083
program	- 1634	professional	- 1073
		material	- 1011

The First Decade of the SITE: 1990-1999

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Abstract: The SITE annuals have grown from a couple of hundred pages in early 1990s to two big volumes of almost two thousand pages in total in 1999. The advancement of the SITE conferences and annuals reflects the maturity of the field of Instructional Technology itself. The paper plans to conduct a content analysis of the SITE annuals published during its first decade. Main focuses of the discussion will be the development of the telecommunications, the advance of the hardware/software tools, and finally the dissemination of the Annuals and related information. The Annuals represent a significant increase in quality as well as quantity. As the SITE begins its second decade, it is worthwhile to look back at the past.

Introduction

During each spring for the past ten years, the Society of Information Technology and Teacher Education (the SITE, was called the Society for Technology and Teacher Education, the STATE, from 1990 through 1994) conferences have offered faculty, graduate students and staff around the world in the field of educational technology a series of events designed to prompt discussion around issues of information technology and teacher education. These events have been as varied as papers, tutorials & workshops, posters & demonstrations, panels, and corporate showcases. The topics covered in the events serve as major sources indicating the current state of teacher education and information technology

The author has been involved with the SITE conferences and the annuals since the first Instructional Technology course she took at the College of Education, University of Houston as a doctoral student. It was back in 1994, when Dr. Jerry Willis was the instructor of the course mentioned above and also the presiding president of the SITE. The different roles she has played include: associate editor, author, presenter, paper reviewer, and proceeding CD developer.

The paper plans to conduct a content analysis of the SITE annuals published during its first decade. By analyzing the volumes, total numbers of contributors each year, numbers of contributors for each section, the categorizations of papers into sections, the topics of the papers, the quality of the papers, and the projects described in the papers, we may get a big picture of the emergent trends in the IT field.

The Growth of the Telecommunications Sections

It is not surprising that telecommunications is one of the fastest growing areas in technology and teacher education. The topic of telecommunications has grown from one section of 11 papers in 1991 to two sections (Telecommunications: Pre-service and Telecommunications: Graduate, In-service, & Faculty Use) of approximately 35 papers in the 1995 annual when the World Wide Web was in its infancy stage, to three sections (Telecommunications: Graduate and In-service, Telecommunications: Pre-service Applications, and Telecommunications: Systems and Services) of over 40 papers in the 1999 version. Not to mention those many telecommunications related papers that have been re-categorized in other sections to avoid overflowing.

The projects described in the papers within the telecommunications section(s) also flag the general trends in this field. In the 1990s the SITE had included several papers that outlined large-scaled projects designed to provide initial Internet access for teachers via the networks. These early papers have a mission of serving as a model for other schools and universities that were planning to jump on the Internet bandwagon. For example, in the 1991 version, the majority of the papers (6 out of 11 papers) are devoted to describe initiatives such as PEN (the Virginia Public Education Network), GC EduNET (Georgia

College Educators' Network), WCTLN (Wyoming Centers for Teaching and Learning Network), GTE Electronic Pages at Sam Houston University, and FrED (the Free Educational Electronic Mail Network). Some of the described networks may have already been phased out and replaced with newer technology.

The contents of the papers in the telecommunications sections also documented contributing authors' change of interests from 'how to start off' to 'how to improve the practice'. As examples of the early 'how to' papers, in SITE 1993, several papers spent pages introducing Internet jargons such as FTP, BBS, telnet, WAIS, Gopher, Archie, Veronica, and listserv. Although listserv is still being used in today's education, the rest of the terms have been made obsolete by newer technology. The initial projects were exploratory in nature, providing teachers with the opportunity to exchange information and teaching ideas. The explosive growth of the Internet has made it a classroom reality. The latter 'how to' papers started to appear in the 1995 version of the annuals with titles such as 'Teacher Education and the Internet: Where Do We Go from Here?' (1995), and 'Look at Communication Patterns on the MariMuse'(1995). The annuals published in the following years have included more of this reflective type of papers on the topic of telecommunications.

An interesting observation about World Wide Web is that, although many resources indicate that World Wide Web first came into being in 1991 (Geyer, p. 585), the first mentioning of the term was found by the author the section editor's remark in 1994 by Glen L. Bull and Frank Becker. 'Although Internet gophers are evolving rapidly, ' Bull and Becker noted in the Preface to the Telecommunications I section, 'other graphical client-server tools are also maturing. The Mosaic interface is one of the more promising of these tools' (Bull & Becker, p. 629). While Bull and Becker have not mentioned the term World Wide Web, the first paper on the topic of World Wide Web was found in 1995 Annual, "The Teacher's Ultimate Classroom Resources: Mosaic and the World Wide Web' written by Roger W. Geyer. This introductory paper first gives a short history of World Wide Web and then provides some demonstration of Mosaic browser.

Ten years have passed since teachers gained initial access to electronic mail and electronic conferencing utilities housed at colleges, and schools. The expanding Internet exceeds any other academic network by an order of magnitude. Beginning from 1991, in the early versions, the names of 'senator' Albert Gole, National Research and Education Network (NREN), and the act Gole has sponsored, 'the High Performance Computing and Communications Act' have been brought up times and again. NCSA (National Center for Supercomputing Applications) and National Science Foundation are two other names that several other early papers have contributed for the Internet's rapid growth in schools all across the US.

The Advance of Hardware/Software Tools

The Annual is also a spectator of the advance of hardware/software tools for the preparation of teacher educators. For example, the section name for hypermedia/multimedia/new media has undergone several changes -- from hypermedia in the early 90s, to multimedia/hypermedia in the mid 90s, to new media in the late 90s. This phenomena reflects the development of the computer hardware and software technologies. In the early 90s, the term hypermedia had recently become popular for describing the use of multimedia technology combined with some type of program that will allow for far more interactivity than has been previously possible.

Several authors who had more resource at their disposal than other teachers have also developed their own video-discs to utilize their programs. The application courseware described in the early Annuals was varied and innovative, but limited by hardware such as computer memory space, and scarcity of CD writer, and software features such as media formats, the products are not as diverse as the products widely discussed in the late 90s. Many of the earlier packages have been used to teach classroom methods to preservice teachers. Integrated learning systems (ILS), interactive videodisc technology (IVD), interactive video instruction (IVI), video tape players (VTP), computer-assisted interactive video (CAIV) were the major tools in the early 90s.

Newly added to the contents and tools of the papers published in the late 90s are Zip drives, VRML, WWW, laptops, digital overhead projectors, document cameras, smart whiteboards, CD recorders, and digital cameras, DVDs, computers with TV output, and high definition scanners.

Many of the innovative, cutting edge projects described in the early papers have become routine, expected activities in the late 90s. On the other hands, a new level of interactive multimedia is on the forefront of web and multimedia authoring and is now available for educators to access and create as supportive information to their curriculum. Software names such as HyperCard and HyperStudio for the

Macintosh and LinkWay for IBM were the topics of the majority of the early papers. Online course tools were not heard of in the earlier years. Today, the names and capabilities of electronic publishing software are too various to list here. During this decade, technology -using educators have also brought information technology out of isolation in the educational computing course and integrate it into the entire range of teacher education. The reclassification of the sections and additions of new sections are indications of the attraction of various audience to the society and the progress of the field itself.

The Dissemination of the Annual-related Information

The SITE annuals are the product of both the time and the hard work of many teacher educators who were selected because of their knowledge and expertise in the field. Each conference is accompanied by a printed proceeding, the Annual. The SITE annuals have grown from a couple of hundred pages in early 1990s to one volume of approximately one thousand pages in 1995, and to two big volumes of almost two thousand pages in total in 1999.

By 1992, the founding organizers of the STATE had elected to move under the umbrella organization of Association for the Advancement of Computing in Education (AACE) (Willis, D. 1999, Preface). And in 1995, when founding organizers the started thinking in more international terms, the society has a new name, the Society of Information Technology and Teacher Education (the SITTE, or the SITE).

To enhance the exchange of information, the Society for Technology and Teacher Education (STATE) Internet server was announced at the 1993 STATE conference in San Diego (Bull & Becker, p. 629). Directions for accessing the National Teacher Education Internet Server established under the auspices of STATE are provided in the article 'The Teacher Education Internet Server – A New Information Technology Resource' Diego (Bull & Becker, p. 629).

The first Annual CD was disseminated in the 1995 SITE conference in San Antonio. The author is proud to participate in developing the CD and HTML version of the 95 Annual. The process was documented in the paper 'Producing Electronic Books: Creating and Using the CD-ROM Version of the Annual' (Chen & Willis, p. 575). As described in the paper, FolioViews has been picked as the interface for the 1995 CD because of its powerful searching and indexing engines. The drawback of the FolioViews interface is that the editors have to spend the same amount of time to convert articles into the HTML format for the Internet archive. Because of this reason and other considerations, from 1996 till this year, Acrobat PDF (portable document format) has been chosen and the dissemination of the Annuals has become easier and more systematic.

To expand the potential audience, the proceedings accompanying the SITE (or STATE) conferences (Technology and Teacher Education Annuals, or the Annuals) are now distributed as printed Annuals, on ERIC microfiche, on searchable electronic books on CD-ROMs, and through the Society's Internet server. Currently, the society has converted its 1994-99 Annuals into PDF version and made available through CD-ROMs and the AACE web site. The HTML version 1995-99 of the Annuals is also available through CD-ROMs and the AACE web site.

Conclusion

From the transition of contents discussed in the papers published in the Annuals, readers have witnessed the replacement of the computer operating systems, computer hardware, and software. The VMS and MS DOS operating systems described in the early papers have been replaced by the more current Unix, Windows, and MAC operating systems. As for computer hardware, VAX, Apple computers, IBM XT, Commodore, MS DOS clones in the early 90s have been phased out by the Windows computers, workstations, and more powerful models of the Macintosh computers. E-mails have been consolidated from various proprietary e-mailing systems such as cc:Mail, FIRNMAIL, and GTE's Electronic Page to e-mail as we see it today. The Internet itself has also stood out to be 'The Internet', instead of being just one of the 'Internets' like BITNET, NFSNet, and FidoNet, etc. as it was in the Annual's early history. There are also validated models, methods, and instructional packages.

The SITE Annuals have chronicled the pioneering efforts of several hundred technology leaders in teacher education. Collectively the papers tell us that teacher education, as a technology-using field, is thriving.

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Appendix

A List of General Editors for the Annuals 1991-1999

1991, Doris Carey, Regan Carey, Dee Anna Willis, Jerry Willis
1992, Doris Carey, Regan Carey, Dee Anna Willis, Jerry Willis
1993, Doris Carey, Regan Carey, Dee Anna Willis, Jerry Willis
1994, Jerry Wills, Bernard Robin, Dee Anna Willis
1995, Jerry Wills, Bernard Robin, Dee Anna Willis
1996, Bernard Robin, , Jerry Willis, Dee Anna Willis
1997, Jerry Wills, Jerry D. Price, Sara McNeil, Bernard Robin, Dee Anna Willis
1998, Jerry Wills, Jerry D. Price, Sara McNeil, Bernard Robin, Dee Anna Willis
1999, Jerry D. Price, Jerry Wills, Dee Anna Willis, Muktha Jost, Stephanie Boger-Mehall

Learners' Reflections in Technological Learning Environments: Why to Promote and How to Evaluate

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Abstract: In the study reported here 24 ninth-grade students investigated several issues related to modern Israeli society. In their investigation students were engaged in activities such as data search, data sorting, and inquires, project writing and construction of a new computerized data-base related to the subjects of their investigations. Students were encouraged to write personal reflection notes after each session throughout the five months period of their work. Studying these reflections allows us to improve our understanding of the way students think about themselves as learners, about the task's demands and about strategies that are needed to deal with the demands. We propose a tool for analyzing the reflections based on Flavell's metacognitive components. Replicas are analyzed according to eighteen dimensions. This tool enables us to compare different patterns of reflections among students, as well as to detect dominant dimensions within the student's own protocols of reflection.

Theoretical Background

The aim of this study is to investigate the metacognitive process of students who reflect verbally on their learning experience in a data-base environment, and to introduce a tool for analyzing their reflections. The relationship between learning in information technology environments, such as databases, and metacognitive processes has not been documented enough yet. However it seems that learning in these environments entails metacognitive activities, such as reflecting on data search strategies and on their efficiency, as well as monitoring their impact (Butler & Winne, 1995).

The ability of individuals to reflect upon their own thinking is one of their unique characteristics as human beings. This capacity was termed by Flavell (1976) as Metacognition. Theoreticians have approached metacognition in different ways, but all of them relate the contribution of metacognitive processes to the enhancement of thinking and learning (Gange & Briggs 1974, Brown 1978, Brown, Bransford, Ferrara & Campione 1983, McCrindle &Christensen, 1995). The consent among researchers (e.g., Paris & Winograd, 1990) is that successful learners apply specific strategies while being aware to their own learning and thinking processes and that they practice it more efficiently and more frequently than less successful learners. Another consent among researchers in the field of metacognitive processes relates to their contribution to Self-Regulated Learning (Butler & Winne, 1995). Self-Regulated Learning (SRL) does not rely only on the development of regulation and monitoring skills, but also involves beliefs in one's competence as well as a self-conviction that learning is a tool to achieve personal goals.

In order to succeed in constructing knowledge in a technological environment that is flooded with information, one has to know how to select the most essential data. Students learning in a data base environment practice different strategies that bear on SRL, such as determining their path of data search, selecting and sorting relevant data, making inquiries and constructing their own data-base. However, learners differ in the extent of which they are capable of accepting responsibility for their own learning and by the extent of which they wish to be independent learners.

Recently, educators have come to realize that the educational system did not adequately enhance students' conception of self-responsibility and sense of autonomy, which are essential for SRL. The teacher's role has changed from being an infallible expert responsible for a final product, to being a guide who is more responsive to the context in which the learning is occurring. The new context that the educators are currently trying to promote stems from the Constructivist approach. This approach encourages learners to control their learning processes, reflect upon them and evaluate their results and progress in an open debugging procedure, which entails self reflection and peer dialogue.

Researchers have promoted the usage of reflections through writing and talking aloud techniques for learners in different learning environments (Cohen 1991, Di pardo 1990, Flower 1989, Graswohl 1989, Weiner 1986, Sarig & Folman 1990). Some interesting works were done about fostering reflections of students working with computers during science studies class (Beretier & Scardamalia, 1987, Taback et al. 1998). However, not enough effort has been invested yet in analyzing and characterizing reflections of students working with databases, as part of their social science studies. The importance of inducing a reflection process in data base environment should be emphasized since this environment is considered as ill defined learning environment. In this environment the learners need to select the desired data and organize it according to their own concepts of the investigated issue. The assumption here is that learning in less structured environment increases the need for reflection as a self-scaffolding and consequently improves learning.

Method

In the study reported here 24 ninth-grade students investigated during History classes several issues related to modern Israeli society. In their investigation they all started with a search for data using different resources such as books, fixed databases and dynamic data-base like the Internet. After the search students were engaged in construction of new databases, using Edubase software, and concluded with writing projects based on their investigation. In addition, students were engaged in activities such as data search, data sorting and categorization, data-base inquires and construction of an appropriate data-base related to the subjects of their investigations. They performed their task in pairs over a five months period, two hours a weekly session. Students were encouraged to write personal reflection notes after each session throughout the whole period of the study. The reflection notes included insights about the topic of their study, difficulties in achieving their plan, ways of solving the problem, new ideas, etc. They avoided writing when they felt that they did not have something to reflect upon. Their reflections were not graded, yet they expressed a keen motivation and a need to reflect upon their work. Students wrote between 1-14 reflections throughout the period of their investigations. The present analysis includes 24 students who wrote at least five reflections.

We attempt to answer two questions regarding students' reflections:

1. How do we evaluate reflections in a data-base environment?
2. What are the characteristics of learners' reflections?

In order to answer these questions we analyzed the reflections through the method of content analysis. We used Flavell's (1976). In their reflections students relate to the content of the task, to the activity involved, describing personal preferences and difficulties concerning the task, criticizing the task's demands, insights about the solution and more.

A Tool for Evaluating Metacognitive Components of Students Reflections (MCSR)

Students' written reflections were analyzed and classified according to components of metacognition: one's own knowledge about: his/her personal characteristics (P), the task requirements (T), strategies needed for accomplishing the task (S). Material within these three main categories was reread to identify subcategories. On the whole we identified 18 subcategories which became the tool dimensions. These dimensions represent students' notions and reflections about their actions during their work with the data-base. The dimensions of the metacognitive tool were coded and are identified in Table 1. Two independent judges performed the coding procedure. After the coding was completed differences were resolved in a conference.

Table 1: Dimensions of metacognitive components

A. Personal Dimensions	Code	Descriptions
1. Personal traits	Pt	Insights about one's own character during the process of learning
2. Learning styles	Ps	Referring to preferences one has in regards to his/her own way of learning
3. Affective variables	Pa	Expressing emotions in relation to the learning process
4. Personal progress	Pp	Referring to one's own achievement, or sense of progress
B. Task dimensions		
1. Task's demands	Td	Monitoring the quality of the task requirements, reporting on the main goal and questions of the investigations
2. Task's relevance	Tr	Evaluating the relevance of the task in compare with the learner's goal or interest
3. Problems and difficulties	Tp	Describing difficulties and problems one encounters in performing the task
4. Task feasibility	Tf	monitoring time, space and resources needed to accomplish the task
5.Task contents	Tc	Describing content, data and materials of the task
6. Characteristics of data-base	Ts	Relating to structure and functions of data-base
C. Strategy dimensions		
1. Planning	Sp	Planning strategies for a specific task
2. Selecting and applying a strategy	Ss	Selecting and applying a strategy for data search and data-base construction
3. Solving problem	Sp	Solving problems concerned with the learning process and with the learning environment
4. Evaluating results	Se	Referring to results of data search and data-base construction
5. Monitoring and changing strategies of data search	Sm	Correcting the strategy used before and explain reason for the change
6. Articulating explanations	Sa	Providing a rational or an explanation to a description related to the learning process
7. Drawing conclusions and generalizations	Sg	Expressing generalized view about the content, or about the learning process
8. Asking for help	Sh	Describing situation where help of another person was needed

In order to provide examples of the various dimensions, we quoted replicas from three students' reflections:

Personal traits (Pt)
D: Deadlines are difficult for me. I feel pressured and I don't read the text profoundly and then forget what I have read (30/10/98)
Learning styles (Ps)
D: I realize that sometimes I can understand better from a picture or a caricature than from regular text (30/10/98)
Task relevance (Tr)
L: Today I searched for information in the library…I found some relevant pieces of information that I needed for my work (3/1/99)

Task feasibility (Tf)
M: The same problem – Imbalance between the amount of data relating to the different women.. .We don't have enough material to start writing (26/3/99)
Problems and difficulties (Tp)
D: We could not connect to the Internet (8/1/99)
Characteristics of data-base (Ts)
L: The headings in the Tekuma data-base are misleading because the documents we found did not match our search (16/10/99)
N: we have learned how to connect between the data-base fields and to create quires (22/1/99)
Planning strategies (Sp)
M: We think it is clever to write the introduction at the end (19/2/99)
M: We decided to focus on specific topic (10/4/99)
Selecting and applying strategies (Ss)
M: we sorted the women list into categories (as: Politics, literature, poetry etc.)
Drawing conclusions and generalizations (Sg)
D: I learned that the difference between a great leader and an ordinary person is the ability to look forward and to vision future (31/10/99)
N: The most important thing is that I have learned to look at things from different perspectives and this is more important and more interesting (31/10/98)
Asking for help (Sh)
D: First we did not know how to import data from the Internet to our data-base. We had to ask Zehava for help and she demonstrated it for us (1/1/99).

Studying these reflections will allow us to improve our understanding of how and what students think about themselves as learners, about the task's demands and about strategies that are needed to deal with the demands. A comprehensive research can benefit from this kind of analysis by comparing different patterns of reflections among students, as well as analyzing dominant dimensions within the student own protocols of reflection. The following case example demonstrates the proposed method of reflections' analysis.

A Case Example

The following is an example of dimensions' analysis of reflections. The reflections were written by two 15 years old students: Michelle(f) and Lior(m). In order to demonstrate their reflections' pattern and to compare between them we selected two dimensions of the Strategy components: 1. Evaluating results (Se) 2. Articulating explanations (Sa). Analysis of these dimensions' frequencies (Table 2) yield a unique pattern for each student and allows a comparison between their reflections.

Table 2: Total Frequencies of Michelle's and Lior's strategy's dimensions

Student	Number of Reflections	Se	Sa
Michelle	14	6	13
Lior	10	8	2

Comparing the two dimensions within each student reveals that Michelle is engaged much more in articulating explanations then in evaluating results (6:13). Lior's reflections pattern is clearly dominated by evaluating results than by articulated explanations (2:8).

Comparison between the two students reveals that Michelle has a clear advantage (4.64 to 1, controlling for the total number of reflections) in accompany her descriptions with articulated explanations whereas Lior tends to evaluate his results more than Michelle does (1.87 to 1).

Another aspect of analyzing the reflections is to evaluate the various dimensions in a qualitative approach. This approach is aimed at evaluating the richness of the dimension rather than its frequency. The following replicas are used to demonstrate a qualitative analysis of the strategy dimension of Articulating explanation (Sa):
Michelle: we think it was a smart idea to write the introduction at the end of our project since we have already resumed the work and we had conclusions and a general view, so it was easier to explain our research question.
Lior: We agreed to split the work between us. Yotam who understands better Edubase was responsible on creating the data-base's fields.Lior: ...today we were supposed to finish the project and to submit it, but because of technical problems with Edubase we needed to...

Analysis of the three replicas above suggest that Michelle's explanations are better articulated, detailed and explicit than Lior's. His first explanation is implicit and rather short and the second replica is missing any information to identify the technical problems he claimed. Michelle's replica has also an argumentative structure that includes a claim and proofs and a conclusion, which Lior's replicas are missing. Based on this analysis we can claim that her articulation is qualitatively richer than Lior's.

Conclusions

It seems evident that by encouraging students to practice reflections we may increase and foster their ability and practice to do it. The contributions of reflection to learning in general and to learning in data-base environment specifically, were discussed earlier in this paper. Analysis of learners' reflections can serve teachers as a prism to get a real time view of their teaching process and as an authentic tool for evaluation of their students learning. Further analyses are performed in order to study gender differences, as well as to examine changes in dominance of various dimensions, along the time course of the intervention.

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Learning with Hypermedia: The Role of Epistemological Beliefs and Self-Regulation

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Abstract: This paper discusses the use of hypermedia as a mainstream instructional tool and what this use means for the success of all learners. Hypermedia research has not provided evidence of superiority to other instructional media. This research has, however, indicated that learner characteristics play a significant role in achievement in these new environments. Epistemological beliefs and self-regulatory skills have been demonstrated to be essential determiners of success in traditional learning environments. These beliefs and skills may be especially crucial to learning in cyberspace. This paper reviews relevant research from the educational psychology and hypermedia literature and discusses implications for the delivery of hypermedia instruction. Future research opportunities are described.

Introduction

More than half of the nation's classrooms are now connected to the Internet (Fatemi, 1999). Online high schools and computer laptops replacing books are just two of the numerous movements that will result in students accessing content knowledge in a hypermedia format. Original conceptions of the World Wide Web described a very interactive medium in which users had a great deal of control over how material was presented. In fact, Tim Berners-Lee, one of the people credited with the advent of the World Wide Web, originally envisioned web browsers as readers and *editors* of text (Berners-Lee, 1999). Unfortunately, hopes of an inherently interactive medium have not materialized. Research with instructional hypermedia has failed to demonstrate superiority over the traditional text (Dillon & Gabbard, 1998). However, when we look at specific learner characteristics, differences are often noted.

The increasing use of hypermedia for instructional purposes demands that we better understand how it affects all learners. Much of the research involving hypermedia in instruction has focused on characteristics of the medium and their impact on learning. Learner characteristics are equally important to success in any instructional setting. What are the characteristics of learners that will impact their success in these new environments? This paper reviews research from the instructional technology and educational psychology literature that demonstrates the importance of epistemological beliefs and self-regulation in learning. The implications for hypermedia-based instruction are presented.

This paper will begin with a brief review of the hypermedia research landscape. We will then describe two concepts that we believe hold a good deal of promise in understanding how all learners react to hypermedia instruction, epistemological beliefs and self-regulation. For each concept we will discuss potential implications for hypermedia learning. Finally, we will describe what type of research is necessary to provide us with a better understanding of the relationships between epistemological beliefs, self-regulation and learning with hypermedia.

Hypermedia Research

Credit for the discovery of the hypertext concept (but not the term) is given to Vannevar Bush who in 1945 described a system (the Memex) that allowed the retrieval of information based on association rather than traditional indexing (Landow, 1997). Theodore Nelson is credited with the first use of the term "hypertext" to describe this method of linking documents. The term "hypermedia" is simply an extension of the original term to incorporate the linking of other media such as images, videos and sound. These and other pioneers in the field originally envisioned hypermedia as a superior learning tool in part because it closely mimics the workings of the human mind (Tergan, 1997).

A recent review by Dillon and Gabbard (1998) explored the hypermedia literature concerning learning comprehension, learner control, and style (i.e. learner characteristics). They concluded that the benefits of hypermedia over other methods of instruction are limited. There is, however, evidence that individual characteristics play a role in success in hypermedia environments (Dillon & Gabbard, 1998). The preponderance of existing hypermedia research literature has investigated differences in user interfaces or instructional methods. Less research has been conducted that explores learner characteristics and their impact on learning in a hypermedia environment. Some of the attributes that have been studied in a hypermedia environment include ability (Repman, Willer & Lan, 1993), passive/active learners (Lee & Lehman, 1993), field independence/dependence (Jonassen & Wang, 1993), and deep vs. shallow processors (Shute, 1993). Dillon and Gabbard's review of each of these areas concluded that these characteristics might offer "the beginning of an explanation for the generally conflicting results in the literature comparing hypermedia and non-hypermedia learning environments" (p. 344). In another review of hypermedia research, Tergan (1997) concludes: "A major result of these studies is that individual learning prerequisites like differences in learning goals may override structural parameters of hypertext/hypermedia documents in affecting performance" (p. 263). We concur with these authors in the need for a better conceptualization of the impact of learner attributes in these new surroundings.

Two learner attributes that are almost completely unexplored in empirical studies of hypermedia are epistemological beliefs and self-regulatory skills. These characteristics hold promise in that they are related to each of the characteristics mentioned above that interact with achievement in hypermedia environments. For example, if one holds the epistemological belief that knowledge consists of discrete facts (see complete description below), they are less likely to deeply process instructional material (Hofer & Pintrich, 1997). In hypermedia environments, this takes on added import as we consider the decisions that the learner must make in terms of sequence of instruction and accessing supplementary materials.

Epistemological Beliefs

Epistemology refers to the study of the nature of knowledge. Researchers have shown that the epistemological beliefs held by students may have important influences on thinking and problem solving. Expanding on the work of Perry (1970) and King and Kitchener (1994), Schommer (1990) has proposed five separate epistemological dimensions corresponding to beliefs about knowledge. Each dimension is based on a continuum. The following lists the "naïve" end of the continuum for each dimension:

1. Certain Knowledge (i.e. absolute knowledge exists and will eventually be known)
2. Simple Knowledge (i.e. knowledge consists of discrete facts)
3. Omniscient Authority (i.e. authorities have access to otherwise inaccessible knowledge)
4. Quick Learning (i.e. learning occurs in a quick or not-at-all fashion)
5. Fixed Ability (i.e. ability to acquire knowledge is innate)

Research conducted with traditional instructional materials indicates that certain epistemological beliefs correlate with achievement. Schommer, Crouse, and Rhodes (1992) reported that beliefs in *Simple Knowledge* negatively affected complex problem solving. Schoenfeld (1983) investigated some of the consequences of a belief in *Quick Learning*. He reported that even experienced students who were asked to solve math problems gave up after five to ten minutes on the assumption that if they failed to solve the problem during this time, the problem could not be solved.

Implications of Epistemological Beliefs for Hypermedia

A study by Jacobson and Spiro (1995) that examined their cognitive flexibility theory briefly addressed epistemological beliefs in a hypermedia environment. They found students with simple epistemological beliefs had difficulty with the non-linear and multidimensional nature of an ill-defined hypertext system. However, the measurements used in this study were exploratory in nature and epistemological beliefs were not the focus of the study. As indicated by Jacobson and Spiro in their paper (1995), more research is necessary, but this study represents an important beginning to the application of what is known about epistemological beliefs to hypermedia learning.

Why would these differences exist? As discussed above, certain epistemological beliefs coincide with a less adequate approach to learning. The belief in *Fixed Ability* as a primary determinant of success leads students to believe that more effort does not coincide with more learning. As a consequence, the additional hypermedia tools available, such as links to definitions, diagrams, self check materials, objectives and advanced organizers, may have little positive impact. The effort required to use the hypermedia tools is less than in traditional settings (e.g. clicking on a term for a definition is easier than looking it up in the glossary). However, it still requires mental effort and thus one would expect the belief in *Fixed Ability* to be negatively correlated with use of hypermedia tools. Similarly, a student who takes a *Quick Learning* approach to hypermedia instruction will be less likely to take advantage of some of the useful tools available in hypermedia environments.

Self-regulation

Like epistemological beliefs, students' self-regulatory skills will also significantly mediate success in most learning environments (Schraw, 1998). Self-regulatory skills include, but are not limited to, the learner's ability to monitor their understanding as they read a text passage and their ability/willingness to set goals. Students who lack skills such as monitoring for understanding and goal setting tend to struggle in many learning environments (Zimmerman, 1990). Short-term instructional goals help students focus on relevant instruction and its relationship to current knowledge. Evidence suggests that students will exert more mental effort on tasks they see as attainable and when they can perceive progress towards a goal (Schunk, 1990).

Self-regulation also depends on students understanding of their own cognition. For example, skilled learners understand how much information they can retain in memory before they need to engage in an alternative approach to storing information (e.g. take notes). These learners have a wide repertoire of learning strategies from which to choose and a good understanding of when to use each.

Implications of Self-regulation for Hypermedia

Most studies that investigate self-regulation and hypermedia are concerned with teaching self-regulatory strategies within the hypermedia environment (e.g. Puntambekar & du Boulay 1997). Other studies investigate strategies used with hypermedia (Hill & Hannafin, 1997). No studies that we are aware of have investigated the relationship between these self-regulatory skills and learning with hypermedia. The learner's self-regulatory capacity is vital to their success in any learning environment, including hypermedia. The learner's repertoire of reading strategies like summarization and their willingness to invoke such strategies when appropriate, have a dramatic effect on their understanding. Highly self-regulated students are better equipped to take advantage of the hypermedia environment. Links to objectives and the opportunity to take a self-test will be of little value to students who do not take advantage of them.

One specific characteristic of hypermedia instructional materials that may cause differences in student success is the web-like organizational structure. It is clear that the learner's ability to develop new, or modify existing, schemata is an important determinant of understanding. The more complicated organizational structure of hypermedia documents (as compared to the largely linear structure of a traditional text) may hinder the success of students who have difficulty organizing topics in their mind.

Future Research

It is important to begin to research the relationships between epistemological beliefs, self-regulatory skills and achievement in a hypermedia instructional environment. These relationships should be measured with tools that have a proven record of reliability. One such measure is the Epistemological Beliefs Inventory, a well-researched measurement tool based on Schommer's (1990) five dimensions of epistemological beliefs. Students' self-regulatory skills should be measured with tools such as the Metacognitive Awareness Inventory (Schraw & Dennison, 1994), a self-report tool that determines the extent with which the learner uses strategies such as rereading (an indication of monitoring for understanding).

The hypermedia instructional materials used in such research should simulate instructional materials now commonly used. Specifically, the materials should include tools such as links to definitions, advanced organizers, objectives and self-tests. How does the use of tools such as objectives and self-check questions relate to students' epistemological beliefs and self-regulation skills? In addition, how does the choice of paths through the content relate to these beliefs and skills? For example, are students with better self-regulation skills likely to progress through the content in a more systematic fashion? These approaches can be easily collected and analyzed using computer log files.

We believe that students who hold more sophisticated epistemological beliefs and greater self-regulatory skills will perform better than their peers in the hypermedia environment. This would have useful and important implications for the delivery of instruction via hypermedia. As online-high-schools, laptops-as-textbooks, and distance learning become commonplace in our system of education, these relationships become increasingly vital.

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Using *TopClass* to Facilitate Regular Educational Research Course

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Abstract: *TopClass* is a web-based distance learning management software. The instructor incorporated it in her regular Educational Research course. The integration enabled her to enhance teaching objectives, promote communication with students, increase individualized instruction and manage time more efficiently. Concerns emanating from the experience included time constraint and her struggle between focusing on research curriculum requirements and facilitating students' technology skills. This paper describes the integration experience and her reflections.

Introduction

TopClass is a distance learning management software developed by the WBT System to facilitate a web-based learning environment. It can help instructors deliver content over the Internet and create tests with automatic correction. It supports embedded Java Applets and is compatible with HTML and Microsoft Word. During the course of the study, students may access coursework, communicate with each other and instructors can monitor students' learning by tracking their progress status individually.

First released in 1995, *TopClass* has been used in distant learning programs at over 600 sites around the world (WBT, 1999). In the last three year, much research has been done to study on-line delivery software and evaluate their effectiveness for classroom instruction. Driscoll studied the advantages and disadvantages of web-based training (Driscoll, 1998). Harrison illustrated how to design self-directed distance learning programs (Harrison, 1999).

In collaborating with three technology committees of British Columbia, Bruce Landon conducted comparative analyses of *TopClass* and other viable applications according to their technical specifications, instructional designs, media capabilities, tools, ease of use, potential for collaboration and contact information (Landon, 1999).

TopClass was used at the education programs of University of Waikato in 1996 and was found that it allowed for more efficient use of lecturers' time. It in turn lead to a higher quality of teaching (Moodie, 1999).

Sharon Gray contributed an extensive web-based instructional resource page which listed *TopClass* and many other course development tools. She compared TopClass, WebCT and other eight distance learning tools based on Course Design, Collaboration Tools, Course Management features and Administrative Convenience. More specifically, these features included Platform Requirements, Set-up Wizards, Communication Convenience, Student Progress Tracking, Contextual Help, and Testing Capability (Gray, 1998).

With its great popularity and continued improvement, *TopClass* was selected as one of the three (with WebCT and Course Info) State System sponsored web-based instructional software for the Pennsylvania State System of Higher Education. Its Center for Distance Learning offered multiple workshops to train SSHE faculty to use these software for instruction.

In spite of the fact that every SSHE faculty member was provided with an access code, there were very limited distance learning courses being taught. During the academic year of 1998 – 1999, there were only three distance learning courses offered at Shippensburg University. While there was a need to encourage professors to develop more distance learning programs, it was also important to encourage faculty to make maximum use of web-based software in their regular instructions. To this end, the instructor tried *TopClass* in her regular Educational Research course.

The purpose of the paper was to share the instructor's experience of using *TopClass* in her regular graduate level Educational Research course. The instructor described her software-integrated lesson planning, illustrated different ways TopClass was used in the course, analyzed advantages and disadvantages of the software in a regular classroom, and shared her reflections.

Integrated Planning

Whereas any teaching requires good planning, integrating software in instruction certainly demands more preparations. A primary requirement for an instructor was to be able to deliver curriculum content in a very short period. Adding an unfamiliar software would undoubtedly take some time away from the regular instruction. Therefore, how to incorporate the software without sacrificing the curriculum objectives became the first concern of the instructor. The purpose of the educational research was to help students learn basic elements of research, which included analyzing research categories, conducting electronic research, writing up research components, mastering functional knowledge of descriptive and inferential statistics and applying their knowledge to design and complete a research project.

Because *TopClass* was such a powerful software, using it for instruction could be a course by itself. If the instructor spent too much time on technology, the research curriculum requirements could be undermined. Consequently, the instructor had to weigh carefully the time spent on technology and its effectiveness on students' learning of elements of research. Therefore, it was clearly stated that the purpose of using *TopClass* was to enhance research skills. Any features that were too time consuming or did not directly facilitate research skills would not be used.

The instructor decided to start with the communication tools that included Message, Discussions and Class Announcements. Almost all students had e-mail accounts before coming to the course; it was easier for them to adapt to a new communication tool that had added features such as Attached URL, Discussion List and Class Announcements. Most of students felt comfortable starting with communication tools and proceeding to others choices.

After making it clear that the purpose of using *TopClass* was to enhance research skills, the instructor planned a list of tasks as optional items, among which were Research Design submissions and test tryouts. Students were exposed to these items, but no requirements were made. As part of the planning, the instructor made a class list, uploaded the major course materials on the web and assigned each student a temporary password. She tested these passwords and assignments online three times on different days for system reliability purposes before passing these codes to students.

Incompatibility of platforms and equipment was another concern the instructor had in planning, because it was one the major issues that had affected earlier web-based instructions on campus. The minimum platform requirement of *TopClasss* was Version 3.0 of Mac, Os 7.1 or Window NT 4.0/Windows 95. It used to be a problem for many students, especially if they wanted to open large graphic files. With upgrading of operation systems and limited use of *TopClass* functions, it didn't pose any problem for this course.

Using *TopClass* in the Classroom

Introducing the Software Students were first exposed to these features of TopClass in a team-teaching setting at the Library Technology Room. It was planned to incorporate the skills of Library staff and use time most efficiently. The Librarian introduced students to electronic resources and the Keystone Library System of PA. The instructor demonstrated the most useful features of TopClass for this course, such as Message, Discussions, Class Announcement, Student Course Work, and Utilities. Features like Create/Edit a Course, Export/Import and Administrative Control, which were mainly used by instructors, were only mentioned in passing. It was a hands-on session. Each student could try out these features. Students had plenty of time to ask questions and conduct individualized resource search after the class.

Curriculum Focus Because *TopClass* had so many fascinating features, it was very hard for the instructor to put aside students' curious questions. Nevertheless, too many inquisitive technology questions could distract them from the focused elements of research. Therefore, the instructor had to be very conscientious of the teaching objectives of the course. She strictly followed the curriculum requirements to teach research skills and

resisted much temptation to further improve students' technology skills.

Course Requirements: For any learning activities, it was easy to get some early explorers to participate. In order to get the whole class involved, it was important to make requirements. The requirements for the course were divided into two parts: Preliminary Requirements and the Optional Tasks. The former consisted of : 1. Locate the course materials on the web; 2. Send the instructor a message with attached URL; 3. Read the Overview of the *TopClass* (Access to the Learning Environment, Communication Tools, Web Course Materials, Discussion List and Tests); and 4. Communicate with peers. Examples of Optional Tasks were using *TopClass* to submit their homework (Problem Statement, Review of Literature, Hypotheses, Research Designs and Article Critique) and trying out web-based tests.

Effectiveness of the Integrated Instruction

Teaching Objectives The effectiveness of the *TopClass*-integrated teaching approach was mainly demonstrated in the following four areas: Enhanced teaching objectives, improved communication, individualized focus and better use of time in class. Compared with Educational Research courses the instructor taught earlier, these students submitted more versions of drafts and hence received more individual feedback. Though there were no data to actually make a quantitative statement, the completed research proposals and projects demonstrated stronger evidences of enhanced research skills and resources.

Improved Communication The software enabled students to read and send messages in an asynchronous way, conduct peer discussions to cooperate, read course work on line if they preferred to do so and submit Research Designs electronically for feedback. When some students were frustrated at the beginning of the semester, which was a typical reaction to the course, the Peer Discussion feature of *TopClass* released much of their anxiety and greatly promoted interactions among students.

Individualized Attention In a regular classroom, individual students usually did not have enough time to ask questions. By allowing them to submit write-ups step by step, student could get much more individualized attention from the instructor and more detailed feedback for their written work.

Time Efficiency Communicate through web-based software could even allow students to cut some of the classroom attendance. In a small town setting, it was not uncommon for some graduates to drive an hour and a half to come to class. Some of the driving time could be better spent on learning course work at home by using TopClass. A combination of the in-class and distance learning formats could greatly enhance learning efficiency.

Discussions

Time Constraint One of the biggest challenges for the instructor to incorporate technology in teaching was to use it without sacrificing curriculum requirements. Any technology tools added to the course had to be weighed very carefully in respect to how much time it would take for students to master, and how effective it would be to enhance productivity of the course. Each student had a different need and technology background, facilitating students individually was very time consuming. There was simply not enough time to explore features such as *TopClass Player, Assistant, Creator and Analyzer.*

Uneven Development of Technology Skills Lack of technology training for some graduate students also contributed to the limited use of the software. There was a big discrepancy between students who thrived on technology and those who were not willing to try anything beyond reading and sending email messages. For beginners, trying out the software once was not enough to encourage them to use the software to enhance learning. Many education students typically came to the Educational Research course with great anxiety and limited knowledge on web-based software. Therefore, the instructor had to spend a lot more time to facilitate their technology skills. Consequently, this became an added burden to the instructor.

Feedback of students Students generally welcomed familiar communication tools with added features such as Discussion and Class Announcements. The improved message system in *TopClass* made their communication easier and more enjoyable. They liked the Attached URL in their messages, but they generally stayed at the Plain Text realm in stead of using the function of Multimedia messages. They were a little disappointed that the email messages in *TopClass* could not be automatically forwarded to their other email addresses. They were

afraid that if they did not check their emails separately, they might miss important messages. A few students tried out some sample tests on the web. Due to students' anxiety over tests online and also because of the instructor's concern over the reliability and the format of those tests, online testing was not a required item for the course. Upload and Down load functions never intrigued them. When time factor became more acute toward the end of the semester, students didn't want to hear about the Sophisticated functions such as *TopClass Player, TopClass Assistant, TopClass Creator and TopClass Analyzer.*

Summary

Using TopClass to facilitate a regular Educational Research course was a great learning experience for both students and the instructor. It enhanced teaching objectives, promoted communication in and after class, increased individualized instruction and managed time more efficiently. The greatest concerns emanating from the experience were the instructor's perpetual struggle to balance curriculum coverage and facilitate students' computer skills. Uneven development of computer skills prevented some students from full benefit of the software. Both students and faculty need to improve their technology skills in learning. Despite these limitations, The Integration of *TopClass* in the regular Educational Research course has demonstrated a positive effect and suggested potential applicability of distance learning tools in more regular courses.

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Technology in Teaching: Just How Confident are Preservice Teachers?

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Abstract: This paper examines the effectiveness of increasing confidence of preservice teachers in using technology for personal and instructional purposes as a result of participating in an introductory educational technology course offered at the University of Virginia's Curry School of Education. Course participants attend sections designed for specific content areas – Elementary/P.E., secondary Humanities, and secondary Math/Science. Pre- and post-survey instruments are given to course participants, measuring personal confidence (22 items) and instructional confidence (21 items) using technology. A modified version of Dawson's (1998) instrument was used to gather data. Factor analyses were performed to group items into like factors, followed by repeated measure analysis of variance to test for significant differences. Results indicate that students' confidence levels significantly increased, across all factors, as a result of taking the course. Difference in content areas was found only for one factor of personal confidence – using spreadsheets and databases.

Introduction/Purpose

The National Council for Accreditation of Teacher Education (NCATE, 1997) and the International Society for Technology in Education (ISTE, 1999) have reported that schools of education are not adequately preparing its preservice teacher education students to effectively integrate technology in their future classrooms. Despite the educational technology standards that have been developed for teachers by international, national, and state organizations, Willis and Mehlinger (1996) suggest that part of the problem is a lack of universal agreement regarding what teachers should know or how teachers should be prepared. NCATE describes the problem as "deficiencies" (p. 7), which are a lack of hardware and software, limited faculty knowledge and skill in using technology, and scarce resources (money to invest in technology). To genuinely integrate technology into preservice teacher education programs requires system-wide change, initiative, and time. Cooper and Bull (1997) contend that teacher educators supporting change need "to be realistic about the time frame that will be required to accomplish this [integration of technology] in the depth that may be eventually desired" (pg. 101).

Many schools of education are in the process of restructuring their programs to better meet the needs of its preservice teacher education students. For example, the University of Virginia's Curry School of Education, recognized for its leadership in integrating technology for over a decade, has been participating in a number of endeavors to more effectively infuse technology into its instructional program. One of its efforts was the establishment of the Center for Technology and Teacher Education (CTTE) in 1997; a goal of the CTTE is to prepare preservice teacher education students to be educational technology leaders. To cultivate these leaders, the CTTE promotes the integration of technology into methods courses and requires all of its preservice teacher education students to complete a two-credit introductory technology course, EDLF 345, *Introduction to Educational Technology*. Unlike most stand-alone technology courses, EDLF 345 incorporates content-specific instruction in utilizing technology. Grouping students into three different areas of emphasis – Elementary, secondary Humanities, and secondary Math/Science – allows instructors to design classes that move beyond mastery of basic technology skills to instruction that encourages students to think of how technology can be used in instructional practice.
A trend witnessed throughout the Curry School has been the increased technological competence of incoming students in recent years. However, students possess a wide repertoire of technological skills and experiences varying from novices, advanced users, and a myriad of others somewhere in between. Adapting to the needs of the expanding range of students is recognized by the CTTE as pivotal in its efforts to continue to be a leader in integrating technology into preservice teacher education. In order to assess

these needs, a pilot study instrument was administered to the students of EDLF 345 in the fall semester of 1998 to gauge prior technology training, usage, attitudes, and confidence towards using technology, both personally and for instruction. By quantifying these attributes, the Curry School expects to provide a better learning experience as well as determine if students are meeting state and NCATE technology standards.

Purpose

Due to length of paper considerations, this paper primarily explores the results of the confidence portions of the pre- and post-survey instrument given to the participants of an introductory educational technology course. The confidence portions of the instrument contain one portion measuring confidence in instructional use of technology while another portion measures confidence in personal use of technology. The confidence portion of the instruments serves as the basis for this paper because developing confidence in preservice teachers is the first step in preparing them to use technology in their teaching (Mager, 1992; Olivier & Shapiro, 1993). The purpose of the study was to:

- Pilot an instrument aligned with the Virginia Technology Standards for Instructional Personnel (Virginia Department of Education, 1998),
- Gather baseline data about students' backgrounds and attitudes about using technology,
- Determine whether the course affected students' personal and instructional confidence in using technology, and
- Determine whether different content areas tended to display different levels of confidence.

Design and Methodology

After consulting with program faculty and researching other existing instruments (Atkins & Vasu, 1998; Becker, 1994; Dawson, 1997; Delcourt & Kinzie, 1993; Trushell, 1994; Moersch, 1999), the authors chose to utilize a modified version of Dawson's (1998) survey. It was chosen because it specifically addressed the Virginia Technology Standards for Instructional Personnel (Virginia Department of Education, 1998). By 2002, all preservice teacher education students in the state of Virginia will need to demonstrate proficiency in these standards. Using such an instrument would provide information that could be used in demonstrating such proficiency. In addition, two tested instruments (Delcourt & Kinzie, 1993; Becker, 1994) were used in its development. Participants were undergraduate and graduate students enrolled in EDLF 345 at the University of Virginia's Curry School of Education during the fall semester of 1998. The pre- and post-survey instruments, examined the following areas as outlined in Table 1:

Table 1

Pre- and Post-survey Items

Pre-Survey	Post-Survey
1. Student demographics	7. ---
2. Previous computer instruction (8 items)	8. ---
3. Current use of technology (10 items)	9. Current use of technology (10 items)
4. Attitudes towards using a variety of technology (10 items)	10. Attitudes towards using a variety of technology (10 items)
5. Confidence in instructional use of technology (21 items)	11. Confidence in instructional use of technology (21 items)
6. Confidence in personal use of technology (22 items)	12. Confidence in personal use of technology (22 items)

Most of the pre- and post-survey items required answers in a 4-point Likert scale format, with responses ranging from Strongly Disagree (1) to Strongly Agree (4). The items being explored in this paper, numbers five and six, used the 4-point Likert scale format.

The design for the study was the one-group pretest-posttest design (Campbell & Stanley, 1963). The pre- and post -surveys were administered to 95 undergraduate and graduate students enrolled in four different sections of EDLF 345. Data reported here reflect pre- and post-surveys from 81 students who completed both instruments (pre and post) and signed informed consent forms allowing the researchers to report their data. The demographic information collected in the survey included gender, year in the Curry School (the Curry School has a five-year teacher education program), major, and area of concentration in the Curry School. Participants were also asked about any prior technology courses or experiences. Data were entered into and analyzed using the statistical software program, SPSS.

Principal axis factor analyses were performed to summarize data related to the post-survey items for both confidence portions of the instrument (see Table 1, numbers 5 and 6). After items were grouped into factors, reliability analyses were performed on the items in each factor.

A one-within, one-between repeated measures analysis of variance design was used to test for significant changes in confidence among course participants. Questions of interests were:

1) Does personal and instructional confidence using technology increase as a result of taking EDLF 345?
2) Is there a difference in personal and instructional confidence using technology between content areas?

From these questions, several Null Hypotheses were made:

Null Hypothesis 1: There will be no significant change in instructional confidence using technology across all factors.
Null Hypothesis 2: There will be no significant change in personal confidence using technology across all factors.
Null Hypothesis 3: There will be no significant difference in instructional confidence using technology between different content areas across all factors.
Null Hypothesis 4: There will be no significant difference in personal confidence using technology between different content areas across all factors.

A repeated measure analysis of variance design was used to test for significant changes in confidence among course participants.

Results

Factor Analyses/Reliability

For the Confidence in Instructional Use of Technology items (21 items), four factors were obtained from the factor analysis. Reliability coefficients were calculated for the items in each factor. The results of these analyses are found in Table 2.

Table 2

Confidence in Instructional Use Factors and Reliability Coefficients

Factor	**Factor Label**	**Number of items**	**Reliability ()**
Factor 1	Instructional Technology Use to Select, Evaluate, and Use Technology Tools in Planning and Delivering Instruction	7	.8953
Factor 2	Instructional Technology Use to Teach Students to Effectively Find and Use Electronic Data/Information	6	.8648
Factor 3	Instructional Technology Use to Teach Students General Technology Terms and General Technology Use	5	.8334
Factor 4	Instructional Technology Use to Use Technology in Constructivist Ways	3	.7523

For the Confidence in Personal Use of Technology items (22 items), six factors were obtained from the analysis. Reliability coefficients and factors are summarized in Table 3.

Table 3

Confidence in Personal Use Factors and Reliability Coefficients

Factor	Factor Label	Number of items	Reliability ()
Factor 1	Personal Technology Use in Using Mindtools (Spreadsheets, Databases)	4	.8902
Factor 2	Personal Technology Use to Operate a Computer	3	.8787
Factor 3	Personal Technology Use to Explain Technology Tools or Use New Technology Products	7	.8088
Factor 4	Personal Technology Use to Explain and Understand Legal and Ethical Issues of Technology	2	.6929
Factor 5	Personal Technology Use to Use and Create Internet Resources	4	.7644
Factor 6	Personal Technology Use to Use a Word Processor and E-mail	2	.5564

Repeated Measure ANOVA

In instructional confidence, significant main effect differences were found for all factors (< .01), allowing for the rejection of Null Hypothesis 1. However, no significant differences in confidence were found between content areas (> .05) preventing the rejection of Null Hypothesis 3. Table 4 presents the results of the analysis of variance tests for instructional confidence:

Table 4

Confidence in Instructional Use ANOVA (Main Effects and Interaction)

All Students	F Value	Significance	Across Content Areas	F Value	Significance
Factor 1	F = 223.03	= .00	Factor 1	F = 1.42	= .25
Factor 2	F = 132.6	= .00	Factor 2	F = .247	= .78
Factor 3	F = 84.52	= .00	Factor 3	F = .47	= .63
Factor 4	F = 91.76	= .00	Factor 4	F = .61	= .55

In personal confidence, significant differences were found for all factors (< .01), allowing for the rejection of Null Hypotheses 2. Slightly different from the instructional confidence interactions, a significant difference in personal confidence between content areas was found for Factor 1: Using Mindtools (Spreadsheets, Databases) (< .05), allowing for the rejection of Null Hypothesis 4 for Factor 1 only. The following table presents the results of the analysis of variance tests for personal confidence:

All Students	F Value	Significance	Across Content Areas	F Value	Significance
Factor 1	F = 216.79	= .00	Factor 1	F = 4.57	= .01
Factor 2	F = 24.74	= .00	Factor 2	F = 1.84	= .17
Factor 3	F = 219.36	= .00	Factor 3	F = 3.09	= .05
Factor 4	F = 23.36	= .00	Factor 4	F =.77	= .47
Factor 5	F = 157.81	= .00	Factor 5	F =.29	= .75
Factor 6	F = 22.64	= .00	Factor 6	F =.31	= .73

Table 3 – Personal Confidence ANOVA

Discussion of Results

As expected, the participants of EDLF 345 experienced significant increases in personal confidence in using technology. Typically, if someone is shown how to do something and also given the opportunity to practice doing it, they will feel more confident when they must do that thing in the future. While it was the desire of the authors to see a significant increase in instructional confidence in using technology, expectations were not as high as with personal use. Since the instrument was not given to the participants of EDLF 345 until after the class was divided into content-specific sections, it is not known whether this had an impact on the significant increase in instructional confidence witnessed in the data. However, it is of the opinion of the authors that offering content-specific sections of the course did indeed play a role in increasing instructional confidence. Giving preservice teachers the opportunity to work independently and collaboratively on technically oriented content-specific projects early in the teacher education program, provides them with a lens to view technology as an instructional tool for several years before they become inservice teachers.

In looking at the graphs of interaction that existed between content areas for Factor 1, several things were noticed. The Math/Science preservice teachers tended to score higher at the pretest level for items in this factor – using mindtools (spreadsheets, databases) – than other content areas. This is to be expected considering the more frequent use of spreadsheets and databases in mathematics and science. This suggests that spreadsheets and databases can be introduced at a more advanced level to the math/science section of EDLF 345 than with the other sections. Interestingly, Elementary preservice teachers scored higher at the posttest level for items in Factor 1 than other content areas. It is speculated that, while students in the elementary sections of the course typically knew less about spreadsheets and databases at the time of the posttest than other content areas, they learned more relative to their starting point than the other content areas. They therefore felt a higher sense of accomplishment with these tools, ultimately increasing there level of confidence of using these technologies.

The Next Step

The instrument has also been administered to the 1999-2000 participants of EDLF 345 and will be administered at least through the 2000-2001 academic year. Pretest results will be compared from each year to determine whether previous technology training, usage, attitudes, and confidence towards using technology is increasing each year for each incoming class as hypothesized. Closely examining this trend will play a major role in the evolution of EDLF 345.

More importantly is the need to track the relationship between confidence and genuine implementation into the teaching arena. It is possible that preservice teachers experience a "technological high" after completing an introductory technology course, but as they proceed through their methods courses, student teaching, and teaching career experiences their confidence dissipates. Several studies have shown results similar to the results found in this study (Gunter et al, 1998; McInerney et al, 1990; Okinaka, 1992; Von Holzen et al, 1990), but few if any studies have continued to track these preservice teachers into the teaching field. It is planned to have this instrument administered to last year's EDLF 345 course participants again after they have completed their fourth-year methods courses, and once again after student teaching (in their fifth year). In addition, it is hoped that qualitative data, in the form of interviews and teaching observations will provide added insight to the most important question as to how well preservice teachers are incorporating technology into their future classrooms.

Educational Significance

This study is significant to the field of teacher education in several ways. It provides baseline data about preservice teacher education students' confidence towards using technology. ISTE (1999) recommends that further research be conducted on where and how preservice teacher education students are acquiring their technology skills. In addition, ISTE's study surveyed deans and faculty of schools, colleges, and departments of education rather than the students in those programs. The results of this study can be used to assist the Curry School of Education in determining whether students have met state technology standards. As the study is carried out during the 1999-2000 and 2001-2001 academic years, by extrapolating current usage trends into future years, the Curry School will be able to forecast the future

technological needs of its preservice teachers. Finally, this study offers research that relates how effective the technology course was in increasing students' technology skills and confidence, key factors that will influence whether they use technology in their future classrooms.

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Effective Use of ICT by Student Teachers – Is It Improving?

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Abstract: Effective use of ICT by student teachers is vital if these technologies are going to be successfully used in the education of children in schools. An earlier study by this author identified three main obstacles that could have limited ICT uptake by student teachers in 1996/7: student access to computers, the ICT policy adopted by initial teacher training providers and the lack of encouragement for students to use ICT on teaching practice. This paper presents a comparative study of the ICT competence and attitudes of a similar cohort of student teachers in the current academic year (1999/2000). It argues that whilst the overall sample of current student teachers appeared to be more competent and confident in the use of ICT than in 1996/7, female and younger students lagged behind their male and older peers. This issue needs to be addressed in the ICT policy adopted by initial teacher training providers.

Introduction

The purpose of this study is to investigate the changing use of ICT by student teachers. Data from the academic year 1999/0 is presented, together with data previously reported for the academic year 1996/7 (Murphy and Greenwood, 1998). The implications for ICT training provision within initial teacher training courses are considered in the light of these findings. The paper will therefore present an empirical study of ICT competence and attitudes in two cohorts of student teachers in a UK university, and contribute to the international debate concerning the low uptake of ICT by student and beginning teachers.

Research findings suggest that ICT is significantly under-used by student and beginning teachers. The problem is world-wide and many explanations are offered. Lack of resources or lack of access to resources in schools/initial teacher training (ITT) institutions has been suggested in the United States by Yopp (1993), Fisher (1996) and Topp, Mortenson and Grandgenett (1996); in Australia by Wild (1996), and in the United Kingdom by Byard (1995), Dearing (1997), Taylor (1997) and Murphy and Greenwood (1998). Lack of ICT experience and training at pre-service level (Oliver, 1994a and Wild, 1995 [Australian studies]) and of confidence in computing skills of both students teachers and teacher trainers (for example, Chen 1997 [China]) have also been implicated as factors leading to low student ICT uptake. Lack of opportunity (Dunn and Ridgway, 1994 [UK]), and lack of encouragement to use computers during school placement (Collison and Murray 1994 and Murphy and Greenwood 1998 [both UK]) and the predominance of other classroom pressures (Wild, 1996 [Australia]) may explain the low level of ICT use by students during school experience.

The importance of gender influences on ICT usage is in dispute. Reports from Summers (1990 [UK]) and McMahon and Gardner (1995 [UK]) suggest that male students are less anxious about and make more frequent use of ICT. Several other studies have reported that female students are less confident or knowledgeable than males about using computers (Blackmore *et al* 1992 [UK]; Oliver 1993 [Australia]; and Marshall 1997 [US]). In contrast, there are also many reports from the United States and Canada which indicate that there are no significant differences between the attitudes of male and female students, for example: Koohang (1989), Kay (1989); Hunt and Bohlin (1993), Marshall and Bannon (1986) and Woodrow (1991).

Conflicting reports have argued whether or not age is a significant factor in determining the extent of low student teacher ICT uptake (Woodrow 1991 [Canada], Blackmore 1992 and Liénard 1995, [both UK]). The age phase for which students are being trained to teach may also be significant in that Blackmore (1992)

and Oliver (1994a) demonstrated respectively that primary-trained students were more anxious and used computers less than secondary-trained students, both findings later confirmed by Murphy and Greenwood (1998). Finally, results from Summers and Easdown (1996) indicate that the subject specialism of student teachers may influence the extent of ICT use. They reported that student teachers attending a UK university specialising in geography tended to use computers more in their teaching when compared with main subject history students.

The Study

For the present study, two cohorts of students attending a one-year Postgraduate Certificate in Education (PGCE) course to teach in UK secondary level schools were compared. The extent that PGCE students used various ICT facilities in the year 1996/7 was compared with the use of similar facilities in the current academic year (1999/2000). The attitudes of the two groups of students towards ICT were also examined. Student groups completed questionnaires (see Murphy and Greenwood [1998] for the research instrument). The first part of the questionnaire consisted of questions designed to collect data concerning access to, training in and use of ICT, and the second part consisted of a set of items designed to measure attitudes towards ICT. Three pilot studies were carried out to test for reliability, validity and selection of items for the main questionnaire. Reliability was tested using an internal consistency method (Cronbach's Alpha coefficient [Cronbach 1990]), which yielded reliability coefficients with values higher that the 0.8 criterion which is regarded as internally viable (Bryman and Carter 1997). Estimates of concurrent validity were measured using Pearson's product moment correlation coefficient. Highly significant positive correlations were observed between positive attitudes and the frequent use of ICT.

Findings

Changes in the Sample Characteristics between 1996/7 and 1999/0

The sample characteristics of the 1999/2000 PGCE cohort of student teachers indicate that there has been a dramatic overall increase in many aspects of their ICT use since 1996/7 (See Tab. 1).

	1996/7 PGCE [n = 119] (%)	1999/0 PGCE [n = 165] (%)	Significance of difference in mean response (p)
Access to home computer	14	60	<0.001
Access to home e-mail	9	33	<0.001
Use word-processing often	84	73	Not significant
Use e-mail often	6	55	<0.001
Use Internet often	19	47	<0.001
Use discussion lists often	1	4	<0.001
Use ICT in lesson preparation often	55	50*	Not significant
Use ICT in teaching often	24	35*	Not significant

* these figures refer to teaching carried out PRIOR to starting the PGCE course – it is anticipated that the percentage use of ICT during school experience in 1999/0 will be much higher due to the current emphasis on ICT in the PGCE course.

Table 1: ICT use by PGCE students in 1996/7 and 1999/0

The percentage of students in these cognate samples who have access to a home computer has more than quadrupled in less than three years and a similar increase is observed for home e-mail access. The use of e-mail, the Internet and discussion lists have all shown highly significant increases – note the almost 10-fold

increase in e-mail users among student teachers since 1997. Differences in the mean response of PGCE groups from 1996/7 and 1999/0 regarding the extent they used word processing and how often they used ICT in lesson preparation and teaching were not significant. It would be expected that the percentage of the 1999/0 cohort of PGCE students often using ICT for teaching will be higher after their school experience.

Despite the fact that more students starting the PGCE course in 1999 were using ICT than in previous years, there remains the problem that significant numbers of current students entered the course with very little or no ICT experience (Tab. 2). In this sample, 1 in 5 students entering the PGCE course in 1999 had never used e-mail.

Student group	Never use Word Processing (%)	Never use E-mail (%)	Never use Internet (%)	Never use Discussion Lists (%)
PGCE 1996/7 (n = 119)	3	69	23	84
PGCE 1999/0 (n = 165)	1	20	15	65

Table 2: Lack of ICT experience in PGCE students 1996/7 and 1999/0 (%)

The vast range in ICT competence of incoming students to the PGCE course is difficult to accommodate during the short period of time PGCE students spend in the initial teacher training institution. The students sampled in the current study attend the University for 10 weeks of their one-year course. A further 22 weeks are school-based. The problem is exacerbated by the relatively small amount of ICT being used by teachers and pupils in the schools. Mansell (1999) discusses a recent UK Office for Standards in Education analysis of the secondary curriculum based on inspections in 1997-98 which found that more than half of English secondary schools do not comply with national curriculum requirements in ICT. Teachers' lack of expertise in ICT is blamed for this shortfall. If ICT is to be effectively used in schools, then it is vital that the current student teachers receive sufficient ICT training to enable them to take the lead in this process. ICT is the one area of teaching in which the student teachers could generally be considered more competent than many class teachers.

In 1996/7 the percentage of male PGCE students often using e-mail, the Internet and discussion lists was markedly higher than female students (Murphy 1997). This is *not* the case in 1999/0 when it can be observed that there was little gender difference in the extent of use of these ICT facilities (Tab. 3). Since teaching is a female-dominated profession and the majority of PGCE students are females (approximately 75% female in this study), it is important that women student teachers use ICT as extensively as their male counterparts.

	Often use E-mail (%)		Often use Internet (%)		Often use Discussion Lists (%)	
Student group	Male	Female	Male	Female	Male	Female
PGCE 1996/7 (n = 119)	13	4	38	15	4	0
PGCE 1999/0 (n = 165)	51	57	54	44	7	3

Table 3: Gender and ICT use by PGCE students in 1996/7 and 1999/0

The reverse situation appears to be the case when comparing the effect of age on ICT use by PGCE students in 1996/7 and 1999/0 (Tab. 4). Whereas there was little effect of age in 1996/7 there now seems to be a difference, with the younger students making more use of e-mail, Internet and discussion lists.

Student group	Often use E-mail (%)		Often use Internet (%)		Often use Discussion Lists (%)	
	Under 25	Over 25	Under 25	Over 25	Under 25	Over 25
PGCE 1996/7 (n=119)	6	6	21	16	0	2
PGCE 1999/0 (n=165)	65	36	50	40	5	2

Table 4: Age and ICT use by PGCE students in 1996/7 and 1999/0 (%)

It appears, therefore, that the students entering the teaching profession in 1999/0 are more computer literate than those of three years ago. Whether this higher level of technical competence will translate into the more effective use of ICT in the classroom is less clear and partly depends on the attitudes of student teachers towards ICT.

Changes in Student Teacher Attitudes towards ICT between 1996/7 and 1999/0

The attitudes towards ICT held student teachers also appear to have changed over the past three years. A summary of these changes is presented in Table 5. Overall, as expected, the 1999/0 PGCE students indicated more positive ICT attitudes than those in 1996/7. However the desire for more ICT training was higher in 1999/0 than in 1996/7. This suggests that student teachers *still* feel that they are not well equipped to use ICT in their teaching.

	Liking of Computers	Confidence in using ICT	Value of ICT in Education	Desire for more ICT Training
Overall	More positive in 1999/0 than in 1996/7	More confident in 1999/0 than in 1996/7	More positive in 1999/0 than in 1996/7	Stronger desire for training in 1999/0 than in 1996/7
Women	More positive in 1999/0 than in 1996/7	Much more confident in 1999/0 than in 1996/7 – still not as confident as male students.	More positive in 1999/0 than in 1996/7	Stronger desire for training in 1999/0 than in 1996/7
Men	No significant difference between 1996/7 and 1999/0	No significant difference between 1996/7 and 1999/0	No significant difference between 1996/7 and 1999/0	Stronger desire for training in 1999/0 than in 1996/7
Under 25	More positive in 1999/0 but less so than older students	*Less confident* in 1999/0 than in 1996/7	More positive in 1999/0 than in 1996/7	Stronger desire for training in 1999/0 than in 1996/7
Over 25	More positive than younger students in both 1996/7 and 1999/0	Older students more confident than younger students in both 1996/7 and 1999/0	Older students more positive than younger students in both 1996/7 and 1999/0	Stronger desire for training in 1999/0 than in 1996/7

Table 5: Summary of Attitude Results (Mean Responses)

Regarding gender, there was a significant increase in the relative confidence of female to male students in using ICT between 1996/7 and 1999/0, although female students still appear to be less confident than males. Women students in 1999/0 also indicated an increased liking for computers and were more positive about the value of computers in education. The attitudes of male students in the sub-scales of liking, confidence and value of ICT in education did not show any significant change between 1996/7 and 1999/0. The implications of these results are that ICT training for student teachers must be concentrated more on the *educational* uses of ICT and should be made more female-friendly. Morgall (1993) draws a distinction between a context-oriented (feminine) approach to technology assessment and a technology-oriented (masculine) approach. Feminist approaches to systems design are centrally concerned with developing systems that allow women to enhance their competences and their confidence in the use of systems that are appropriate to the reality of their working lives (Webster 1996). In a teacher-training context, therefore, the emphasis should be changed from the current *requirement* to using ICT in the classroom to a demonstration of ways in which ICT can be used to enhance teaching and learning.

The relationship between age and attitudes to computers in 1999/0 was similar to that in 1996/7. Older students, despite making less use of e-mail and the Internet (see Tab. 4) displayed a greater liking for computers, more confidence in their use of ICT and more appreciation of the value of ICT in education than

the under 25 group. It is possible that the context(s) in which the under 25 students were using e-mail and Internet may have been totally unrelated to work involving teaching and therefore did not have any effect on their confidence in using ICT in a classroom situation. The implication of this finding is that teacher trainers must be made aware that younger students may be more apprehensive about using ICT during their school-based work and may require more practical assistance during their time in the initial teacher training institution.

Conclusions

The overall level of ICT competence of incoming students to the PGCE course appears to be significantly higher in 1999/0 than in 1996/7. However, there is still an extremely wide range of competence that is difficult to accommodate during the short period of time PGCE students spend in the initial teacher training institution. Female and younger students indicate lower levels of confidence in using ICT. This problem should be addressed in the ICT policy of the institution, perhaps by a stronger concentration on the *educational* uses of ICT (including demonstration of good use by specialists and practical application by students).

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Strategies To Increase Interaction In Online Social Learning Environments

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Abstract: Social presence is one of the most critical factors in technology-based learning. To increase the level of interaction, the degree of social presence must be increased. Social presence was defined as the degree of person-to-person awareness in previous studies. This does not provide a clear definition of social presence. This study was designed to redefine the social learning theory for the online learning environment. Three dimensions of social presence and the privacy factor were examined in this study to redefine the social presence theory. It was concluded that three dimensions of social presence, social context, online communication and interactivity, emerged and the privacy factor correlated to the social presence theory.

Introduction

The importance of examining social factors that impact communication and learning in telecommunications-based systems has been emphasized in recent studies (Feenberg, 1989; Hackman & Walker, 1990; Lea, 1992; Sanders & Wiseman, 1990; Walther, 1992, 1995, 1996). Virtual classrooms with multicultural students are pervasive. McIsaac and Gunawardena (1996) have suggested that future research should explore the relationship between media and the socio-cultural construction of knowledge, and examine the cultural effects of technology and courseware transfer in distance education. Social presence is the degree of person-to-person awareness, which occurs in the computer environment. Social presence, the most important concept in social context, is an important key to understanding person-to-person telecommunication (Short, Williams, & Christie, 1976). Recent studies (Dillon & Walsh, 1992; Rice, 1984, 1993; Spears & Lea, 1992) have emphasized that social presence possesses potential for future study. Gunawardena (1995) argues that social presence is necessary to enhance and improve effective instruction in both traditional and technology-based classrooms. When the level of social presence is low, interaction is also low (Garramone, Harris, & Anderson, 1986). The lack of social presence will lead to a high level of frustration, an attitude critical of the instructor's effectiveness, and a lower level of affective learning (Rifkind, 1992).

Most text-based users transfer their traditional written style to the computer-mediated communication (CMC) environment without considering the receiver's local social context and/or the characteristics of CMC systems. The degree of social presence has not been considered in instructional design. Two groups of researchers (Connolly, Jessup, & Valacich, 1990; Hiltz, Johnson, & Turoff, 1986) concluded that CMC was unable to provide social context cues and was, therefore, considered to possess limited social presence because it was perceived as an impersonal medium (Walther & Burgoon, 1992). For instance, e-mail is considered to be casual written conversation, unlike traditional correspondence. CMC users often compose e-mail in a very formal written style, such as "Dear Mr. Tu," "Sincerely," etc.; some users are unable to apply "emoticons" to express non-verbal cues, producing an impersonal feeling; and, others resort to using all capital letters to express emphasis, which is considered as "shouting" by the receiver. These examples

demonstrate the problems of delivering low social presence, or an inappropriate degree of social presence, online.

The social presence theory was not originally designed to explain CMC; in fact, it was initially studied in face-to-face, audio and closed-circuit television encounters. Unlike traditional media, CMC provides very different characteristics, such as multiple identities, anonymity, etc. What is the social presence theory for CMC systems? Is it the same as or different from the original social presence theory that was studied in face-to-face, closed-circuit television and audio conferencing formats? If it is different, what is the difference? How will social presence affect online learning? How will the online learner perceive and respond to this new medium as a communication tool? To provide discipline for the instructional design of distance education, these questions must be examined and answered.

The current CMC application of social presence has not been clearly defined (Rafaeli, 1988; Svenning & Ruchinskas, 1984; Walther, 1992). The universal application of CMC as an educational communication tool requires that social presence be redefined. A clear understanding of social presence is necessary to direct research and to provide practitioners with clear guidelines for instructional design for distance education.

Literature Review

Summary of Social Presence

Recent studies have shown that social presence is a significant factor in improving instructional effectiveness; therefore, it is one of the most significant factors in distance education. Hackman and Walker (1990) investigated the effects of conveyance system design and social presence, in the form of teacher immediacy behavior on perceived student learning and satisfaction in the televised classroom. They conclude that system design and teacher immediacy behavior strongly impact student learning and satisfaction. Gunawardena and Zittle (1997) report similar findings in a CMC system. Social presence is a strong predictor of satisfaction within a CMC environment. Also, it is considered to be an element of interpersonal communication in an online learning environment. Perse, Burton, Kovner, Lears, & Sen (1992) studied college students' utilization of e-mail, and concluded that students used CMC more when they felt that e-mail conveyed more interpersonal presence.

The user judges the degree of social presence (Perse et al., 1992; Walther, 1992). Lack of non-verbal cues in CMC causes an impersonal feeling, doubted to be inherent to the system (Walther & Burgoon, 1992; Walther, 1996). Online users have perceived CMC as a high social presence medium (Gunawardena, 1995; Gunawardena & Zittle, 1997; Perse et al., 1992). Social presence can be cultured by teleconference users and leaders or encouraged by initial learning sessions (Johansen, Vallee, & Spangler, 1988). Gunawardena (1995) suggested that by successfully "inculturating" themselves within CMC, learners promote their levels of social presence, and allow themselves an opportunity for greater participation. In spite of the characteristics of the medium, students' perceptions of the social and human qualities of CMC will depend on the social presence created by the instructors/moderators and the online community (Gunawardena, 1995; Gunawardena & Zittle, 1997). Therefore the instructor or the moderator must utilize their interaction skills and techniques, rather than those of the medium; this will enhance students' perceptions of social presence on CMC.

Purpose of the Study

The social presence theory is not clearly defined for CMC because low levels, and inappropriate levels, of social presence are usually found in the CMC environment. The purpose of this study is to examine social presence, determine how it relates to online interaction; and, to provide an operational definition.

Research Questions

By examining the learner's perception of social presence in three CMC systems, e-mail, bulletin board, and real-time chat, the following questions are answered:

1. Is there a relationship between social presence and online interaction?
2. Do issues of privacy influence online social interaction?
3. Do social relationships affect online interaction?
4. Does task orientation impact online interaction?
5. How does online communication literacy impact interaction on CMC?
6. Does the use of CMC intensify social interaction among online learners?

Method

Both quantitative and qualitative methods were used to gain a better understanding of the student's perception of social presence for redefinition of the social presence theory for CMC. Fifty students enrolled in EMC 598 Internet for Teachers, a graduate level course offered by the College of Education at Arizona State University.

Participant observation method with a dramaturgy perspective was used to understand the issues of privacy, social relationships, task orientation, online communication, and social interaction on CMC from the student's point of view.

Quantitative methods was used to examine the relationship between social presence and online interaction; and, whether social context, online communication, and interactivity, the three dimensions proposed in this study, and privacy, will significantly contribute to the degree of social presence.

Fifty participants were asked to answer the Social Presence and Privacy Questionnaire (Tu, DiGangi, Jannasch, & Yu, in preparation). This questionnaire, evaluating e-mail, bulletin board, and real-time chat, contains seventeen social presence items, and thirteen privacy items each with a 5-point Likert scale, and twelve demographic identifiers. Bartlett's test of sphericity (Bartlett, 1973) was applied to increase the validity because of the small number of participants. Confirmatory factor analysis was utilized to examine the three dimensions of social presence.

Triangulation

Triangulation was not a validation process in this study. Rather, it was considered a means to a better understanding about the perception of social presence. Triangulation allows the consideration of analyses from a novel standpoint, additional data are available for study, but, further, these additional data may alter the researcher's perception of the initial data (Bloor, 1997).

Results

Quantitative Results

A confirmatory factor analysis was performed on 30 questionnaire items on social presence, risky behaviors, and computer privacy. Five factors analyses from a previous study (Tu, 1999) were computed. These five factors accounted for 76.7 percent of the variance. The five factors were extracted using varimax rotation. With a cutoff of .45, three items were removed from the loading. These five factors were social context, online communication, interactivity, system privacy, and feeling of privacy yielding a

Cronbach's coefficient alpha of 0.82, 0.88, 0.73, 0.75, and 0.71, respectively. Correlations were computed between social presence and privacy, and among five factors. The result was $r = 0.311$ with significance at the 0.05 level.

A Pearson correlation between mean social presence rating and frequency produced a correlation of $r= -0.004$, and this correlation was not significant at $\alpha = 0.05$ ($r = 41) = -0.004$, $p > .05$). It was concluded that the level of social presence did not vary with frequency.

Qualitative Results

Social context dimension included the recipient, task, social relationship, social skills, message topics, locations, psychological issues, and flaming messages. The level of social presence decreased when a group member typed too fast, was too talkative, didn't listen to others, and dominated the conversation. Those participants have a negative impact on other's participation because of their communication behavior. One's fast typing could have a negative impact on the other's level of social presence because the other could not keep up with the typing speed and could easily generate pressure on the slower typist. This situation occurred when one talked a lot, many of these communications were nonsensical.

Online communication is the exchange of thoughts, messages, or information that occurs online. Online immediacy includes expressiveness, stimulation, and the conveying of feelings and emotions through online language. The language used in an online communication expressed meanings and thoughts with difficulty and was easily misunderstood. Many messages were perceived and interpreted as not stimulating while some were perceived as stimulating. To convey feeling and emotions, emoticons and paralanguage were used to compensate for the absence of non-verbal cues. Female students tended to use emoticons and paralanguage more frequently to convey their feeling and emotions. Both genders agreed that the use of emoticons and paralanguage made the message more stimulating, sensitive, and expressive.

In the interactivity dimension, immediate response, communication style, multi-thread communication, and physical distance between users contributed to the level of social presence. Personal communication style had a great impact on the level of social presence, such as formal/informal style, short/long messages, stylistic communication style, task-oriented style, use of humor, inviting tone, slang, and using of you versus we. E-mail communication has been considered to be a casual written communication. However, many e-mail messages are formal communications that increased the psychological distance. Long messages were identified as inappropriate for e-mail and real time chat.

Private/public issues on CMC have an impact on the level of social presence. When students perceived a medium as more public, the level of social presence is lower, and vice versa on a medium that is perceived as more private. Students perceived e-mail communication as more private than bulletin board while real time chat varied with the numbers of participants. It was found that very private and personal e-mail messages were sent to multiple recipients and group discussion folders without notifying the original senders. Although e-mail was conducted mostly as a one-to-one communication, whether the recipient read the message or not is unknown. Students could share an e-mail account with their spouse, family members, or others. E-mail messages with a long recipient list that preceded the body of the message were perceived as impolite because e-mail is supposed to be a more personal communication medium. The long recipient list made the individual recipient less important. Although both bulletin board and real time chat can be considered as one-to-many communications, bulletin board is perceived as a more public communication because the bulletin board messages were available online most of the time, unlike real time chat messages which disappeared at the end of the chat, an erroneous impression. However, students considered private real time chat could be public as well because one could just observe and not participate. This could have a negative impact on the chat participants.

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PATTERNS OF E-MAIL USE IN A CONVERSATION-BASED TEACHER DEVELOPMENT GROUP

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Abstract

Telecommunications has been proposed as a way to address the problem of teacher isolation and provide opportunities for teacher professional development. The literature on teachers' use of telecommunication suggests that the medium may be ideal for supporting teacher learning and growth when collegiality in a school is insufficient or unavailable. This study investigated the nature of e-mail use in an established teacher inquiry group focusing on patterns of use and support for individual teacher growth. The results suggest that while telecommunications provides opportunities for teachers to engage in substantive discussions and collaborations with peers who are distant but share interests and curricular work, the actual uses of e-mail and other forms of electronic communication are constrained by a number of factors. These include access, time, shared goals, and interdependence. The results also suggest that even groups that meet the criteria suggested by researchers as essential for success do not guarantee successful use of e-mail for professional development.

Introduction

Proponents of educational technology often point to the value of telecommunications and the Internet as a tool for teacher professional development. By providing classroom teachers with access to conversations and collaborations with their peers through virtual communities, it is argued, participants can benefit from collegial interactions that they rarely have access to within their own school culture. While it is probably true that existing school structures may prohibit or restrict sustainable collegial relationships, there are questions about the extent to which telecommunications can offer a viable form of teacher professional development.

A popular view suggests that by providing teachers with access to telecommunications they will discuss their beliefs with their peers, reflect on their own teaching methods, and adopt educational innovations (Bos, Krajcik, & Patrick, 1995; Lieberman & McLaughlin, 1992). While this may be true for some teachers, especially those pre-disposed to using technology, what is needed is a better understanding of how telecommunications can be used by more teachers to accomplish their own goals and reflect on their beliefs about teaching. An important question is: how do teachers come to use technology, especially telecommunications, for their own purposes to shape their own learning and development?

In order to understand how this question might be answered in the context of practicing teachers, we need to examine the literature on the use of e-mail and it's potential to support substantive conversations about teaching and learning.

Teachers Use of Telecommunications

Studies of e-mail use suggest that members of electronic discussion groups tend to participate more equally than members of face-to-face groups (Sproull & Kiesler, 1991; Kiesler et al, 1984). Students may also be more efficient and uninhibited while using e-mail (Dubrovsky, Kiesler, & Sethna, 1988). Some researchers

have found a lack of inhibition among experienced and novice users of e-mail (Kiesler et al., 1984) while others found that e-mail groups produced a greater variety of opinions (Hiltz et al., 1986).

A study of beginning teachers' use of a computer network (Merseth, 1989) found that it was most effective in providing moral support and least effective in providing technical support for curricular planning. The factors found to enhance the network included its convenience, its ability to reduce feelings of isolation, and the safe non-evaluative environment it created for teachers.

These and other studies suggest that e-mail may represent an ideal medium for fostering and examining critical reflective conversations among professionally isolated teachers. The growing availability and use of e-mail in colleges and K-12 schools makes it a good choice for further study. In addition, e-mail conversations may be more topic-centered than person- or task-centered, and, as such, may represent a forum for discussion where the explicit focus is on ideas rather than on individual status.

While telecommunications might provide teachers with access to ideas and innovations, teachers need to consider how these innovations can be transformed to fit into their local conditions and supported as they experiment with adapting these ideas into their regular classroom activities. Technology, then, is necessary, but insufficient, to support the kind of reform described in the literature. Teachers also need a supportive school context in which they can experiment with new ideas and try out new teaching practices as they grow professionally.

In a recent review of research related to characteristics of successful networks, Riel & Levin (1990) described differences between networks that succeeded -- that is, that accomplished their goals through the interactions and meaningful conversations through technology -- and those that failed -- that is, they never "got off the ground" or they were unable to sustain their efforts. The five characteristics needed for success were: (a) the group already exists, (b) it has need for telecommunication, (c) it has a shared goal with specific outcomes, (d) it has a person who facilitates group planning and work, and (e) all members have easy, efficient access to technology.

An existing conversation-based teacher development group (Florio-Ruane, 1991; Florio-Ruane, 1990; Raphael et al., 1994; Raphael & McMahon, 1994) provides a site for studying how an existing group, with a specific inquiry focus, might benefit from access to asynchronous communication. Using the characteristics described by Riel & Levin, we examined how e-mail was supportive of teacher learning over the first year of this project. This study investigated how e-mail was used in a teacher development group during a 12-month period and how member use of e-mail may or may not have been supportive of their individual growth and development.

Research Questions

We began this study with a series of guiding research questions:

1. How will e-mail be used by members of an existing teacher inquiry group?
2. Will e-mail be used as a tool in the pre-existing activity setting?
3. Will e-mail change the nature of that activity setting and/or the learning opportunities within it?
4. Does e-mail help participants cross borders or does it help reify existing patterns of interaction?
5. If you start with an inquiry premise (this is not a course nor is it a support group; it is an existing group with an explicit focus on inquiry), will you get discourse that is more tolerant of conjecture and skepticism – even though there is an inclination in these kinds of groups not to challenge each other directly?
6. If we do see evidence of critical conversations, will we see challenges in the form of indirect questioning of one another, or of self, or of the emergent explanations?

Data sources for this study include participant surveys, archived e-mail messages, and a yearly events timeline. Analyzing these data, we examine how the use of e-mail as a medium for communication and collaboration shapes the regular patterns of interactions among the members of this teacher inquiry group.

The results show that even when specified conditions for success are met, teachers may be inclined to use electronic communication in subtly different ways and for different purposes.

Methods of Inquiry

Using the archived e-mail messages posted to a list server, along with private e-mail messages exchanged between a small number of group participants, we analyzed the nature of the electronic conversations using discourse analysis. We also asked participants to return a questionnaire that focused on their use of e-mail within the group as well as a timeframe for major events that occurred within the group and corresponding exchanges over e-mail. Using triangulation, we identified key themes or patterns that emerged from these data and also used modified viewing sessions with participants looking at the data to verify our interpretations and conclusions.

Procedures

For the first year of the group's participation in an on-line e-mail list server, we examined the nature of these interactions with an eye towards the characteristics of successful electronic networks identified by Riel & Levin. We attempted to verify which of these characteristics existed in the teacher development group and how these factors did or did not contribute to the use of e-mail as a medium for communications and collaboration during the data collection period. We also investigated the nature of the electronic conversations paying special attention to the relationships between the community, its' established but changing practice, and the media's role on both.

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Using Computers to Enhance Action Research

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Abstract: This paper outlines the potential benefits of using computers to enhance the action research process for classroom teachers. An argument is made for classifying action research as a type of qualitative methodology. This argument is then used to apply the literature on computer use in qualitative research to its use in action research. Specific applications of various types of software are discussed in terms of their potential for supporting and strengthening action research efforts.

Introduction

Action research is hailed by its proponents as an effective way for teachers and other classroom practitioners to actively and rigorously examine aspects of an educational environment in order to inform efforts to change current practice or routine (e.g., McKernan, 1991; McNiff, 1997; Stringer, 1999). In form, the action research process is made up of several components that are traditionally seen as hallmarks of qualitative research:

- It is focused on the meanings of participants within an environment, and thus reflects the *–emic* perspective adopted in qualitative studies. This is evidenced by the fact that action research efforts are geared towards change and development for those who are members of the researched community; such an effort is deemed successful when subsequent changes (if any) positively impact the educational experience of those involved (Stringer, 1999).
- The researcher serves as the main measurement instrument. It is the teacher/practitioner who collects, analyzes, and interprets the data, and who ultimately acts on his or her findings.
- The research takes place in a naturalistic setting. For the purposes of this paper, that is presumed to be the classroom.
- In action research, the teacher/practitioner takes on the role of the qualitative researcher and acts as the primary investigator for the study. Typical duties for both types of researcher include collecting, analyzing, and organizing data, as well as making decisions on sampling issues of depth versus breadth (McNiff, 1988).

Because of these similarities in design and method, it is reasonable to classify action research as a qualitative research endeavor. While some professionals balk at any attempt to label action research as "real" research, its structure and methodology do provide an adequate basis for consideration as one variant of the educational research process.

The increased general use of computers during the last several decades has resulted in increased application of their functions and capabilities in the research process. Many qualitative researchers make use of the organization, storage, and retrieval functions of various computer software applications to aid their efforts in making sense of the data they collect (see: Fielding & Lee, 1998; Kelle, 1995; Weitzman & Miles, 1995). Given the argument presented above for classifying action research as a form of qualitative methodology, it is reasonable to assume that similar applications of computer technology will benefit the action research process as well.

The purpose of this paper is to explore the possible uses of computer applications for teachers and practitioners who are conducting, or are interested in conducting, action research projects in their own schools or classrooms. As with the use of computers in qualitative research, computers should be used in action research only in those cases in which their applications can enhance and not replace the research

process. Accordingly, it is important for those conducting action research to have a clear understanding of how various computer software programs can add rigor to sampling, coding, and hypothesis refinement.

Definition

The action research process is applicable to many areas in which participants in a context or members of a community wish to analyze their practice and the ways in which members mutually influence the action of others. At the most basic level, the main goal of such analysis is to inform efforts to effect positive change in an organization or community. Stringer (1999) and Zeichner & Gore (1995) demonstrate the application of action research principles in both community and educational settings. However, their approach is focused on its potential as a social reconstructionist process aimed at empowerment and social justice. For the purposes of this paper, action research is defined as a method of educational, qualitative research in which teachers and practitioners rigorously examine their own practice in an effort to improve their teaching and communicate their findings to colleagues.

Computers and Qualitative Research

The application of computers to qualitative research efforts can be seen as a merging of incompatibilities. Bogdan & Biklen (1998) state that qualitative research deals with "soft" data that is primarily composed of "description of people, places, and conversations, and not easily handled by statistical procedures" (p. 2). Computers on the other hand, are generally classified according to their numerical nature and ability to process quantitative data rapidly. When the two are joined in the research process, a contradiction can arise in which some fear the loss of the inherent artfulness and humanity of qualitative methodology, while others fear the loss of rigor in the analysis process (Hesse-Biber, 1995). While this contradiction is far from trivial, it is not prohibitive to productive use of the computer's potential for enhancing research efforts. There are some specific, useful features of computer software that can aid the action researcher in some of the more basic functions of qualitative research.

Data collection and Analysis

The lack of regular, systematic tests and measurement instruments in qualitative research places the focus of data collection and analysis on the researcher. He or she is responsible for ensuring the collection of adequate amounts of data that most accurately represent what is happening in the context of a study. They are simultaneously charged with analyzing that data in a way that most clearly and accurately represents the meanings of phenomena and contexts for participants.

This notion of the researcher as instrument in qualitative methodology is particularly applicable to action research, as it is the researcher's own environment and practices that are analyzed. This places particular emphasis on the context of any action research study. Tesch (1990) describes the process of de-contextualizing and re-contextualizing data that is inherent in all qualitative data analysis, and which can be aided by the use of computer software. The first step in this process is the segmentation of relevant chunks of data that are coded and subsequently separated out of the data corpus. This is done in such a way as to ensure that the chunks retain meaning once they are separated. It is then the task of the researcher to re-assemble these pieces into meaningful categories in "data documents". Connections are then made between these documents that represent and support a theory of the phenomenon under study. Tesch argues that Computer Assisted Qualitative Data Analysis Software (CAQDAS) can aid this process through its increased capacity for archiving and organizing data. In essence, CAQDAS is much more efficient at the traditional tasks of cutting, pasting, organizing, and retrieving data as it is de-contextualized and subsequently re-contextualized according to the design of the researcher. Since the average teacher as action researcher is not rigorously trained in research methodology, this particular functionality of CAQDAS programs can help them more efficiently organize what might otherwise be an intimidating amount of data in a way that is not necessarily familiar to them.

Validity

In their ability to aid the researcher in processing larger amounts of data more efficiently, computers and CAQDAS programs help address common criticisms leveled at the validity of qualitative research findings. The complaints that qualitative research is subjective, not rigorous, not systematic, and narrow in its sampling can be countered to a certain extent with the use of computers for the research process. CAQDAS makes it possible to collect, organize, and manage much larger amounts of data from a greater number of subjects than was previously possible for human researchers. It is also possible to be more systematic and accurate when coding using the search and retrieval capabilities of many CAQDAS programs.

In action research, validity is tied to three key elements (McNiff, 1997): Self-validation, peer-validation, and learner validation. In essence, the action research process can be considered valid if it adequately enhances the learning process and environment for teachers, their colleagues, and their students. Triangulation of these three perspectives strengthens the validity claims of any action research study (McKernan, 1991). As discussed below, advances in computer technology have greatly enhanced the ability to record and communicate multiple perspectives among participants, thus increasing an action researcher's ability to achieve this type of triangulation.

At the same time, Seidel (1991) warns of the danger of becoming too enamored of the ability to process large amounts of qualitative data with computers. He argues that is possible for qualitative researchers to fall victim to the illusion that their research is more scientific in nature simply because they are using larger sample sizes. He points out that in some cases, single subjects and/or single occurrences of phenomena are more significant than occurrences across large groups. Ultimately, he argues, while it is advantageous to be skilled in the use of computers for qualitative research, it is equally important to be aware of what the applications can and can not do, as well as how they can be misapplied to the research process (see also: Hesse-Biber, 1995; Kelle & Laurie, 1995). In the following sections, appropriate applications of computers and CAQDAS programs for action research are discussed.

Productivity Tools

For most teachers time is precious. While the concept of examining one's practice, reflecting on that examination, and taking action to improve the learning process is attractive to those who are committed to education, it is also a time-consuming practice. As a result, action research involves a significant commitment of time and effort. When computers, and especially CAQDAS programs, are added to the mix, the amount of time required can increase dramatically due to the learning curve that is inherent in many computer applications.

It is therefore important for action researchers to consider those computer resources that already exist in their environment, and how they might be applied to the research process. In most cases, those resources will include some basic productivity software tools that are standard issue with most computers purchased in today's market.

Databases and spreadsheets are non-specialized programs that can be used to efficiently store, organize, and present data. They have the advantage of being two of the most commonly used software applications, which increases the likelihood that experienced users can readily be located locally to assist researchers who are not familiar with their capabilities. Spreadsheets are particularly advantageous because of their ability to save and import data as delimited text. This facilitates the transfer of certain data configurations between several types of computer software applications (e.g., spreadsheets, word processors, *SPSS, QSR NUD*IST*, etc.).

While there are specialized programs such as *Inspiration* that are designed to facilitate the visual display of qualitative data (see: Miles & Huberman, 1994), standard draw and paint programs can be used to achieve similar types of display. This eliminates the need for action researchers to learn an entirely new software package, and allows them to use an application that they are most likely using with their students already.

CAQDAS Software

If an action researcher is committed to using software that is specific to qualitative research, there are a number of specialized packages that can enhance and facilitate the basic tasks they must accomplish in the analysis process (e.g., *QSR NUD*IST, Atlas/ti, FolioViews, HyperQual, HyperResearch, The Ethnograph*). In most cases, these programs require a significant investment of time to become familiar and comfortable with their basic functionality. However, they have the advantage of providing some very powerful tools for data analysis.

Coding

A basic function of all CAQDAS program is the ability to assign codes to chunks of data. An advantage to doing this on the computer is the ability to create, assign, and keep track of a greater number of codes than would be humanly possible using pencil and paper. At the same time, when dealing with fewer codes and more manageable amounts of data, the organizational functionality of CAQDAS programs can still outperform human ability, thus freeing the researcher to concentrate more on analysis and less on organization. In most packages, the creation, naming conventions, and organizational scheme for coding is flexible. This allows the researcher to have increased ownership of the analysis process, and to proceed in a manner that is most intuitive to them. For action researchers, this alleviates the need to stick to formal classification and hierarchical organization schemes that may not be familiar to them, and allows them to structure the coding process to fit their needs and abilities.

Search and Retrieval

A second basic function of CAQDAS programs is the ability to search for specified strings or patterns, and to retrieve and display the results of such searches. As the analysis begins to take shape within the software program, the individual researcher becomes intimately grounded in his or her original data, the coding schemes they have identified and used, and patterns that begin to emerge as the process moves forward. The ability to search for occurrences of single or multiple codes helps the researcher to explore relationships between concepts and phenomena, and to then reorganize those patterns and relationships into an explanation of what they have found.

The action researcher who chooses to use such CAQDAS programs for data analysis can take advantage of this functionality to formulate and examine hypotheses about their practice. One of the key elements of action research is the ability to gain a new perspective on personal practice. The rigorous organization and analysis of data within this type of software can help the action researcher to explore their practice more deeply, to formulate hypotheses that are grounded in their data, and, ideally, to gain new insights into how they can improve what they are doing in the classroom.

Communication

At the most basic level, action research is a social process (McNiff, 1997; Stringer, 1999). In opposition to traditional scientific research, action research is concerned less with an objective, primary investigator and more with a practitioner who is invested in the inquiry into his or her own practices. The successful action research study moves forward only as the researcher gains insight into and understanding of his or her practice (McNiff, 1997). It is a process that is validated through the exploration of different perspectives, and built upon successful communication between all the members within a community or context (Stringer, 1999).

In recent years, developments in technology have greatly increased the potential for easy, inexpensive communication over long or short distances. For the action researcher, this provides an excellent avenue for the sharing and comparison of different opinions, perspectives, and findings. Tools such as electronic mail, electronic mailing lists, online newsgroups, web sites, and video conferencing can

all be used to communicate with colleagues during the research process. This type of technology is particularly valuable for communication across distances and in an asynchronous mode. Given the restrictive daily schedule required of most teachers, it is not always possible to find common times for meeting and sharing ideas or findings. The ability to post and retrieve information online at any time permits communication on a more flexible basis.

Conclusion

At a basic level, action research is designed to benefit practitioners who are not professional researchers. In the process of conducting action research, teachers have the opportunity to take an in-depth look into their educational practices in a way that is illuminating and, ideally, transforming for themselves and the members of their communities of practice. Computers, and specifically CAQDAS programs, can serve as tools for the action researcher that can simultaneously simplify and enhance the research process. As teachers approach action research with a plate that is already overflowing, CAQDAS offers a way to support them in their new role as researchers, and to lend credibility to their efforts, which can ultimately help ensure their continued participation in this type of critical, self-evaluation.

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EVALUATING ONLINE LEARNING: MODELS AND METHODS

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Abstract:

This paper critically reflects upon the questions we have asked and the models and methods we have employed to evaluate online learning in several studies. The paper examines the methodologies used to answer the following evaluation research questions: 1. How can we describe online participation, interaction patterns, and group dynamics? 2. Were students satisfied with the experience of participating in the conference? 3. Did participants learn? 4. Was knowledge constructed?

One of the critical challenges facing educators as we move into the twenty-first century is the development of appropriate methodologies and tools for evaluating online learning networks. The open-ended nature of online learning projects, the multiple threads of conversation, and the fluid participation patterns pose new challenges to evaluators. Online learning designs are often based on constructivist, learner- centered principles which provide more learner control, facilitate the sharing of multiple perspectives, and places emphasis on individual learners creating their own meaning. Behavioral objectives with a stated outcome for all learners, is not the goal of many online learning projects. Traditional evaluation methods used to evaluate learning within the four walls of a classroom do not transfer well to the online context. Evaluators therefore, are challenged to understand the unique characteristics of the online medium and its social and ecological structure in order to develop new principles for evaluating learning.

The purpose of this paper is to critically reflect upon the questions we have asked and the models and methods we have employed to evaluate online learning in several studies we have conducted. These online studies range from setting up online networks for social

interaction, facilitating collaborative learning experiences among graduate students in several universities, to moderating worldwide online professional development activities.

This paper will be organized according to the evaluation questions we have asked and attempted to answer:
1. How can we describe online participation, interaction patterns, and group dynamics?
2. Were students satisfied with the experience of participating in the conference? Did they feel that it had been a worthwhile use of their time, and one that they would be willing to repeat?

These questions were answered using a variety of techniques; both quantitative and qualitative. However, while these questions have value in understanding the nature of a computer conference (CC) , they do not yield useful information on the quality of the learning that took place.

One significant question which has yet to be satisfactorily answered is: How do you assess the quality of the learning experience in a computer-mediated conference (CMC)? Questions we need to ask are:

3. Did participants learn?
4. Was knowledge constructed?

Currently, the question that has intrigued us, is: How is knowledge constructed in online learning networks through the process of social negotiation? In order to address this challenging question, content analysis or interaction analysis of computer transcripts using qualitative research techniques is essential. We have relied on interaction analysis in our attempts to develop an interaction analysis model for examining social construction of knowledge in online learning networks (Gunawardena, Lowe, and Anderson, 1997) which we will describe in this paper.

How Can We Describe Online Participation, Interaction Patterns, and Group Dynamics?

Participation analysis techniques examine the capacity of a conference to engage members and reveal comparative patterns of participation among learners from varying backgrounds. An evaluation tool we have employed to address these questions is the model developed by Levin, Kim and Riel (1990) for analyzing instructional interactions on electronic message networks. This model has four dimensions of analysis: 1) Participant Structures Analysis, 2) Intermessage Reference Analysis, 3) Message Act Analysis, and 4) Message Flow analysis. We used this model to evaluate a peer support network for medical students at the University of New Mexico (UNM), set up to maintain the social and psychological support network during the period of time that they worked with preceptors in isolated rural communities in New Mexico (Gunawardena, Gittinger, and Dvorak, 1991).

In reflecting on the use of the Levin, et al. (1990) model, we found that while it is a good starting point for obtaining an overall picture of the network group, activities, and interaction, it did not fit neatly with the purpose of our project. The Intermessage Reference Analysis was difficult to apply since our application of CMC was primarily

social in nature. All participants on-line were peers; no instructor activity existed. The purpose of these communications was not academic and tasks were not performed on-line. As a result, information such as whose messages were referenced most, what topics were referenced most, did not stand out in any particular way. Levin, et al. do not address content analysis within Message Act Analysis. We found our research was enriched by a careful analysis of the content of the interaction. We have found other data such as unsolicited participant reactions online, solicited participant reactions, both instructor and student perspectives on interaction and the analysis of computer transcripts to be more useful in forming a picture of events that occurred in the online community (Gunawardena, 1993).

Were Learners Satisfied with Their Online Learning Experiences?

The methods we have used most often to solicit learner reactions to and satisfaction with online learning experiences include online surveys, paper and pencil surveys, and participant reactions to the conference posted online in a conference area designed for this purpose. Another important source of data are the unsolicited comments on participant satisfaction or dissatisfaction with the learning experience that occur throughout the transcript.

Structured survey questions are useful in obtaining an overall view of student reactions to the conference and their satisfaction. It is also possible to obtain more in-depth data on selected open-ended questions. The survey is an easy vehicle to obtain data when students are scattered across geographic distance. Analysis of survey data has taken many forms depending on the questions we have asked related to various studies we have conducted.

Hiltz (1990) discussed an approach to determining learner satisfaction by examining the social psychological (characteristics of the users); human relations (characteristics of the groups and organizations within which systems are implemented); and technological determinist (characteristics of the system); factors that impact student satisfaction with, and subsequent use of computer conferencing. Using her theoretical framework we examined a computer conference in which a group of graduate students from the University of New Mexico joined 13 academic experts from 7 countries to discuss "cooperative learning" within the context of a global electronic pre-conference for the international TeleTeaching '93 conference held in Norway (Gunawardena and Heeren, 1993). The analysis was based on a questionnaire that addressed Hiltz's dimensions. One of the major problems associated with our study and with quantitative analysis when applied to the CMC context was sample size and sample selection. While multiple regression and analysis of variance were conducted to examine these variables, the statistical significant differences are not convincing because of the small number of participants in our study.

A recent quantitative study we conducted to answer the question: What are the variables that can predict student satisfaction in online learning networks? yielded more positive

outcomes (Gunawardena & Zittle, 1997). The purpose of this research was to examine which process variables such as proficiency in technical skills, learner support, and "social presence" or the degree to which a person is perceived as "real" in mediated communication (Short, Williams, and Christie, 1976), could predict learner satisfaction within a CMC environment. The process and satisfaction variables were measured by a 61-item questionnaire consisting of predominantly five-point Likert scale items specially designed for this study.

The subjects were fifty graduate students from five universities: San Diego State (N=8), Texas A & M (N=11), University of New Mexico (N=14), University of Wisconsin-Madison (N=7), and University of Wyoming (N=10), who participated in the Fall 1993 Globaled inter-university virtual conference. The Globaled conference was an academic exercise that was a class requirement at each participating university (Gunawardena, et. al. 1994).

In this analysis (Gunawardena and Zittle, 1997), eight process variables were used to predict overall satisfaction with the Globaled conference. The stepwise regression analysis converged on a three-predictor model revealing that social presence, student perception of having equal opportunity to participate in the conference, and proficiency in technical skills accounted for about 68% of the explained variance. Social presence alone contributed about 60% of this variance, suggesting that it may be a very strong predictor of satisfaction. Although care must be taken in generalizing these results due to sample selection and size, the results suggest that social presence alone is a strong predictor of satisfaction in a text-based computer conference.

When reflecting on the quantitative analyses we have done using surveys, we feel that the strengths of these analyses lie their ability to point out salient differences in process variables as they relate to learner satisfaction. One of the shortcomings of quantitative analysis however, is the inability to explain the reasons for the significant differences observed. This is where qualitative analysis of open-ended questions or interviews is of value. A related problem with quantitative analysis when applied to the CMC context, is the small sample size in many conferences, and problems related to sample selection as random sampling is difficult in the distance education context. Quantitative analyses should be performed only when there is an adequate sample size to study the variables of interest. Qualitative data used in conjunction with quantitative data can usually explain the significant differences found. Therefore, we would advocate a mixed methodology approach (Tashakkori & Teddlie, 1998) combining quantitative and qualitative data to overcome some of the problems related to quantitative data alone.

Did participants learn?

How did the individual learner make sense of the computer conference? What did he or she learn? These questions are more difficult to answer if we subscribe to a constructivist view of learning where the individual learner is expected to take away a unique perspective from the learning experience. Traditional methods of measuring learning

using pre and post tests will not work well in this context as learning occurs in many different forms and is not limited to learning the content or subject under study. We have been interested in examining questions related to learning from two perspectives: What did participants learn about the subject/topic/content that was discussed? and What did they learn about the medium of computer conferencing and it's influence on the learning process?

One method is to analyze the computer transcript as it affords an unobtrusive, and fairly accurate means of gauging whether participants learned during the conference. If one looks carefully at the transcript, we can decipher several unsolicited comments or "thinking aloud" comments that refer to individual learning such as the following in a debate that discussed the importance of 'interaction' to distance education: "In the past two days, you who are participating in this conversation have made me stop and think about 'interaction.' I guess you'd call that 'learning.' Without your thoughts this would not have happened. I think this demonstrates the importance of 'interaction' to learning." (Gunawardena, Lowe, and Anderson, 1995, p. 202).

Another technique is to ask participants directly what they learned, either through open-ended questions in questionnaires, or individual interviews, or, asking them to discuss their learning in a separate conference space specially designed for this purpose. In a study where we used open-ended questions in a questionnaire to find out what students learned about "cooperative learning," the topic of the conference, we found that students learned about: 1. cooperative learning as an educational concept, 2. how to participate in a conference that generated diverse opinions, 3. what makes a good and a bad conference, and 4. how to use the technology to participate in a computer conference (Gunawardena and Heeren, 1993).

Evaluation data on student learning can also be collected online by asking very general questions such as: What did you think about this computer conferencing experience?

In order to understand the myriad forms of learning that occurs in a computer conference, we have often asked students to keep weekly journals documenting all aspects of learning. These journals have given us a unique perspective of each individual's learning process. Other techniques we have used are to ask students to critique their online learning experiences and to apply and transfer what they have learned from the computer conference to developing a computer conferencing design.

In reflecting on the various evaluation techniques we have used to understand student learning, we have found that qualitative approaches work better than quantitative methods in being able to understand the unique ways in which individual students learn.

Was Knowledge Constructed?

Perhaps the most challenging and the most exciting question one can ask in evaluating online learning is: Was knowledge constructed within the group by means of the

exchanges among participants? We will discuss two interaction analysis models we have used to answer this question. Initially, we began to use Henri's (1992) model to analyze the transcripts of a global online debate we had conducted as an adult professional development experience. However, it became clear that three aspects of Henri's model; its basis in a teacher-centered instructional paradigm, its distinction between the cognitive and the metacognitive dimensions, and its treatment of the concept of interaction, were unsuited for application to the debate. We felt that we needed to develop a new definition of interaction for the CMC context if we are to examine the process of social negotiation (Gunawardena, Lowe, and Anderson, 1997).

We believe that the metaphor of a patchwork quilt better describes the process of shared construction of knowledge that occurs in a constructivist learning environment. A quilt block is built up by the application, one after another, of small pieces of cloth, which when assembled form a bright and colorful pattern. The pieces, according to this analogy, are the contributions of individual participants. Each participant contributes to the whole his or her own texture and color of thought, just as every scrap of fabric forms a distinctive element in the overall pattern. The pattern may not be complete during a single conference, but individual responses can contribute toward the formation of a pattern. The process by which the contributions are fitted together is interaction, broadly understood, and the pattern which emerges at the end, when the entire gestalt of accumulated interaction is viewed, is the newly-created knowledge or meaning. Interaction is the essential process of putting together the pieces in the co-creation of knowledge.

Based on this new definition of interaction, and grounded theory principles, we developed an outline of the process of negotiation which appears to occur in the co-construction of knowledge. The outline led to the development of the interaction analysis model which has five phases, reflecting the complete process of negotiation which must occur when there are substantial areas of inconsistency or disagreement to be resolved. The phases of learning outlined in this model occur at both the individual and social level and can be described as:
Phase I: Sharing/Comparing,
Phase II: Dissonance,
Phase III: Negotiation/Co-construction,
Phase IV: Testing Tentative Constructions, and
Phase V: Statement/Application of Newly-Constructed Knowledge.
A detailed discussion of this model and its underlying theoretical framework is found in Gunawardena, Lowe, and Anderson (1997).

Two major themes were observed related to knowledge construction. One was the progress of certain strands of argument from Phase I to Phase V which can be described as an exercise in the co-construction of knowledge, moving from lower to higher mental functions. The other was the evidence of more than one and sometimes three phases within a single message posted by one participant, which usually progressed in sequence through the phases, showing progress from lower to higher mental functions, showing how individuals contributed toward the co-construction.

Conclusion

The adoption of a single technique for analyzing the quality of the learning experience in online learning networks has not yielded satisfactory answers. The complex nature of online learning calls for the use of multiple methods and multiple sources of data to understand group as well as individual learning. While quantitative analysis of interaction patterns and learner satisfaction has yielded useful information on the overall nature of online learning and the variables that influence its success, several problems exist in the application of the quantitative paradigm to evaluating learning in the online context. Two problems relate to sample size and selection. While quantitative data can point out a significant difference, it cannot adequately explain the reasons for the observed difference. The naturalistic paradigm employing qualitative data from in-depth interviews, observations, and computer transcript analysis, can often explain the observed differences. When used in conjunction with quantitative data, qualitative data can overcome some of the shortcomings of utilizing quantitative data alone. Therefore, it is recommended that a mixed methodology approach be used to study the complex nature of online learning networks.

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Beyond Computer Literacy: Addressing the Evolution of Technology Standards

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Abstract: This paper is a report on findings of a study conducted with the purpose of assessing the level of technology skills of graduate and undergraduate students enrolled in the teacher education program at Eastern Kentucky University. The study revealed both strengths and weaknesses in relation to a new technology standard for teachers recently adopted by the state of Kentucky. Marked differences were found among three groups of undergraduate students. These differences were analyzed and used as a basis for recommended changes in the teacher education program.

Introduction

The state of Kentucky has been engaged in a wide-ranging reform of elementary and secondary education since the Kentucky Educational Reform Act (KERA) of 1990. As part of that reform, the state has adopted New Teacher Standards (NTS) and Experienced Teacher Standards (ETS) for initial and continued certification for teachers. Although technology was an emphasis in KERA, no standard for technology was included in either the New or Experienced Teacher Standards. In early 1999, the Kentucky Education Professional Standards Board proposed that a new standard for technology be added to both the New and Experienced Teacher Standards. As a part of preparation to meet such a standard, the authors conducted a survey in the College of Education at Eastern Kentucky University to assess technology needs of undergraduate and graduate teacher education students and to compare the needs with those of a selected sample of faculty members. The new technology standard was adopted by the Kentucky Department of Education in October 1999.

Project Description

Eastern Kentucky University is one of the eight state supported universities in the state of Kentucky and has the largest teacher preparation program in the state. A computer literacy requirement has been in place for pre-service teachers for several years. Approximately five years ago, all course syllabi for teacher preparation programs were re-examined and revised to include a technology component. It seems important to ascertain the level of skills attained by teacher education students who have been in this program before deciding whether additional provisions are needed to meet the change in Kentucky Teacher Standards.

Kentucky's technology standard for teachers is similar to guidelines established by the International Society for Technology in Education (ISTE) as the *Recommended Foundations in Technology for All Teacher* . (ISTE, 1997). Kentucky's introductory standard statement is: "The teacher uses technology to support instruction; access and manipulate data; enhance professional growth and productivity; communicate and collaborate with

colleagues, parents, and the community; and conduct research" (Kentucky Department of Education, 1999). This statement is followed by 16 performance criteria that relate to how the teacher uses technology in the preparation and delivery of instruction and for professional growth and productivity. Findings from the survey described in this paper were analyzed in relation to these performance criteria, and recommendations for changes in the teacher preparation program were made based on the analysis.

Several constraints exist for proposed changes in the teacher preparation program designed to meet the new standard. First, there is an immediate need for addressing the new standard. The state has developed an implementation time line such that teachers beginning their teaching career in the fall of 2000 will be held accountable for the standard. Second, any new course proposal would be highly unlikely to be approved due to the university's desire to limit the number of credit hours to 128 for all teacher preparation programs. Even if approved, students currently in the program could not be required to complete an additional course. Third, the university climate would make it extremely difficult to get approval for a course designed to focus on technology for teachers. Taken together these constraints require accelerated but thorough planning for assessing strengths and weaknesses in the current program, integrating instruction for use of technology into existing required classes, and designing means for helping faculty members utilize technology more efficiently and productively in their classes and as part of course requirements.

A survey focusing on computer skills needed by adult users of computer hardware and software was administered to three cohorts of undergraduate students during the fall semester of 1999. The three groups included (1) all students enrolled in the first course in the language arts sequence for elementary and middle grade majors (juniors), (2) all students enrolled in the elementary blocked methods classes, and (3) all students enrolled in middle grades methods classes. These students were all either junior or senior level students who were enrolled in teacher education programs. The survey was also administered to two groups of graduate students enrolled in education classes, and to faculty members in the Department of Curriculum and Instruction.

Findings from the Project

All the undergraduate students had taken at least one 3-semester hour credit class related to computer literacy and/or usage. Approximately 86% reported that they have a computer at home, yet only 45% responded that they felt very confident about using them. Another 39% stated that they felt somewhat confident in their use of computers. A few students reported being timid about using computers and avoided them when possible.

A majority of the graduate students had taken a minimum of one course plus additional in-service computer training. They represented a wide variety of teaching levels and experience. Approximately 70% reported having their own computers at home. Length of use and frequency of use varied for this group. Some had used computers less than two years, others reported two to four years with many reporting more than five years use for instructional purposes. However, most had used them for word processing and electronic mail only.

Very few of the faculty members surveyed had any college credit hours in computers, but most had taken some in-service computer training. Eighty-two percent reported having computers at home and all have computers in their offices as well as access to related peripheral devices (e.g. scanners, video and digital cameras). The majority reported using computers for more than five years and most said they used them on a daily basis. However, like the graduate students, most faculty members used them for word processing and electronic mail only.

All the groups reported good skills in using computer technology to access electronic mail and use the Internet. Most of the respondents reported using electronic mail for communication. A similar majority responded that they use the Internet for research to support instruction. All three groups also reported feeling comfortable with operating a computer and some types of software. The major software used was a word processing program. These findings indicate areas of strength in all groups.

In a question on using database programs, 2% of the juniors, 14% of the elementary methods students, 21% of the middle grades methods students, and 27% of the graduate students reported using databases regularly while only one faculty member did so. Forty-two percent of the elementary methods students, 46% of the middle

grades students, 34% of the juniors, 33% of the graduate students and 15% of the faculty reported using spreadsheets regularly. All these percentages represent less than half of any group. Since a part of the new technology standard is that everyone will be able to use productivity tools for database management and spreadsheet applications, these results are an indication of a major need area for all groups surveyed.

Several questions in the survey were related to the skill level of the teacher in operating a multimedia computer and peripherals and in doing simple connections and installations of the computer and peripherals. All groups reported being somewhat unsure about installation and troubleshooting minor problems with both hardware and software. All groups rated themselves low on being able to evaluate the type of hardware needed for use in the classroom for instruction. They also rated themselves low on being able to use a computer manual and other technology reference materials. This indicates additional areas of need for all groups surveyed.

In some skill areas there was a marked difference in the response of the various groups. The students enrolled in the middle grades methods courses rated themselves higher on five areas of technology use for instructional purposes. These areas were 1) creating multimedia presentations and using presentation software in the teaching of lessons, 2) using the scanner and video and digital equipment in preparation of lessons and for professional productivity. 3) choosing appropriate software for use in the classroom, 4) developing lesson plans that include using the computer as a part of the instruction, and 5) planning pre- and post-computer interaction activities.

One area in which the graduate students rated themselves more skilled than the other groups was in the use of computer software to individualize instruction. Sixty percent of the graduate students, 45% of the middle grades methods students, 35 % of the elementary methods students, 16% of the juniors and 40% of the faculty members rated themselves high in this area.

Discussion

The discussion of the findings and recommendations drawn from the findings will focus on how the results of the survey can be used to change the teacher education program so that students have the opportunity to meet the sixteen performance criteria in Kentucky's new technology standard.

The strength areas found in all groups in word processing, use of electronic mail, accessing the Internet and utilizing software are among the most widespread uses of computers. This indicates a success area in our current teacher preparation program. Another explanation of this finding may be related to the fact that word processing, electronic mail and the Internet are helpful for two basic functions of teaching and learning. These functions, accessing and communicating information, were accomplished by teachers in the past using reference books and pencil and paper tasks. Some software programs utilized by teachers may be merely a different form of worksheets and learning centers. This relationship to traditional functions may lead both in-service and pre-service teachers to feel more comfortable with these areas.

Areas of need for all groups surveyed include the use of databases and spreadsheets as well as the technical aspects of technology use such as connecting and installing computers and peripherals, installing software, and troubleshooting minor problems with hardware and software. In addition, a low rating was reported by all groups in using computer manuals and other technology reference materials. These specific areas of need represent a current weakness throughout the teacher education preparation program in relation to the new technology standard.

Three major differences among the survey groups were noted in the analysis of the survey data. First, the students at the junior level in the early language arts course rated themselves lower than the two groups enrolled in senior level methods classes. This was particularly noticeable in the areas of planning and implementing instruction. This finding was to be expected since the students in the junior level group had experienced fewer opportunities in planning and implementing instruction and less exposure to instructional software. These students did report approximately equal skill in word processing with the other groups but less skill in database and spreadsheet applications.

The second difference among the groups, the finding that graduate students were more skilled in using computer software to individualize instruction, is also to be expected. These graduate students are classroom teachers with many opportunities to use computer software with students on a daily basis.

One other difference among the groups was the most interesting and useful finding, that students in the middle grades methods courses were more advanced in skills and usage than the other groups. In examining this phenomena, a model emerged that could be used with other groups of students. The five middle school faculty members worked as a team to decide on technology skills that they felt were important for the middle grades education students to use in the block experience. The instructors conducted technology seminars for students at the beginning of the semester and then expected the students to use the skills in preparation of class assignments. These seminars were developed with the aid of the College of Education technology coordinator, who then trained the faculty members to deliver the seminars to the students. Faculty members became "experts" in teaching one area of computer skills through both the training and delivery of the seminars to five groups of students. Two members of the middle grades faculty had received training in online course development. They used this training and developed an online component for all courses in the middle grades block. This component included resources such as course syllabi, schedule of class times, electronic addresses, forms needed for the course, assignment guidelines, and other materials often given as hard copy handouts. This web enhanced component of the course helped students become familiar with a distance learning application which used online materials for learning.

Recommendations

In considering the new Kentucky technology standard and the sixteen performance criteria associated with it, a plan can be designed for improvement of the teacher education program that is based both on the findings of the survey and on the criteria teachers will now be expected to meet.

Since all students are required to take a basic computer applications course, six of the performance criteria can be met within that course. The faculty who teach this course are now redesigning the course to focus more on the performance criteria related to operating the computer and peripherals; connecting peripherals to the computer; installing software; using computer and technology terminology; uses of technology in business and society; and legal and ethical issues related to technology use. In the future, this course will also focus more on database and spreadsheet skills rather than word processing.

In redesigning the pre-service teacher education program three years ago, a special education course was made a requirement for all education majors. This course seems an appropriate place to incorporate a seventh criteria which is for students to learn about the use of assistive and adaptive devices for students with special needs.

Another existing course into which one performance criteria could be incorporated is a course on assessment in education. The criteria addresses the need to use technology to support multiple assessments of student learning.

A ninth criteria is for students to use distance learning applications to enhance professional productivity and support instruction. The web enhanced format used by the middle grades faculty provides a model for one such application. Since compressed video courses are offered on campus, the compressed video rooms could be used for pre-service teaching majors to communicate with schools as a part of their field experience.

Another group of five performance criteria are specifically related to instructional planning and delivery. These criteria could be addressed in the blocked methods courses. The middle grades model can be used as a base for redesigning the elementary methods block by incorporating training for faculty members, seminars for students, course assignments that require using technology skills, and adding a web component to the courses. In addition, the content areas of mathematics and science within both methods blocks lend themselves to more intense emphasis on utilizing spreadsheets in instruction. The two content areas of language arts and social studies similarly lend themselves to greater emphasis on databases.

The final two performance criteria include applying research-based instructional practices and facilitating lifelong learning of self and others through the use of technology. To address the first of these criteria it is

important to focus on raising skill levels of faculty. Working with the college technology coordinator, seminars addressing needed skills can be developed and delivered to the faculty. If faculty feel competent and comfortable using technology, they are much more likely to use technology and model its use for their students. Facilitating lifelong learning is a natural outgrowth of developing competence and comfort in all the other criteria. With competence and comfort in technology, faculty and students will use and continue to grow in their use and understanding of technology in education.

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11th International Conference

Proceedings of SITE 2000–

February 8-12, 2000
San Diego, California

General Editors –
Dee Anna Willis
Jerry D. Price
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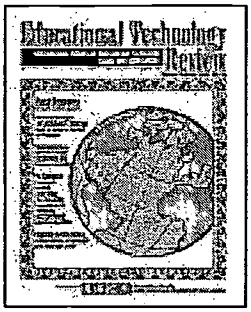

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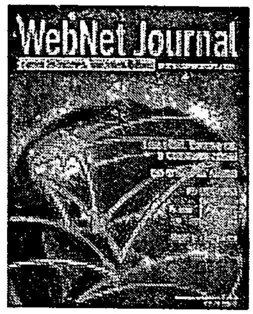

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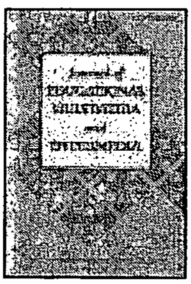

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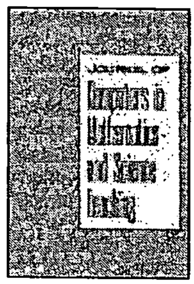

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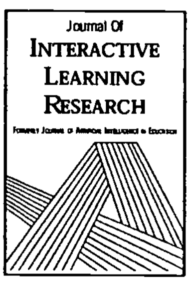

The *Journal's* published papers relate to the underlying theory, design, implementation, effectiveness, and impact on education and training of the following interactive learning environments: authoring systems, CALL, assessment systems, CBT, computer-mediated communications, collaborative learning, distributed learning environments, performance support systems, multimedia systems, simulations and games, intelligent agents on the Internet, intelligent tutoring systems, micro-worlds, and virtual reality based learning systems.

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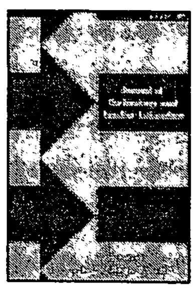

A forum for the exchange of knowledge about the use of information technology in teacher education. *Journal* content covers preservice and inservice teacher education, graduate programs in areas such as curriculum and instruction, educational administration, staff development, instructional technology, and educational computing.

International Journal of Educational Telecommunications
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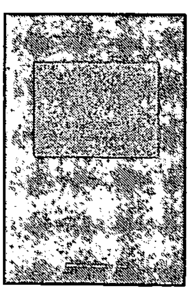

IJET serves as a forum to facilitate the international exchange of information on the current theory, research, development, and practice of telecommunications in education and training. This journal is designed for researchers, developers and practitioners in schools, colleges, and universities, administrators, policy decision-makers, professional trainers, adult educators, and other specialists in education, industry, and government.

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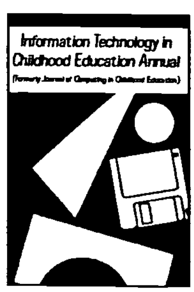

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Preface to the Millennium Edition!

Now that we have had our celebrations about the coming of a new century and a new millennium, purists are pointing out that we are not really in the first year of the new millennium but in the last year of the old one! "What?", you say. I vacationed in Turkey this Christmas (thanks to Dee Anna Willis being willing to shoulder most of the load for getting the section leaders' comments in and organized) and the English language paper in Turkey ran an article about the way the monk who organized the calendar we use today started it. Instead of making the first year, 0, he made it year 1. Thus, the year 2000 is actually not the two thousandth year, it is the 1999th year. So, if we want to do the whole thing over again next year, we can.

What about the Annual? Is this the 9th or the 10th year of the Annual? That too is a bit complicated. The first conference was held in 1990 which means this is the 11th conference. (We did not think far enough ahead to hold the first conference in 1991 instead of 1990 so it would be easy to keep up with.) Everything being equal this should be the 11th Annual, right? Well, not quite. The papers presented at the first conference were not published in an Annual. Instead, they were Issues 1, 2, and 3 of the 1990 volume of the journal, Computers in the Schools. So, when it comes to Annuals, the year and the number of the Annual is consistent. This is the tenth Annual.

Ten years! For the Annual. And eleven for the conference! Not long in the grand scheme of things but a long time when it comes to conferences. I would estimate that there are 80% more "First Annual" conferences than "Second Annual." And, if we extrapolate a bit my guess is that less than 5% of the academic conferences are around for an eleventh incarnation. SITE is a survivor for several reasons. One is that it does a good job of meeting a need. There is a growing community of scholars and professionals who have a strong interest in technology and teacher education. SITE is THE conference if that is your interest. A country singer whose name eludes me had a popular song a few years ago that had the lyric, "I was country before country was in." SITE was here, with a focus on teacher education before that was an "in thing."

Today, technology and teacher education is an in thing. The U.S. Department of Education's $75 million dollar grant program on preparing teachers to use technology has raised the interest level and attention of teacher education, as have a number of other activities such as the AACTE report on technology in teacher education. Technology was not always in the limelight of teacher education, however. In introducing the special issue of Educational Technology Research and Development on technology and teacher education, Bob Hannafin (1999) commented that in the past teacher education and instructional technology "lived quite happily in separate worlds, neither really knowing - or caring to know - what the other was doing" (p. 27). Hannafin edited the special issue of ETR&D on technology and teacher education because he felt this was an emerging field that deserved the attention of the IT community. I am happy to say that of the seven authors involved in writing articles for that special issue, all except one are regular participants in SITE. Two have been or are presidents of the organization and several others have won awards for their papers at SITE.

The USDOE grants program, the work of NCATE, ISTE, and AACTE; and special issues of journals like ETR&D, are all indicators of the changing landscape of technology and teacher education. SITE and its membership has many opportunities to form collaborative relationships with other organizations. The time is right for that, thus the theme of the conference, Bridges Among Professional Associations. I hope you have a productive and enjoyable conference and that you become an active and energetic part of the process of building bridges in this time of high interest and attractive possibilities.

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Reading, Language Arts & Literacy

Section Editor:
Kathy Matthew, *Louisiana Tech University*

The balancing act of integrating technology, delivering the content, and meeting content standards in language arts and literacy classes is the unifying theme of these papers. This balancing act may require redesigning a course or an entire curriculum. Professors, classroom teachers, and students often lack the necessary technology skills, the time, and the support system to learn to use technology. These papers chronicle the challenges faced and overcome, as well as the challenges that remain. The work and effort required to integrate technology, content, and standards are well worth the effort as these papers show. Progress is being made as professors, teachers, and students work together to infuse technology into the curriculum.

Mary Ann Kolloff at Eastern Kentucky University describes her experiences as she integrated technology into an adolescent literature course for preservice and inservice teachers. She speaks of balancing needed technology skills and delivering course content. Her work highlights how important it is for professors to model technology integration for their students.

Sometimes the integration of technology requires the redesign of the course as Judith Crowe discovered. Materials for her graduate level reading methods course at California Lutheran University were redesigned and placed online. She recounts the challenges and successes encountered in this project. To assist students as they made the transition from text to electronic format for class materials, the final hour of the class sessions were spent in the computer lab where the students worked with partners to access the materials. Two measures of the success of the project are that students reported an increase in their personal technology skills and that they planned to continue to access the course site in the future.

Reading methods students in Kimberly Kimbell-Lopez's class at Louisiana Tech University had first hand opportunities to teach with technology. The preservice teachers and elementary students read and discussed several books on World War II. Then, they helped the elementary students use Inspiration, a concept mapping software program, to extend and organize the elementary students' understanding of World War II.

Carla Piper at Chapman University and Susan Eskridge at the University of the Pacific had students create electronic portfolios to assess their performance and achievement of course objectives in a reading methods class. Challenges in this project included the students' lack of technology skills and lack of time to learn to use technology, a concern voiced by others working with preservice teachers. Students reported positive feelings toward the self-assessment and self-reflection required in the project and many expressed pleasure in learning to use technology to creatively express themselves in a multimedia format. George Canney and John Davis at the University of Idaho also used technology to assess students' learning. They developed a computerized test to determine preservice teachers' knowledge of phonics. Their computerized test was found to be a valid, cost-effective alternative to the paper and pencil version of the test.

Graduate students at Griffith University in Australia wrote research grants as part of a class title "Research Issues in Technology and Language Learning." The grant writing was a simulation that required the students to learn about current research and issues in their field. Cristina Matas felt that this simulation provided her students a context for authentic learning in addition to giving them the means to pursue research in their field.

Nedra Crow and Joan Sebastian, co-directors of the Distance Education ESL Endorsement Program, responded to the growing need for English as a Second Language (ESL) teachers in local school districts. University and public school collaboration lead to an ESL endorsement program for teachers offered via distance education by the University of Utah. Distance education was deemed to be a cost-effective way to deliver a high quality program to a large number of educators. In their paper the researchers shared the challenges they faced and overcame as new technologies were implemented and teachers became familiar with learning via distance education.

Higher education faculty faced with developing technology workshops for their peers will want to read Lorraine Williams' article detailing her experiences at Saint Michael's College. A needs assessment questionnaire, formative, and summative evaluations, in addition to

discussions with faculty members enabled her to make changes in the workshops in order to meet the needs of individual professors. Some professors indicated a preference for one-on-one instruction, something deemed necessary but not often available to faculty as they learn to use technology in their teaching. Lorraine Williams presented technology workshops for language professors, as did Jessamine Cooke-Plagwitz at the University of South Carolina. A non-threatening, supportive environment is deemed essential if faculty members are to incorporate technology into their teaching.

Jackie Jing-Fong Hsu, Yin Mei Wong, and Der-Thanq Chen of Singapore discuss how technology was used to enhance learning in a Mandarin language classroom. Using rote memorization to teach the Mandarin language results in students who cannot use the language in life-based situations. To encourage students to think divergently and apply their knowledge of Madarin, a technology enhanced Directed Reading Thinking Activity (DRTA) was incorporated into the classroom. At Carey Academy Fabienne Gérard and Mark Newmark examined the Web's impact on learning in a history and in a foreign language class. They found that in the history classes there was more learning on the Web and in the foreign language classes there was more learning through the Web.

Internet resources are changing teaching and learning in classrooms as teachers and students incorporate the Web into the reading/language arts curriculum. Meyer, Steuck, Miller, Kretschmer, and Miller discuss the use of an intelligent tutor, I-Maestrol, to deliver instruction in the writing process via the Internet. This interactive system provides individualized instruction to students as they prewrite, draft, and edit their writing. Rose Yesu and Jennifer Rudolph at Massasoit Community College have successfully combined electronic resources including the Internet with critical thinking activities to enhance the reading and writing skills of students enrolled in developmental classes. Their collaborative efforts include a variety of activities that can be adapted to meet the needs of students in other reading and writing classes. Baines uses a variety of media to involve students in 3-D writing to enhance the quality of their work. Text, images, and sounds are used as students create multimedia presentations to share with their classmates. Jean Casey examines the impact of technology in early literacy learning in a project involving six school districts in Southern California. Technology equipped classrooms, technology literate teachers, and a risk free environment enhance the early literacy learning of students in these six school districts.

THE INFUSION OF TECHNOLOGY into a TEACHER EDUCATION COURSE: ISSUES and STRATEGIES

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Abstract: There is no argument that today's pre-service and in-service teachers must incorporate instructional technology into their teaching. However, institutions of higher education with teacher training programs debate the best way to train teachers to use technology effectively. The following paper examines the issues and strategies in infusing technology into a language arts curriculum at the middle grade level for in-service and pre-service teachers. The issues are discussed in view of the four areas of focus for the language arts curriculum according to the National Council of Teachers of English. In the language arts example, it is shown that the student must be able to *read* and *write* the media in each of the four areas in order to effectively infuse the technology into the content area.

Introduction

A major issue in teacher education is whether to teach the use of technology to pre-service and in-service teachers separate technology courses or within content area courses. The trend for technology to be taught along with the content area is based on the premise that the acquisition of technological knowledge, skills, and attitudes is greatest when presented in the context of a content area. It is thought that this will lead to a better infusion of technology in the teaching of a particular content. In addition, it is believed that this method will lead to a teaching style and learning environment enabled by technology. Given this position, many involved with teacher education are convinced that infusing technology can improve learning, while, at the same time, they fear that because of the amount of time needed to teach the technology, the remaining time available for content will be significantly diminished. In order to embed technology into the content area, teacher education institutions are today challenged with engendering a positive attitude toward the content/technology combination and providing an environment and resources to maintain and enhance the knowledge, skills and ability to carry out the integration task.

It is the intent of this paper to address the issue of infusing technology into a content area by using as an example a course in a language arts curriculum at the middle grade level for in-service and pre-service teachers. The two objectives for the paper are to: (a) discuss the issues surrounding teaching and applying appropriate technology in this situation; and (b) provide strategies for developing teaching styles and learning environments for a technology-rich, content-based course.

The National Council of Teachers of English (NCTE) in its document, *Standards for English Language Arts* (1996), suggests four areas of focus for the language arts curriculum. These areas include: (a) obtaining and communicating information, (b) literary response and expression, (c) learning and reflection, and (d) problem solving and application. These areas will be used as a basis for identifying and categorizing various technological applications and experiences for pre-service and in-service teachers. Each technological experience can be categorized as *reading* the media which refers to such activities gathering, analyzing, and evaluating the information, or *writing* the media which refers to synthesizing information and producing a product.

Course Description

The example in this paper is adolescent literature and related materials, a course designed to help pre-service and in-service teachers extend their knowledge of authors, literature, and related materials for middle grade students, 10-14 years of age. The course emphasizes literary criticism and the relation of the interests and needs of adolescents to literature. The course assignments focus on: (a) searching, locating, reading and responding to fiction and non-fiction books and materials, (b) interacting with adolescents in

literature circles, (c) performing booktalks, readers theatre, and/or storytelling, and (d) researching, writing, and presenting an author/issue paper. In addition, in-service teachers conduct an action-research project centering on adolescents, their nature and needs, and the literature with its related materials.

Obtaining and Communicating Information

Obtaining and communicating information is the first category for focusing the discussion of integrating content and technology. This category is a major concern of the course since the participants are to engage in such activities as identifying and locating appropriate fiction and non-fiction books and materials for adolescents, becoming familiar with the nature and needs of adolescents, and writing and presenting an author/issue paper. Obtaining and communicating information focuses on the goal of conducting research communication, and presenting the research in some form. Given this goal, the concern becomes the selection of technology activities that would be the most appropriate for the content.

Reading the Media

As a pre-service or in-service teacher *reads* various forms of technology to obtain information, some of the cognitive activities or process skills required include developing, accessing, locating, searching, watching, analyzing, evaluating, and concluding. These cognitive activities or process skills engage learners if they have ownership of the research. The issue is to engage the students in their own information needs or problems so they sustain an interest in the content. This is different from the teacher compiling research topics and students choosing a topic of interest. The underlying method in obtaining information is to engage students in information literacy skills using the Big Six Approach outlined by Eisenberg and Berkowitz (1988).

Various forms of *reading* the media to acquire information include using various software programs, CD-ROMs, still visuals, video and audio sources, databases, and web sites to access, locate, gather, and evaluate information. Of course, there are issues surrounding the use of each of the technologies, but because of space considerations, only issues associated with web sites and still visuals will be addressed.

Currently, the most popular technology used to access and locate information is the Internet. The major concern with searching for web sites is quality of content. Access by middle grade students to sites associated with sex, pornography, and hate groups is a concern. A solution to this problem is for teachers to develop *web quests* for students. These *web quests* are inquiry-based activities developed by the classroom teacher that are directed toward a clear task. Some web sites are designed specifically for students to visit and obtain information. Although this provides an immediate solution to the problem, there are drawbacks. For example, students are left without developing search strategies when real-life problems arise. Also, students may have difficulty deciding what they are interested in researching and in forming problem statements. Given these two situations, a strategy is to provide a balance by collaborating/team teaching with the library media specialist to develop skills in identifying information needs, locating appropriate sources, and forming conclusions.

Still visuals are used in non-fiction or information books to gain information. Visuals are seldom used in fiction books. Maps may appear in the front cover of a fantasy book so the reader has a sense of the area described in the fantasy. It is an unusual book that incorporates visuals to represent the storyline. Using the literary device of juxtaposition, Paul Fleischman in *Dateline Troy* successfully uses visuals to connect modern day life to the epic of the Trojan War. Leading questions by the students focused on the manner juxtaposition was used to present the story of the Trojan War. Students were asked whether by having the story presented in this style (modern headlines), if their original comprehension of the story had been enhanced. A typical student response suggested that by having the story presented in that manner, they found the story easier to interpret. Many, not being big history fans, were not looking forward to reading the book. However, after getting started they found that the modern clips helped to keep their attention throughout the story. They felt that modern clippings would make it easier for young readers to remember details because it is related to something that is happening in the present.

Writing the media

The most common form of *writing* the media is to use word-processing to compose a traditional paper. The challenge is to include other forms of media such as an acceptable means of producing a research paper. On the other hand, the writing process changes as various other media such as flyers, videos, presentation software, or web pages are used to present and communicate the information.

Although various media are read, the challenge comes when students are ready to write the paper in a different medium. For instance, pre-service and in-service students were required to prepare a web page for their author study. In addition, their web pages were to include original visuals to illustrate abstract concepts in the fiction book they read. Students were first introduced to image processing software so they could manipulate photographs or create illustrations. The students found the task difficult for three reasons. First, fleeting images of text are seldom transformed into mental images for the text. Second, students reported seeing words as their mental images. Finally, this was their first introduction to image processing software and web page authoring programs. The students were given guidelines as to the criteria needed in the author study web page. However, the learning of the technology took over the significance of the content since this was their first introduction to the software. Considering that each software program has a steep learning curve, frustration occurred among the students. After the assignment was completed, students reported a satisfaction with their learning and products and increased use of visuals in courses outside of this class.

Literary Response and Expression

Literary response and expression relates to discussing books and accessing materials that are read or viewed. In this particular course, literature circles are the prime means of discussing the books and materials. The discussion of books and materials are categorized into three areas: (a) personal response, (b) topics, and (c) interpretative responses. Pre-service and in-service teachers discuss books and materials among peers in class and with adolescents. Also, the teachers perform booktalks, readers' theatre, and/or storytelling to provide a literary expression of fiction books.

Reading the Media

Accessing databases on the Internet allows students to read postings of responses to various books. Visiting popular sites such as Amazon.com or Barnes & noble.com allows students to read reviews from sources such as Kirkus Review, Booklist, etc. Often, these reviews offer diversity in the literary criticism of the book. Interviews with various authors and reviews are also accessed through these popular web sites. A web site may include frequently asked questions about an author. Some authors have their own web sites where students may gather information. The pre-service and in-service teachers are required to use these sites for their author/issue paper. This information can provide evidence and support for students' personal

Writing the media

As students engage in the discussion of books read, materials viewed, or web sites visited, discussion takes place in a text-based environment. Students discuss the books and materials among class members and with middle grade students. Response journals are written on a personal, topical, and interpretative level. Initially, students' wordprocess papers on a weekly basis as they respond to various books and materials. A listserv is used to structure the class discussion for class members and middle grade students. Presently, web-based discussion forums are used for the conversations about books. The goal for using a listserv or a web-based environment is to provide the basis for creating a learning community of pre-service and in-service teachers, and middle grade students. This community supports a commitment to learning and recognizes that its most important asset is the diversity of the people who form the community.

In spite of the technological environment in which the response to the book and materials are prepared, students' personal and topical responses are generally well written. As pre-service and in-service teachers engage in conversations with middle grade students, the interests of the middle grade students become the focal point of the interchanges. In addition, the middle grade students identify books they are

reading in their language arts classes. The difficult task comes when students form interpretative responses; that is, a critical analyses of the text or material. Providing evidence and supporting material for their statements become more difficult. Moving students from personally responding and finding topics of interest to conducting research and to critically analyze books, materials, and web-sites is the major issue. This issue relates to engaging pre-service and in-service teachers in critical thinking skills and to the age-old question of how to teach students to be critical thinkers. Students need to further analyze responses for biases and habits, and to search for critical questions in the personal and topical responses. A strategy to provide students with such an activity is to have the students analyze data in discussion forums and to summarize the information based on biases, opinions and critical questions. Students must revisit the text, materials, and web sites to provided evidence to support statements.

Learning and Reflection

Learning content and technology skills are tightly woven together. At times, acquiring the technology abilities and skills diminishes the focus on the content, leaving the content to emerge in a technology-rich environment. *Reading* the media and *writing* the media are closely related as students in this class interact with the content and technology activities.

Reading the Media

Throughout the assignments in the class, pre-service and in-service students are required to engage in conversations that focus on effective ways to teach students to *read* the media; that is, comprehension of the visual images and verbal information. Activities for reading the media are focused on reading picture books appropriate for middle grade students, developing Web Quests to investigate sensitive and critical issues relating to the nature and needs of adolescents, and evaluating information in all media formats. To teach students to critique what they see and hear in ways that help them make informed decisions is a constant effort. These decisions focus on problem situations as they relate to an integrated curriculum.

Writing the Media

Word processors and web pages allow students to create and communicate information. Use of listservs, web-based learning environments and image-processors support the access and communication of information. Each technology offers opportunities for educators to create learning environments for middle grade students.

For pre-service and in-service teachers to reflect upon their learning of content and technology skills in this course, students are required to write professional goals relating to the content and their technology skills and abilities. The goal is for the students to create a vision as how to teach content using appropriate technology. Professional development goals are generally related to the here and now of using technology in the content areas rather than building a vision for the future. Often the debate of using the technology relates to the dilemma of technology vs. content. Pre-service and in-service teachers often state that the *time* to learn the technology is overwhelming when content is the main focus of their concern. In-service teachers often state that they feel unprepared to teach with technology. On the other hand, they also believe that technology is an important part of the workforce and teaching with technology is a necessity. Yet, finding the time to acquire the necessary technological skills themselves and then teaching the technological skills to the students becomes almost a difficult task. Their center of focus is on the content, its concepts and principles. Frustration mounts when attempting to use technology since they believe they run out of time to cover the necessary lessons and skills that will prepare students for testing and portfolios. Those teachers who report teaching with technology are, generally, pressured by principals. Some examples reported by in-service teachers include having to incorporate technology once a week in their lesson plans, or their teaching evaluation occurring in a two-way interactive environment.

The major issue of teaching with technology is time. Time to learn about the various means of incorporating appropriate technology activities into content. Time and technology present new problems for teachers as they solve conventional problems of teaching and learning. It is easier to design, organize, and deliver content in the traditional way than to form real-life, problem-solving environments where

technology is used to formulate solutions. Change from teaching in a traditional manner, disseminating information, and preparing drill and practice activities challenges the teachers. A strategy for teachers is to choose one particular technology they would like to concentrate on and use the technology with students. This one-step-at-a-time approach is more likely to enhance the confidence of the teacher than trying to master it all at one time.

Problem Solving and Application

The basic problem for the pre-service and in-service teachers is developing a strategy for finding appropriate titles of books, materials, and web sites for middle grade students to use in the language arts curriculum and in other content areas as integrated units are designed. Often, students in the class feel prepared to design lessons for books used as common reads and materials or web sites discussed in class. However, developing a strategy for finding appropriate books, materials, and web sites is an issue and challenge itself since there are many authors and titles appropriate for middle grade students. This situation can be classified as a curriculum-related problem.

Other problem solving activities for the pre-service and in-service teachers are related to societal and global problems. Violence in schools is a current problem that is highly visible. Students in this class find quick solutions to this particular problem. An approach to protect middle grade students may be not allowing them to read books considered violent such as *The Wringer* by Jerry Spinelli. The media reported *No Tolerance Rule* of the Decatur, Illinois school violence incident may appear as another quick cure for a more prominent problem. Responses such as these lead students to investigate such issues as the role of the media in prompting violence, or how our judgments about the news, its content and placement, direct our thinking about sensitive issues.

Reading the Media

Reading the media in both problem situations involves browsing and searching the Internet, newspapers, and print materials to gather, analyze, and evaluate information. A medium often overlooked in gathering information is that of databases. The Internet is considered a huge database along with libraries' on-line catalogs. Furthermore, accessing government online databases allows middle grade students to sample information sources and to choose appropriate information that serves their purposes of determining the factors associated with the prevalence of violence in schools, for example. Students sample data, analyze, predict, discuss, and provide evidence for their conclusions. In reading the media, students develop and refine their information retrieval skills.

Writing the Media

Students may construct and communicate useful insights and implications that result from using information in traditional research papers or by giving presentations using presentation software. Furthermore, *writing* the media can be accomplished by students formulating their own databases to collect information concerning violence in their schools or communities. Local community resource individuals may be contacted and interviewed. The interview may be video taped by students after gaining appropriate permissions. Creating databases and interviewing local community resource individuals give students an opportunity to practice their research skills and abilities to identify information needs as they relate to the stated problem. Skills practiced include critical thinking skills such as identifying criteria, prioritizing, finding and recognizing errors in information and thinking, and testing the accuracy of the evidence collected.

Conclusions

The instructional activities using technology to teach content in this particular course are only snippets of activities to present the content. Infusion of technology into the curriculum assumes that technology is an integral part of the curriculum for *reading* and *writing* the media. Generally, teachers want to match national and state content standards with the technology activities. Enhancing lesson plans

and activities for *reading* the media is a much easier task for pre-service and in-service teachers. The use of word processing, drill and practice software, and e-mail are regular activities for the pre-service and in-service teachers. On the other hand, *writing* the media is a totally different process. In spite of teachers, using media everyday, writing in different media formats requires new and different writing skills and attention to specific conventions for each medium. Using presentation software requires students to change their writing format. No longer are sentences or paragraphs written out completely, but phrases and ideas are outlined using bullets. Interviewing a community resource person for a video tape requires planning interview questions and deciding upon appropriate camera shots. These skills are acquired only through first *reading* and analyzing the medium followed by producing a product such as a computer presentation, video production or a web page. It is learning the writing that becomes the issue for teachers since it is viewed as a time-consuming process. Those responsible for preparing pre-service and in-service teachers need to guide the students in setting priorities for learning to read and write for the various media and putting them to use in the classroom. Each technology provides a rich environment for learning the content and for experiences for middle grade students. The most significant change in teaching with technology will come from the choices pre-service and in-service teachers make when designing and implementing lesson plans and activities that allow middle grade students to interact with content and the technology tools.

When designing a course for pre-service and in-service teachers, one has to be conscious of what might be termed *technology fatigue syndrome*. The sense of exhaustion may be a result of constantly learning the *how-to* of a particular application and embedding it in a technology-rich environment. There may be a loss of motivation to learn the skills and abilities because of the pressure to infuse technology while at the same time fearing the loss of content as the technology skills are acquired.

Offering experiences to gain knowledge of skills and abilities in technology in one course is not enough. The knowledge, skills and abilities and concepts of the technology must be addressed in several courses, over time, and required of learners to demonstrate the use of technology skills in their performances.

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Project READ: Developing Online Course Materials for a Reading Methods Class

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Abstract: This paper is a report on a study of a project conducted on a graduate level reading methods course. Course materials were redesigned and presented in electronic format. The purpose of the redesign was to increase student learning of course content through hands-on participation, electronic communication and discussion, and extension of resources related to teaching reading. Findings indicate that students increased time spent on using course materials and increased comfort with technology in a number of cases. The expectation that students would increase discussion through electronic communication was not achieved. It was noted that students plan to continue to make use of the materials in future teaching. Educators need to nurture and guide students in using technology and to model and provide time for hands-on practice.

Introduction

The use of technology, and especially the use of telecommunications tools, is changing the process of education. As college and K-12 classrooms begin to employ the latest technologies, both academic performance and student-teacher relationships can be extended and enhanced. California Lutheran University (CLU) is committed to integration of technology throughout the undergraduate and graduate programs. This commitment is extended into the Teacher Preparation program in a number of ways. All course syllabi are available on the World Wide Web through Eres, an electronic reserve system. All faculty have created a profile home page. Several professors use electronic discussion groups as a tool to enrich and expand the educational experience of the students beyond the classroom. Others are exploring the use of electronic portfolios with students. In spring 1999 an opportunity was provided through the Charles J. Culpeper Foundation-sponsored faculty development grants to further implement technology into an existing course design. The purpose of this proposal was to enhance student learning through the use of technology. The grant allowed the faculty member, together with a supporting team, to redesign course materials. The team was composed of the professor as content expert, a member of CLU's Information Systems Service, an instructional technology expert, and a student intern. This project proposed to convert all course materials into web page format. The course, Methods of Teaching Reading and Language Arts in Diverse Elementary Classrooms, is a required part of the methods block for elementary student teachers. This course redesign provided opportunities for students to experience a model of instruction that spoke to the vision of incorporating technological tools into effective teaching practices. The inclusion of interactive technology provided an opportunity to connect theory to practice by increasing hands-on participation by students. Electronic discussions provided students with opportunities to respect and respond to each other in respectful and empowering ways. Certainly the use of information technology in a course such as this provided a vehicle for students and instructor to participate in educational growth and change, as it modeled techniques that the students, as teachers, would one day use themselves.

There were a number of instructional challenges inherent in the course that could be addressed through the use of technology. Students needed to be prepared for the California Reading Instruction Competency Assessment (RICA), which they must pass in order to obtain a teaching credential. There was a large amount of content area knowledge required (phonics, assessment, diagnosis and intervention strategies for teaching reading, systematic, explicit word attack skills instruction, etc.) necessary for students to master in order to fulfill the requirements for this exam. Readings were dense and challenging, and there was never enough time to thoroughly discuss and practice the theories and connect them to practice, according to course feedback from students. Some concepts taught in this course that students seemed to find difficult to understand included content area strategies such as those listed above; lesson planning, Specially Designed Academic Instruction in English (SDAIE) techniques, and

connecting instruction to the California reading standards. Student feedback from previous semesters indicated that they felt the need for more discussion of content. Successful pedagogies already implemented in the class included modeling teaching strategies, providing handouts that directly related to teaching reading, taking time for hands-on experience with the strategies, and providing opportunities for students to share strategies across grade levels with each other. Course evaluations, coupled with informal, formative feedback garnered from the students during the semester indicated that these techniques were noted and appreciated as being effective. The challenge, then, was to redesign the course so that the use of technology would support already successful strategies while addressing the instructional challenges.

The Process

Development

The development of the course was begun in summer, 1999 and implementation began in the fall semester. The team was to provide design support through converting existing documents into html format, scanning documents, sound clips, and video clips into the pages, creating a CD-ROM, and researching useful links for the course content. In addition, the team would continue to provide support during the implementation semester by providing a smart classroom to support lecture, discussion, and hands-on work during class time as well as campus lab facilities for students to use as needed for electronic discussion and review of materials. This course had a history of implementing technology. A web page version of the syllabus was provided, along with selected readings, PowerPoint slides of lecture topics and lesson plans and links to Internet resources. Students had in the past communicated through email. The redesign made all lectures and discussion topics available in web page presentation format, increasing the interaction between student and text. This included interactive forms for students to practice hands-on strategies, pre-test themselves on concepts, and develop lesson plans connecting theory to practice. Rubrics developed by the instructor were also available electronically.

The team met for weekly planning and update sessions during the summer. The professor's files were ftp'd to the student intern, who used multimedia authoring programs to create a splash page and consistent topic pages. Topics were presented in the form of web page "chapters," the topics including the syllabus, weekly lessons, study guide access, and student work. Each weekly lesson topic, available in web format, included a sample lesson plan, strategies for teaching language arts, and links to the literature tropic of the week. The ISS team member greatly expanded the number of topical links available by researching web sites for appropriate material. The professor then reviewed the sites and passed the links to the student intern, who posted the links to the web page. The educational technologist provided hardware and software support to the student intern and began a process of converting videotapes of teaching episodes for CD-ROM or videoclip development. The last project was put on hold due to hardware limitations and has not been implemented to date. In reflecting on the effectiveness of the developmental process, a number of points were noted. First, it was critical that the team met weekly to discuss progress and revise timelines for next steps. Hardware and software constraints such as late delivery and incompatibility were addressed and understood by all members of the team. This helped to deal with frustrations that arose because parts of the project could not be implemented at this time. Secondly, it became apparent that student interns bring a great deal of multimedia expertise and enthusiasm to the project and that they are yet students and cannot be expected to perform at a level of professional development that they have not matured into. Demands from other classes, jobs, and life challenges impacted student intern performance on this project as well as some others. The level of commitment and performance from the ISS team member, on the other hand, was well matched to the role as conceived, and that part of the project was implemented effectively and in a timely manner. Finally, it became apparent during the implementation semester that team members were unable to provide the projected support because they were immersed in new grant projects.

Implementation

The project was implemented during the fall semester. Internet connectivity was available in he designated classroom, and the last hour of class time was reserved for the instructor and students to use the computer lab. There were 21 students in the class, and 12 computers, so pairing was the preferred method of computer use. At the first class meeting, students were taught to log on, access their university account, and use email and a browser. Students were able to view the electronic syllabus, and were pointed to links to online readings required for the next class. It was apparent at the first meeting that a wide variety of expertise and comfort with technology existed among the

students in the class. As the semester progressed, some students became more comfortable, while others continued to show resistance to this form of communication.

Examples and Use of Materials

For the purposes of this paper, a lesson topic example was selected for discussion. The following figure shows the format of the day's activities as presented online. The lesson included a PowerPoint presentation, links to other online sites for the topic which included lesson plans and classroom activities as well as research into the genre, and a sample lesson plan which would be analyzed for content and method, or practiced and used in the field.

Lesson Topic Example

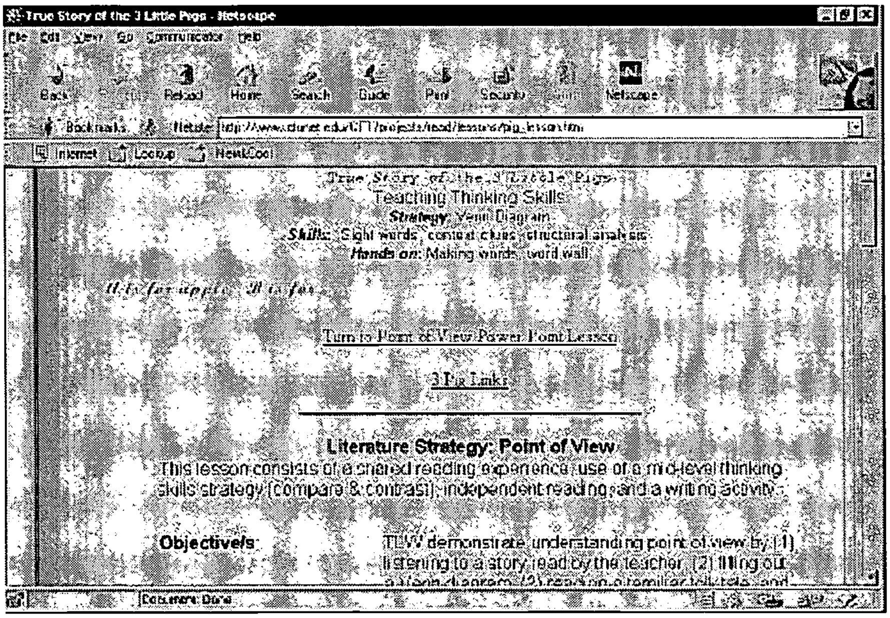

Fig. 1: Opening page for a week's lesson presented in book page format, with agenda items, links to lesson and online resources, and formal lesson plan.

In class, this page would be presented and discussed, then the PowerPoint lesson was implemented. It included opportunities for lecture, discussion, small group work and hands-on activities. For example, in this lesson a Venn diagram was used to compare and contrast the traditional and the alternative versions of the story, then students worked in small groups to read a folktale, select an alternative character, and create a Venn showing similarities and differences in point of view. A follow-up activity was to write the tale from the alternative point of view. Students could later access the PowerPoint lesson from any computer with PowerPoint Viewer and download, print, or add notes pages to the presentation. This possibility moved the use of the software from strictly a lecture aid to a process for interactive learning.

PowerPoint Lesson

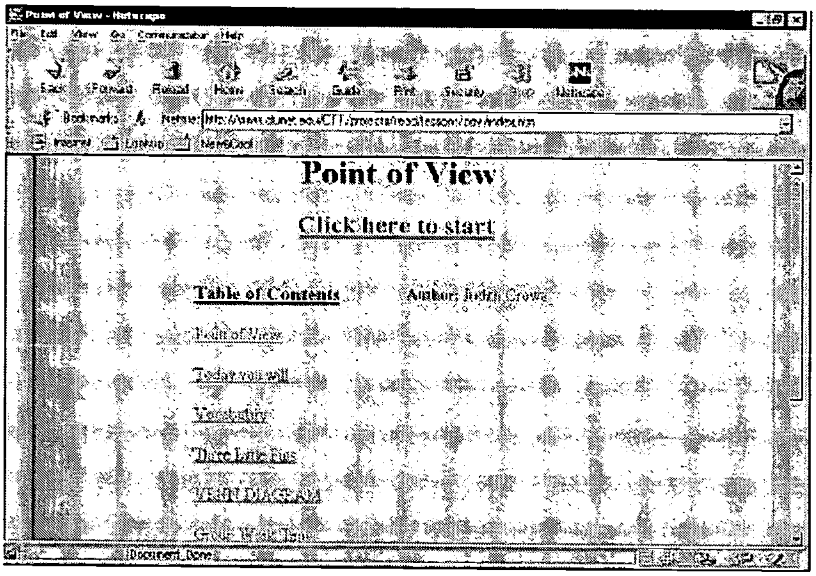

Fig. 2: First slide of the presentation. This was used in class and could be accessed online as well. The slide outline shows provision for hands-on and group work as well as lecture.

After completing the lesson and activities in the regular classroom, students moved to the computer lab for the next section of the class. There were generally two students per computer, which enhanced sharing and enjoyment of this part of the class activities. Students opened the web page for the lesson and then followed the links to online resources. Since the sites were briefly annotated and categorized, students could select a variety of sites to visit. The instructor could ask them to find a site they would use for their grade level, a lesson plan, a discussion of the genre, and a bibliography or related references. This particular set of links offered lesson plans that integrated other curricular areas gave Cajun and Spanish versions of the story, dramatizations, interactive versions of the story, and an activity for constructing the three houses.

Sample Links

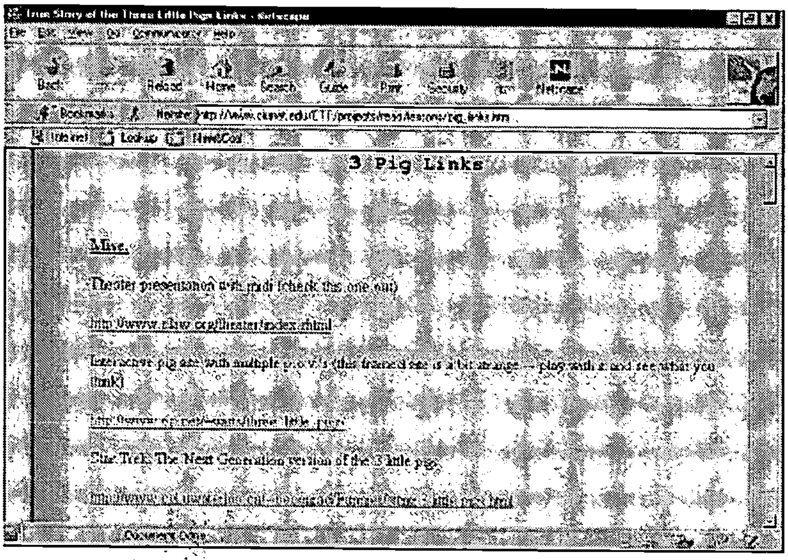

Fig. 3: This screen shows the first links available to students as part of the lesson extension.

Findings

The course redesign, then, was intended to:

- extend use of the reading content addressed in the textbooks beyond the dimension of class time;
- increase student hands-on participation related to teaching reading strategies;
- increase the number of successful, proven strategies that students shared with each other over the course of the semester;
- add student work samples to the page during the course of the semester, which will allow them to see work "published," receive collaborative feedback from each other; and
- enhance students' teaching portfolios through demonstration of technological competencies.

Students reported that they did use the electronic materials outside of class time. One student wrote, " I did use the electronic course page several times during the duration of the course - quite frequently, as a matter of fact, maybe weekly just to make sure I was still on track. " Another stated, " I did use the electronic course pages. At first, I printed out the syllabus and used that in my notebook for the class. Later, as we were assigned things to explore, I ventured through the various links that were provided."

As for increasing student hands-on participation in teaching reading strategies, the researcher expected that this participation would occur within the boundary of class time. That did not happen; it was in fact difficult to include all aspects of the planned work in the time allotted. However, it was found that students used the resources in preparing for their teaching in the field. " I felt that your inclusion of technology in your course was extremely helpful in introducing a teacher to the unimaginable wealth of lesson plans and classroom ideas available through the Internet...." and another replied, "(I) found that some of (the sites) were quite helpful, especially when it came time to write my lesson plans. I found many links to language art sites, as well as math and science." One student reported using it in the classroom, as well: " I have had some of my 5th graders in the mornig (sic) before school explore your website. They seemed to enjoy some of the sites that linked from Madeline and the three little pigs."

The study did not find that there was an increase in the number of successful, proven strategies that students shared with each other over the course of the semester; in fact, there was less sharing done in class. In past semesters, students had presented at least one strategy each to their peers. One goal of this project was to post all the strategies turned in by students to the 'student work' portion of the web page. This did not occur. It was found that the process of collecting reports in a variety of formats, from email attachments to scannable text documents, and formatting them for inclusion on a web page was too time consuming to be possible. This also impacted the expectation that students would see their work published online and receive peer feedback.

Students did report that they felt their technical competencies had improved through the course of the semester. One stated, " I felt that your inclusion of technology in your course was extremely helpful in introducing a teacher to the unimaginable wealth of lesson plans and classroom ideas available through the Internet, especially someone relatively unfamiliar with how helpful these sources can be (and we did have a few of these people in our class). Well done on your part, I believe." At this point in time it cannot be determined that students' portfolios reflect the technological competencies desired; students have not yet developed their portfolios for the course.

In addition, several students indicated that they planned to continue to use the site in future. Some said they would use the links to RICA study guides, and others planned to continue to use the lesson plans and other links and resources in their future classrooms. Replies such as "(The sites) are useful and the best part about it is that I know they will continue to be of great help to me during my career as an educator," and ", the links are useful and I do plan on using this as a resource when I am a beginning teacher." show that students expect to be able to continue to use the online course materials.

Conclusions and Recommendations

Weekly meetings helped to keep all team members accountable for the work. Even though some parts of the project had to be shelved, all team members were aware of why that happened. In addition, the weekly meetings helped to keep team members accountable for completing their parts of the project. It is recommended that any team project of this type include weekly meetings of all team members. Inclusion of undergraduate multimedia students as part of the team resulted in consistency of presentation and creative design of the presentation. It was noted that an understanding of programming languages would result in a more professional product and enhance the student's future employability. Teams also need to be aware of the difference between adult professionals and undergraduate students as far as accountability is concerned. Part of the education for the student intern could include professional development. The stated expectations for implementation of the online course materials were not consistently achieved. The expected support during the implementation semester was not available. New teams had been created by this time to work on new projects, and personnel were not available for support of implementation. A recommendation could be that funds be set aside to provide some assistance during the semester. In his case, having help to re-format and post the student work could have resulted in students' being able to share strategies during the semester. However, in considering the responses that indicate students plan to continue using the resources, perhaps it is not too late to post their lessons and strategies. Finally, it is recommended that educators planning a similar use of technology in their classes create an instrument to measure how well objectives have been met. The feedback from students in this case was informal, but did show that, although some expectations were not met, others were partially met and still others may be met in future.

Reading Methods Students' Use of a Visual Learning Environment with Elementary Aged Students: Modeling Development and Organization of Written Response to Text

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Abstract: Preservice Teachers taking a Reading Methods course as part of their elementary program requirements were introduced to a graphic presentation program called *Inspiration*. The students were shown how to utilize this program as a way of responding to books. This enabled the Preservice Teachers to be exposed to a range of possibilities in how they can use these same strategies and techniques with elementary students to show them how to organize information encountered as part of classroom reading instruction. Through this visual representation of ideas, the Preservice Teachers and elementary students were able to extend and clarify their understandings.

Introduction

The impact of technology on our language use opens up even more diverse ways that language can be showcased and displayed even as it continues to change. Through our students' construction, manipulation, and explorations with language, they illustrate how language exists in interactions with others, how language is a system of multiple signs, and how the meanings of language emerge from the social relationships within which they occur (IRA/NCTE, 1994). As a result, children within a learning community use their social relationships, their personal histories, and their collective memory in order to make sense of the language around them. Using new communication and information technologies, teachers and students are discovering more ways to communicate with others, to make things, to learn about the world, and to express themselves (Bruce, 1998/1999, p. 307). There are multiple opportunities for students to experiment with a myriad of ways to share information as they enhance their understanding of a particular topic. Bruce (1998/1999) states that the range of possibilities by which students learn (i.e. communication, inquiry, construction, and expression) are expanded as a result of these new tools.

Role of Social Constructivism

When exploring the influence technology has for students in our classrooms today, it is helpful to look at social constructivism. As a theory of cognitive development, social constructivism shifts us away from thinking about individuals who construct their own meanings through interaction within their environment to a view of a collectively constructed meaning (Carroll, 1999). Three principal assumptions of Vygotsky's sociohistorical learning theory include: a) the individual's making of meaning is influenced by the role of the community, b) tools are important in cognitive development, and c) the zone of proximal development (Willis, Stephens, and Matthew, 1996). In a Vygotskian classroom, the collaborative element in the learning process is promoted as students share background knowledge in order to construct knowledge. The use of tools in cognitive development is expanded when technology is available. There are many forms of electronic tools available by which students can construct and communicate knowledge. The use of text, sound, and images found within many programs takes literacy beyond the boundaries of simple pen and paper.

Carroll (1999) discusses two roles of classroom technology in relationship to the social-constructivist perspective. The first role relates to how opportunities can be provided to students so that they can take advantage of multiple symbolic perspectives through participation in the meaning construction process. As students learn to use language as part of their literacy development, they are making use of multiple sign systems as a means of making sense of the world (Carroll, 1990). The second role of classroom technology is for children to have

opportunities to reflect on language. In the social context of the classroom, they learn how to use different sign systems, how these sign systems can take different forms and meanings, and how technology can be used to support the use of multiple symbolic perspectives in writing.

Semiotic Mediation

A central tenet of Vygotsky's theory is the concept of mediation by psychological tools or signs (Wertsch, 1990). While engaging in activities with adults and more competent peers, children learn to use signs (e.g. language, numbers) to mediate or, in other words, to shape and define their thinking (Ashton, 1996). The semiotic mediation that occurs is evident as technology facilitates students' use of multiple sign systems to foster communication and thinking. Bruce (1997) posits a transactional stance when considering technology in relation to literacy practices.

> In the case of literacy technologies, a transactional account tells us that technologies do not transform or determine literacies, nor could they ever be irrelevant to literacy practices. Instead, they are part of the continual reconstruction of literacies. As such, they too are constructed out of the evolving literacy practices. (Bruce, 1997, p. 303)

Through her exploration of the transactional stance, Bruce (1997) states that technology within a literacy setting participates in a transaction with other technologies, text, artifacts, physical spaces, and procedures present (Bruce, 1997). She also states that we cannot begin to understand the role of technology in literacy if we set it apart as "only a tool"; instead the picture is more one of multiple literacies, each employing a wide range of technologies that overlap with those of other literacies.

Semiotics and Critical Thinking

Through their work on semiotics (i.e. how signs work), Siegel and Carey (1989) propose the notion that thinking critically is a matter of reading signs. Our understanding of critical thinking is a construction of signs, which enables us to think critically about critical thinking itself (Harste, 1989). The role of language in critical thinking is that language allows individuals to name their world, it provides the signs that make thinking public, and it allows language users to distance themselves from their knowing; ideas can be set aside, looked at, thought about, and evaluated (Harste, 1989). Gestures, pictures, monuments, visual images, finger movements, anything deliberately and artificially employed as a sign is, logically, language (Dewey, 1933). Siegel and Carey (1989) refer back to Dewey's description of reflection as involving the movement forward to possible conclusions as well as the more traditional movement back to uncover the grounds or bases for some form of knowledge. The signifying function makes it possible for the simultaneous movement back and forth.

Ways of Reading Texts

In literacy development, reading and writing visual texts is an important skill for our students to learn (Moline, 1995). It is possible for information to come in pictures and in words, which is most apparent when considering types of texts that are encountered as students read across content areas. In science, math, and social studies alone, visual texts that combine images with words can range from diagrams to maps to charts to graphs to tables and to time lines.

Moline (1995, p. 7) states that how we read depends on our purpose for reading: a) We can read it front to back leaving nothing out, b) we can browse through the pictures, c) we can search selectively for facts, or d) we can scan, sample, skip, and skim. When we read for the story we start at the front of the book and read to the end of the story, since we want to read the whole text. It is possible to put the book down and return to reading it at a later time. In contrast to this is how we read selectively to locate specific information. A certain part of the text may be chosen, and it is possible to start at the front, the back, or in the middle, since it is dependent on where the information being sought might be located.

In some cases, we may read the same book at a later time for an entirely different purpose as we search for a particular piece of information. The benefits of showing our students how to utilize *selected reading* such as this

is that they can be shown how to skim and scan as they seek certain information contained in the text. Students can find a way of recomposing as they read the information in one format and attempt to write their own account of the information in a different format (Moline, 1995). When they do this, students learn to show relationships between information through the use of various sign systems (i.e. written, graphic, pictorial, numerical). Sometimes the sign systems utilized are conventional (picture of a chair) and other times they may be invented (semi-circle to depict the chair) as students seek the best way to represent important relationships.

Representing Information

In this section, the various support structures provided by a graphic presentation program, *Inspiration*, are used to illustrate how elementary students represented information about World War II. Four groups of 5-6 elementary students were each assigned a Preservice Teacher enrolled in a university reading methods class. Over the course of five weeks, the groups met weekly with the Preservice Teacher to discuss the novel that they were reading. As part of this process, the students would also complete other response activities (e.g. journal entries, character analyses, prediction charts) under the direction of the university student.

The different ways of reading discussed by Moline are reflected in this section in a cross-textual format. These students were reading various narrative and informational books related to World War II as they participated in an in-depth exploration of this topic. Initially, the elementary students read the novels in a front to back format and met weekly with the Preservice Teacher to talk about what they had read since their last meeting. As a culminating activity to the reading of the book, the elementary students were asked to use a template (Figure 1) found within the *Inspiration* software to consider the following questions: a) what immediately precipitated the event, b) causes leading toward the event, and c) factors fighting against the event. During this process cross-textual connections were made as the students returned to the various books (e.g. narrative and informational) they had been reading to seek out and verify particular information they wanted to include in the diagram.

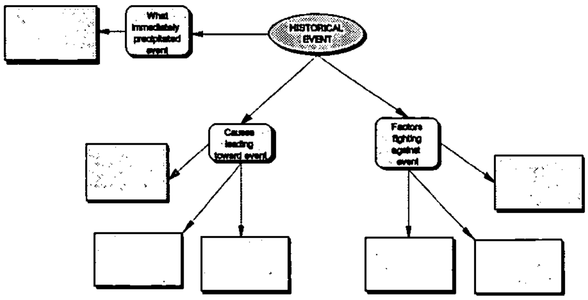

Figure 1: The *History Web 2* template used by students to discuss World War II.

Moline (1995) identifies certain elements of graphic design that should be considered when organizing information. Some of these elements include such features as highlighting, connecting, grouping, organizing and separating. The use of a graphic presentation program such as *Inspiration* serves as a model for students as it guides them into an awareness of design principles helpful in establishing relationships across related information. The following subsections illustrate how this program helped to scaffold students' organization of information through the various support structures found with the software. An important element to this process was the collaboration as the students and their preservice teacher worked and talked together about what information to include in the diagram. Students also actively sought available resources as they looked back for information in their novels as well as in the various informational books that were provided by their regular classroom teacher.

Highlighting

The use of color or shading is easily available to students through choices related to overall background, frame background, frame outline, text color, or through the use of bold, italics, or underlining. Another form of highlighting that the students found available was the embedding of a symbol within the frame itself. Students could select one already available in the graphic library or they could create their own. The following frame was used by one group to complement the text they had typed (Figure 2).

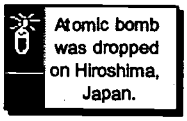

Figure 2. Example of a frame with an embedded symbol.

Organizing and Separating

In the template used by students in this activity, each of the main headings was divided into three subheadings, which helped to support students as they selected information for each of these areas (Figure 3). In addition, students could easily move frames by clicking and dragging or to enlarge frames to accommodate text.

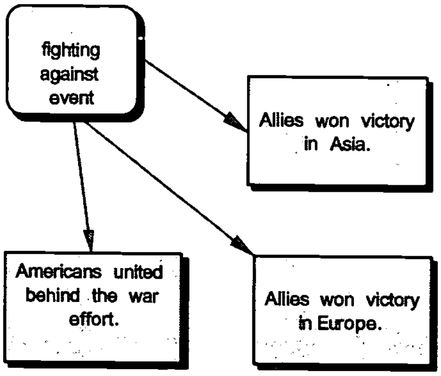

Figure 3. Organization of ideas facilitated through use of the template.

Grouping

Some groups also selected particular graphics as a way of extending thoughts within the different categories. The placement of each graphic would be grouped alongside the text frame that it best represented. The following example illustrates how one of the groups decided that a cause leading toward World War II was the bombing of Pearl Harbor by Japanese forces. As part of this information, the group went on a search through an available clip art CD-ROM so that they could include a flag of Japan (Figure 4).

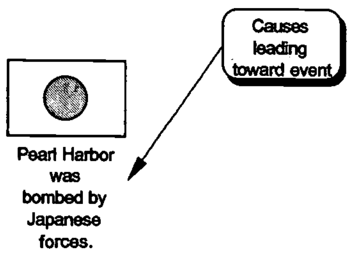

Figure 4. The use of grouping to illustrate a key piece of information.

Connecting

Basic templates are also available that have a preset structure with connecting arrows. In the previous examples, Figures 3 and 4 illustrate how arrows can link ideas within a major category. Another support feature relates to arrows automatically linking concepts through the use of *RapidFire*. When selected, this feature enables the writer to input ideas, hit the *Enter* key, and the information will automatically be connected to the main category heading in the diagram. To continue the writer simply has to type in a new idea, hit the *Return* key again, and the next idea will also be displayed.

Symbols

In addition to the design elements discussed by Moline, the students also utilized various symbols as a way to enhance or extend their thoughts. In Figure 5, the group selected a conventional symbol to represent the *Star of David* associated with the Jewish religion. This symbol also represented the main heading for their diagram.

Figure 5. Students' use of a symbol to enhance information in text frames.

A second group became intrigued with the use of flags to represent the different countries discussed in relation to the three subheadings. Overall, this group included flags to represent France, Great Britain, Germany, Italy, and Japan. One example of this group's work was shown in Figure 4. This same group also used multiple symbols to represent the topic of the *Great Depression* (Figure 6). To do so, the students selected a frowning face embedded in the text frame along with the graphic plate with a fork and knife on it. This group's example represents the use of conventional symbols to depict the feelings and experiences related to this era in American history. The same symbols standing alone might have entirely different meanings, but when grouped together with particular text a new level of meaning can be construed.

Figure 6. Use of multiple symbols to represent key ideas found within text frames.

Conclusions

As students sought to represent information, there was evidence of multiple overlapping literacies that assisted in providing essential support structures:

1. The elementary students and Preservice Teachers illustrate how technology is a literacy in itself as they worked to communicate their ideas with others in order to organize relationships between selected information. Bruce (1998/1999) has stated that the range of possibilities by which students learn (i.e. communication, inquiry, construction, and expression) are expanded as a result of these new tools.

2. The students and preservice teachers learned how to use different *sign systems*, they experimented with how these sign systems could take different forms and meanings, and they illustrated how technology can be used to support the use of multiple symbolic perspectives in writing. One point made by Moline (1995) is that children should be allowed to experiment with symbols and graphic relationships. These participants took advantage of the opportunity provided through use of the *Inspiration* program as a way to experiment with graphic and pictorial sign systems to enhance and extend particular relationships within categories.

3. In their reading and writing of texts, the students practiced use of varied *selection strategies* such as scanning, sampling, skipping, and skimming to think critically about what information to include in their diagram. They drew on their collective background knowledge and made cross-textual connections during this process. Students then utilized the recomposing strategy (Moline, 1995) to write their own account of the information.

4. Throughout this entire process, students utilized *critical thinking skills* as they made decisions concerning where to seek information, how much information to include, how to represent the information in a text format, and, in some cases, how to represent the information using other sign systems. In his work, Harste (1989) has stated that critical thinking...is what people do in an attempt to understand and act on what they see, read, hear, feel, etc. This process of critical thinking is exemplified in these fifth grade students' use of critical thinking to assist in their discussions and negotiations to represent information. One belief that Siegel and Carey (1989) hold relates to how understanding the way in which one thing signifies or stands for another is central to understanding reflection and, consequently, critical thinking.

Technology, multiple sign systems, selection strategies, and critical thinking were all overlapping literacies integral to the students' successful organization of information. The support structure provided by the *Inspiration* software program as well as the guidance offered by each Preservice Teacher helped students to construct new meanings and establish and verify relationships within the topic they were studying.

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Electronic Portfolios in Reading Methods Courses

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Abstract: The question of how to use technology effectively in the assessment of teacher candidates to demonstrate achievement of course objectives based on state certification standards led to the development of the electronic portfolio project in a small university teacher credential program. The process of preparing an electronic portfolio using computer and multimedia technology was examined from the perspective of twelve teacher candidates enrolled in a multiple subject reading methods classes. This research was a multiple case study in which qualitative data was obtained through open-ended interviews with the teacher candidates, the course professor, and the computer lab technician, as well as through analysis of the electronic portfolio product. Whether the electronic portfolio could be considered an effective tool for documenting teacher candidate performance and the achievement of course objectives was the primary question investigated in this study.

Preparing teachers for the 21st Century has been a concern for both political and educational leaders in this country during the last two decades. Public education reform was triggered a decade earlier by a report, A Nation at Risk, which claimed that U.S. students generally achieved at lower skill levels than those of other industrialized nations (National Commission on Excellence in Education, 1983). The Goals 2000: Educate America Act enacted by Congress in 1994, provided the framework for education reform for the 21st Century. This legislation called for the establishment of high-quality, internationally competitive content and performance standards for all students, promoted the use of technology to enable all students to achieve national goals, and emphasized the need for teacher education and professional development. Teachers were to be given the opportunity to acquire the knowledge and skills needed to instruct and prepare students for the next century. They were to have access to programs to improve professional skills and encouraged "to use emerging new methods, forms of assessment, and technologies" (The National Education Goals Panel, 1998).

The National Council for Accreditation of Teacher Education (NCATE) issued a report called "Technology and the New Professional Teacher: Preparing for the 21st Century Classroom" in 1997. The NCATE Task Force on Technology and Teacher Education recommended that NCATE stimulate more effective uses of technology in teacher education programs. NCATE challenged higher education to incorporate technology across the entire teacher education program, not just as a "computer literacy" class added to the existing curriculum. The NCATE Task Force stated that teacher education is in a time of transition, calling for experimentation and a new attitude that is "fearless in the use of technology." NCATE recommended that teacher education programs provide early experiences for their students and that technology be integrated into other education reform efforts. This study focused on the use of technology as a tool for performance assessment of teacher candidates who were enrolled in reading methods courses.

Three themes of significance for this study converged in recent education reform documents concerning the preparation of teachers for the 21st Century: teacher accountability to professional content and certification standards, performance-based authentic assessment for both teachers and students, and the need for educators to have technological expertise. The U.S. Department of Education's New Teacher's Guide stated: "The

highest academic standards, the best facilities, the strongest accountability measures, and the latest technology will do little good if we do not have a teaching force of the highest quality" (1997, p. 1). Providing well-prepared, technologically literate teachers who meet high professional standards has presented a challenge to pre-service teacher training institutions.

An electronic portfolio project was developed in a small university teacher preparation program to explore the possibilities of using computer technology to store artifacts as evidence of achievement of course objectives. The electronic portfolio project was the final assessment for multiple subjects credential candidates enrolled in reading methodology classes during two consecutive semesters. The portfolio provided an electronic framework for documenting the meeting of course criteria, as well as evidence of self-reflection and self-assessment. A portfolio template was designed around specific course objectives based on state standards. Students included artifacts created with computer text, graphics, sound, or video as evidence of meeting each course objective. Students provided a reflective cover sheet in which they defended their selections for each objective. The text of the reflective cover sheets was examined to gain insight into the student's perceptions.

The course syllabus, designed with emphasis on learning objectives based on current state certification standards, was prepared by the course professor prior to the electronic portfolio project. Two successive groups of teacher candidates were involved in the electronic portfolio project: the spring group of six students (Group I) and the fall group of six students (Group II). The electronic portfolio project was constantly evolving throughout both semesters due to revisions in state credential standards and technological considerations. The course syllabus was altered for Group II due to revised state standards and the implementation of the Reading Instruction Competency Assessment (RICA). In addition, an attempt was made to solve some of the technical problems that were experienced by Group I. Students of Group II were required to attend a computer training seminar at the beginning of the semester to prepare for the electronic portfolio project.

This study was guided by the following questions:

- What effect does incorporating technology have on the development of a portfolio for teacher candidates?
- To what extent does the electronic portfolio process encourage self-assessment and reflection?
- In what ways does the electronic portfolio provide evidence of student learning and achievement in line with course objectives?
- What are the problems encountered in putting together the portfolio electronically?
- What do students perceive as the strengths and/or weaknesses of creating a portfolio electronically?
- What are the course professor's perceptions concerning the effectiveness of the electronic portfolio as a tool for assessment?

Themes and patterns that emerged from interviews, portfolio reflections, and field records were examined through Ethnograph, a qualitative data software analysis program, in order to gather information concerning the teacher candidate's experience of collecting and preserving digital artifacts to be used as evidence of demonstrating competencies. The teacher candidate's perceptions of the strengths and weaknesses, as well as the software and hardware problems encountered during the electronic portfolio process, were explored. Written reflections within the electronic portfolio framework were examined to gain insight into the student's process of self-reflection and self-assessment. A computer literacy questionnaire was administered prior to the study in order to determine previous experience with and attitude toward technology. The researcher's process of creating templates in hypertext markup language (HTML) and Hyperstudio, a multimedia authoring software program, provided further insight into the design and implementation of the electronic portfolio project.

The results of this study were presented in an interactive multimedia format. Text, data, literature references, figures, tables, and graphic images were saved as HTML within a portfolio web. Qualitative data

generated from Ethnograph, including sample screens, were linked to an interactive table of contents. A Powerpoint presentation provided the framework for linking directly to the Hyperstudio and HTML portfolios of teacher candidates. The reading methods course objectives were linked to multimedia evidence within each student portfolio. Design templates, narratives, interview questions, the computer literacy questionnaire, and other research data were linked from menu options as well. Narratives were presented in audio format, as well as through interactive text.

The paper portfolio was an established means of assessment in the teaching training courses at this university before the electronic portfolio project began. When the course professor was asked why she implemented electronic portfolios into her class, she stated:

> I have worked for ten years to get faculty to infuse the use of technology into their courses and teach students to do so in productive ways--this is just another step along the way. The benefits for me? Not having to carry home 100 pounds of paper portfolios as I have been doing for several years--and seeing that students DO know how to use the technology in their classrooms when they leave--and understand not just the tech part--but the curricular uses. They have to get through the learning/uncomfortable stage before they can connect to the important parts of teaching them how to use technology in appropriate ways--and since the state does not require the computer course until 5th year--that puts all of us at a disadvantage because most do not know how to do anything but word processing and email--and now most know how to surf the net. This was my way of forcing them to learn what I wanted them to know even though I couldn't make them take the computer course.

Narratives from student interviews and portfolio reflections provided insight into the students' perceptions of the electronic portfolio process. Each individual's process varied in terms of approach to the project, the use of templates, working at home, using Hyperstudio or HTML, and the amount of time required for completing the electronic portfolio product. Technical processes varied in terms of how much technical support was needed, what technical skills were gained, and what problems were encountered. Student perceptions varied as to what they perceived as the purpose of the electronic portfolio, what attitudes they demonstrated concerning the process, how they compared electronic portfolios to paper portfolios, and how they felt concerning the use of technology in their future classrooms. Strengths and weaknesses were examined from the perspective of the participating students, as well as that of the course professor. Narratives from student interviews and portfolio cover sheets provided evidence of students' self-assessment and reflective practice. The course professor's discussion of how she evaluated students' portfolios provided further understanding of the potential for the electronic portfolio as a tool for assessment.

The process of collecting artifacts, selecting the work that best matched the course objective, determining how to get the evidence into digital format, and writing a cover sheet evaluation explaining personal achievement of each objective resulted in on-going self-assessment and self-reflection. Generally, students felt they were adequately able to present their artifacts as evidence of meeting course objectives based on standards within the electronic portfolio framework. Students demonstrated that they were guided by the course objectives throughout the electronic portfolio process and believed they were able to demonstrate achievement, competency, and proficiency in the course subject matter

The course objectives were specifically aimed at teaching reading and literacy. The artifacts included in the electronic portfolios included digitized versions of a variety of assignments from the reading methods class, as well as material from other teacher training courses. The course objectives successfully provided the students with the criteria for assessment in the electronic portfolio project. Upon the request of the course professor, Hyperstudio and HTML templates were designed to placed emphasis on the course objectives. Students provided self-reflective statements explaining the significance of the evidence they included in their portfolios. All twelve of the students in the study clearly indicated that they viewed the purpose of the electronic portfolio as a way of demonstrating that they had met the objectives.

In addition to providing evidence of meeting objectives, reflective teaching was considered one of the desired effects of the electronic portfolio project. Results of this research indicated that students were engaged in self-assessment and self-reflection as they described, explained, and defended the evidence they chose to include within the electronic portfolio framework. The student comments supported the researcher's belief that, not only were course objectives considered significant to students, but that the electronic portfolio project stimulated reflective practice:

1. It was a good way for the professor to make sure we had met all of the objectives.
2. I felt that the things in the course pretty well matched the objectives.
3. I liked reflecting on what I was doing and looking back and seeing how my assignments actually matched the objectives.
4. I understand the objectives better now that I have analyzed my work.
5. To think about once we had all this information, how are we actually going to apply it and how do the goals fit with the objectives?
6. I liked having to think about how everything was related in the class because I think a lot of times teachers give you their syllabus, you read the goals and objectives, and you never think about them again.
7. The objectives--when I read them--I thought--well I think this fits and I went back and I read my stuff again and then things that I'd written sometimes gave me a clue as to whether or not I really got the material.
8. I really felt that the electronic portfolio was a great way to organize evidence and artifacts.
9. The other purpose was to show that I had met the necessary objectives for the class and that I understood that I met the objectives.
10. As with any portfolio, I was in the position to review all my work and the initial objectives of the course.
11. If you clicked on course objectives you went to a cover page that had the objective written out and you could go to the explanation page or directly to each artifact.
12. Now I can see where the objective was to make me understand how we met everything.
13. I didn't think that I had met all the objectives…but I think after sitting down and looking at all the work I had done, that I realized that I did meet those objectives.
14. I could demonstrate competency by matching artifacts with competencies. I believe I was very careful in selecting my evidence material to be certain it was adequate--and I did a good job!

One student indicated that she felt the electronic portfolio "tied the class together and gave it a sense of closure." She said, "It was nice to see the purpose and made it personal." Another student explained that the process of reflection meant "critically examining your work to determine which way you have met the selected criteria, and how you can best example or highlight your work." She had described the process of developing the portfolio as "a constant self-assessment." Another student said that the class helped her feel prepared. She said, "I think sticking it all in one place and making connections between the objectives and the things helped me say, oh look I am prepared. Not only do I think I am, but I can tell you why."

In terms of assessment, students generally felt that the electronic portfolio was valid and useful. One student referred to the electronic portfolio as a "viable measure of assessment." Another student remarked, "I guess they [electronic portfolios] are a good form of assessment--rather than a test." Another student expressed her preference for portfolio assessment over studying for a test. The course professor indicated that she thought students selected artifacts more carefully in the electronic portfolio because they had to "go through the mechanics of digitizing their artifacts." In her assessment, she said she examined students' choices of artifacts, the explanations regarding their choices, and indications of personal reflection upon their learning.

The emphasis on self-assessment and self-reflection was considered more significant to this study than the effectiveness of the electronic portfolio as a tool of assessment in terms of course grading or evaluation. One student said, "In doing this I was able to assess my work and reflect upon how the work I completed met these objectives." Another student stated that she got more out of the electronic portfolio and enjoyed reflecting back on what she had accomplished. Another student thought that the electronic portfolio allowed her to think about what they were supposed to be gaining from the course and the purpose for every class, lecture, and activity.

Results indicated that the primary effect of incorporating technology into the portfolio process was that students gained knowledge of computers and technical skill with software

and hardware, particularly in graphics and multimedia. The total number of technical references found in interview transcriptions and within portfolio reflections provided further indication that students gained knowledge and understanding of technical processes and terminology used in computer multimedia. References to the digitizing of graphics through scanning appeared 80 times within the text of the student interviews and portfolio reflections. Eight students discussed scanning at least three times within their interviews. One student did not mention scanning, but she discussed another more complex graphic digitizing process, single frame video capture. All students participating in this study demonstrated a high level of technical understanding of the processes of digitizing their graphics. Table 1 shows the number of references to technology made by each student in interviews or within the portfolio cover sheet reflections.

Counts of References to Use of Technical Skills in Student Interviews and Portfolio Cover Sheets	#
Hyperstudio Software	89
HTML Web/Internet/E-Mail	54
Scanning/Video and Audio Capture	82
Cut/Paste/Transfer Files	50
Use of Graphics/Multimedia	36
Computer Formats and Compatibility	34
Creating Links/ Creating Interactive Buttons	27
Use of Zip Disk	20

Table 1. Counts of References to Use of Technical Skills

Most of the students were pleased with their final electronic portfolio product and were proud of their accomplishments. Students were able to personalize their portfolios, demonstrate creativity, and show their competencies electronically. Students demonstrated that they were able to self-assess and self-reflect on their learning within the electronic portfolio framework. The cover sheet reflections in which students defended their choice of artifacts placed the focus on meeting of specific course criteria. From the course professor's perceptions, the electronic portfolio project could be considered a viable means of assessment and an effective tool for self-reflection. She has continued to use the electronic portfolio in subsequent courses and indicated that students have learned to use technology successfully. Table 2 includes examples of positive student statements.

Positive Student Comments
I was really happy with the final product
I feel competent.
It was easy, fun, simple, and I was successful at producing my own products.
It was really proud of it.
I feel more comfortable now.
It was pretty when it was all done.
I felt pretty good about my personal section.
I had fun fooling with Photoshop.
There's always a satisfaction in seeing something get built.
I'm proud of what I prepared and I will be using it as a tool.
Hyperstudio is nice to learn because I will be able to use it in the classroom.
Hyperstudio is kid friendly.
I can apply this knowledge to other areas.
I had fun.

The artistic thing was fun. I really enjoyed the drawing part.
Really good way to show off this is what I did.
That was a blast.
You can tell I got a little silly, but it was it was fun so I didn't care.
I did a good job!
The most exciting evidence is my electronic children's book.
It is so fun and fancy done electronically.
I was happy with the way things turned out.
I feel more prepared.
Another Ah-Ha for me.

Table 2. Student Comments Reflecting Positive Attitude

The primary strength of the electronic portfolio was that students could include multimedia artifacts in the form of graphics, audio, video, animation, as well as text, providing a more complete picture of their achievement. Students regarded the aesthetic qualities and the possibilities for personal creativity as strengths of the portfolio as well. The weaknesses included the demands on students' already busy schedules, the lack of previous experience with computers, the lack of time to learn the technology required for multimedia, and the need to work within the school computer lab setting. Problems included lack of time to work on the technology, difficulty with computer lab availability, broken computer equipment, cross-platform compatibility issues with home computers, technical difficulties with hardware and software, lack of computer skills, insufficient previous experience, and the need for considerable technical support.

One of the unexpected patterns that emerged from this study was the students' pleasure in being able to express themselves creatively, artistically, and aesthetically through technology. Previous to this study, the researcher believed that multimedia technology incorporated powerful tools for creativity, particularly in performance areas that are difficult to document through the traditional verbal linguistic modes of expression typically used in academic settings. Many students expressed emotions and attitudes indicating that they enjoyed being able to use multimedia means of expression. In addition, most students believed that these creative new technologies would allow them to enhance their future classroom instruction. The course professor felt that the attitude changed as students began to see the finished product. She said that students appeared to get excited about the portfolios, particularly in terms of being able to show their individuality. She said that they demonstrated personal pride in their final product and indicated that they appeared to see "the benefits of the

The NCATE technology task force suggested that perhaps the best way the teacher education faculty can inspire future teachers to use technology is "to cast themselves as learners and to experiment fearlessly in the applications of technology," making themselves "role models of lifelong learning." The task force stated that re-educating the existing teaching force would require extensive professional development, but that the problem would be compounded if future teachers were inadequately prepared to use new technology. All students who participated in the electronic portfolio project indicated that they had improved their technology skills and understanding significantly through this process. This study furthered understanding of the potential for infusing technology into teacher education through electronic portfolio assessment within a non-technology reading methods course.

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A Study of the Effectiveness of Using Computers to Assess the Phonic Knowledge of Preservice Teachers

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Abstract

For 25 years the undergraduate reading methods course for elementary and special education preservice teachers at the University of Idaho has included a strong phonics component. To demonstrate their grasp of phonic patterns, students have five chances to pass a written phonics test outside class time. The major drawbacks of this assessment led to the development of a self-scoring computerized version.

A study was conducted to address the following question: Does a computerized test with an auto-score feature enhance the assessment of students' knowledge of phonic content compared to an existing paper-and-pencil test? Students in two four-semester-credit, teaching reading in the elementary school courses formed the two treatment groups. The results indicated statistical, practical, and educational significance supporting the use of the computerized assessment as a valid, cost-effective replacement for the pencil-and-paper version.

Introduction

Background

Current research affirms the importance of phonic instruction in helping children become proficient readers. Developing readers must learn to recognize recurrent spelling patterns within words, including letter-sound regularities (Adams, Foorman, Lundberg, and Beeler, 1998), initial consonant patterns (onsets) and common vowel-consonant patterns (rimes, or phonograms) (Braunger and Lewis, 1997; Burns, Griffin, and Snow, 1999; Cunninghan, 2000; Moustafa and Maldonado-Colon, 1999; Snow, Burns, and Griffin, 1998). Most educators also agree that phonic knowledge is not about learning rules, but about learning common spelling patterns within syllables (Braunger and Lewis, 1997; Stahl, Duffy-Hester, and Stahl, 1998). Part of helping students become fluent readers is understanding both the content of phonics and various instructional approaches explicit and embedded, for presenting phonic patterns to students (Stahl, Duffy-Hester, and Stahl, 1998). The newly revised Standards for Reading Professionals (International Reading Association, 1998) states that elementary school teachers must be able to:

6.1 teach students to monitor their own word identification through the use of syntactic, semantic, and grapho-phonic relations

6.2 use phonics to teach students to use their knowledge of letter/sound correspondence to identify sounds in the construction of meaning

Given these standards, it is appropriate for preservice teachers to demonstrate that they understand both the content of phonics and methods for helping their students learn and use phonics to read fluently.

Current Program

For 25 years the undergraduate reading methods course for elementary and special education preservice teachers at the University of Idaho has included a strong phonics component. Students learn phoneme-grapheme correspondences and phonic patterns, including consonant blends, digraphs and silent letters, and common vowel patterns. The vowel patterns are clustered into five distinct groups--r-controlled, diphthongs, regular vowel patterns (au, aw, ay, ea (e), ei (a), ew, ey, oo, ui, ue), predictable patterns (CVC, CVCE, CVVC, CV), and variant predictable patterns (all, ind, old, igh[t]). This scheme addresses twenty common vowel phonemes and their spelling patterns. Students learn both analytic and synthetic methods for teaching phonics, plus ways to teach whole (sight) words,

structural analysis, and use of context to decode. During five, two-hour class periods, the preservice teachers receive information sheets and direct instruction delineating the various phonic patterns, guided practice exercises to help them identify phonic patterns within syllables within words, and individual help upon request. They discover that their ability to quickly recognize phonic patterns helps them evaluate children's use of phonics when reading aloud or in their writings. They can determine which phonic patterns children know well, know in some contexts but not others, or do not recognize. Since no one teaching method is best for all students (Braunger and Lewis, 1997; Pearson, 1998), such learner-centered, diagnostic teaching prepares them to meet the diverse needs of all learners.

To demonstrate their grasp of phonic patterns, students have five chances to pass a phonics test outside class time. The phonics test is comprised of 10 paper and pencil forms, each with a 50 running word text; half the texts are from second grade basal stories and half are from published children's books. The number of unique words within each passage varies from 32 to 38 words. The same ten test items with variant text passages are on each of the 10 test forms, yielding 10 equivalent-form tests.

Each item is worth 3 points, for a total possible score of 30 points. For example, under the item, "List all words containing r-controlled vowel patterns", students might select from the text words like February, early, awkward, organized, and steer. According to the scoring rubric, students receive partial credit if their answer is incomplete or includes incorrect words. Percentage correct is determined based upon the total number of correct words selected for an item, minus the number of correct words omitted and/or incorrect words included. If an item response is 80% correct, it earns 2 points; 70% earns a single point. Items with few correct words possible earn either 3 points or 0 points, since the base (denominator) is small. Students' single highest score becomes the points they receive for course grading purposes.

To take a test, students in the paper-and-pencil group went to the College of Education Instructional Materials and Technology Center during regular work hours, which included two evenings and four hours on Saturday. They spun a dial to select one of the ten test forms; if they had previously taken a test form, they spun again until they landed on a new form. The student would sit at a table across from the front desk (for proctoring purposes) and take the test, closed-book. There was no time limit imposed, but most students completed a test in less than 45 minutes. The test was placed in a folder for scoring that evening or the next day. Students' completed tests were kept in individual folders, which they could check out when they wanted to study from their previous tests. At this time they could study alone or with other students in the class, even if the peer had not taken that particular test. A student could stop taking the tests any time he/she decided that the highest score earned to date (from 30 possible points) was satisfactory. Most students, however, took the test at least four times. Students could take up to five forms of the test any time during a five week period, but no form more than once.

Issues and Concerns

Despite our best efforts, there were several major drawbacks to assessing students' knowledge of phonic patterns in this manner. One, the turn-around time between taking a test and receiving the scored form for study was, at a minimum, 24 hours, and typically several days. Two, students were often unable to figure out why they had missed an item, so the instructor ended up putting many hours into individual instruction--valuable, but redundant and time-consuming. Three, resources for hiring and training aides to score the tests were limited and growing harder to find. Four, scorer reliability was a problem; although the aides had scoring keys, it was easy to err, leading students to believe their answers were incorrect when they were not, and vice versa. Finally, it was all but impossible to maintain a current record on how well students were doing as a class, which would have helped the instructor examine teaching practices in light of student learning.

Several options were considered given these four constraints. Clearly, the option that emerged with the highest potential was the creation of a computerized test with an accompanying scoring feature which could reduce administration and scoring time, increase scorer reliability, significantly decrease turn-around time, and standardize results. The main concern and subsequent question for this study, then, was whether such a test would compare favorably to its pencil-and-paper counterpart to determine student achievement related to learning phonics content.

The Study

Research Question

This study addressed the following question: Does a computerized test with an auto-score feature enhance the assessment of students' knowledge of phonic content compared to an existing paper-and-pencil test? Furthermore, it is of interest to the researchers as to whether or not this computerized format increase student achievement as a result of immediacy and clarity of feedback.

Method

Students in a four-semester-credit, first course *in teaching reading in the elementary school* formed the two treatment groups. Group 1, the paper and pencil group with 52 students, was enrolled during the Fall, 1997 semester. Group 2, the computer group of 53 students, was enrolled in the Fall, 1998 semester. The composition of the two groups was comparable in gender mix, overall grade point average, and age. Most of the students were in their junior year of a four-year teacher preparation program. The previously described pencil-and-paper assessment was modified for use on the computer, with the addition of a scoring feature. A program was written and refined until students could take a phonics test within 30 minutes. The 10 computerized phonics tests were identical in format and content to the paper and pencil tests. The screen format was slightly different than the paper and pencil version, as one would expect.

Each student had a personal user name and password to access just her/his own records. A sign-up sheet permitted them to reserve a 45 minute time slot for taking a new test, or reviewing previously taken tests. The computer program randomly selected a test form not previously taken by the student. For the computer test, the 50 word passages were arrayed at the top of the screen; the unique passage words were also listed alphabetically down a left column. To respond, students highlighted the word(s) they believed contained the phonic pattern requested, then clicked on the on-screen "select" button; if they wanted to remove a word from their answer list, they highlighted it and clicked on the on-screen "delete" button. Students could select the items in any order, and return to previously answered items. When finished, the students clicked on the "score the test" button and their responses were permanently recorded (the scoring feature was designed to mirror the scoring rubric used for the paper-and-pencil test, so that the scoring was the same for Group 1 and Group 2 tests). Students received a total score, including an item by item breakdown of points earned. For each item, they were shown the total possible words correct, words they listed that were correct, and words they listed that were incorrect. After taking five tests, students were blocked from taking additional tests (similar to the paper-and-pencil testing). An electronic record was kept for every student, listing which of the 10 test forms they took, when, and how quickly. When reviewing previously taken tests, students could have course materials in hand to learn why particular answers earned less than 3 points. They could even review together during this study phase.

Both treatment groups received instruction from the same instructor using identical materials, classification system for phonics, and time frame. Students had the same number of weeks to complete the phonics assessment outside class. Upon completion of their studies, Group 1 completed the paper-and-pencil test followed by test scoring. The following fall semester, Group 2 received instruction and completed their phonics assessment via the computers in a proctored environment. In order to ensure standardization of test scoring procedures in this study, Group 1 test responses were entered into the computer as if each student had taken the computerized form of the phonics test. The result was that the scores for Groups 1 and 2 were tallied using a common metric, thereby reducing threats to internal and external validity of the comparison while meeting the necessary constraints for statistical analysis.

Results

An ANOVA test was used to test for statistically significant differences between the paper and pencil and computerized test groups in highest mean score on the phonics tests. No significant difference was determined; students taking the paper and pencil form had a group mean score of 19.38 correct out of 30 points possible (s.d.=5.31), while the computer group's mean score was 19.43, s.d.=5.66 ($F=3.28$; $p>.833$). Statistically the forms were found to be of equivalent difficulty. They used the same ten items, in the same order. Only the 50 word texts varied, and they were taken from basal and literature selections appropriate for second grade developing readers. Group mean scores ranged from 12.37 on Form VIII to 17.56 on Form III; seven of the test forms recorded group mean scores in the 14-15 point range. Post hoc analyses also suggested that the two groups of students did not vary

significantly in number of tests taken (1 to 5 trials). Students in the paper and pencil group took the phonics test an average of 4.4 times; the computerized group took the test an average of 4.0 times.

Based on these data, the computerized test version appeared to be no more advantageous in terms of students learning phonic patterns than taking the same tests in paper and pencil form. The practical significance of the computer format was the overall cost-effectiveness in terms of administration, scoring, and scorer reliability. The computer also reduced substantially the cost of test administration. In terms of educational significance, the time devoted to re-teaching individual students dropped substantially now that they were receiving more feedback about their performance immediately after completing a test. They knew the total number of correct words for an item--information they typically requested for the in-class phonic practice sheets. They also knew which words they listed were correct and which were incorrect, leaving them to study the passages for the correct words omitted in their original answer. Fewer students requested individual instruction, and did so closer to the time when they were approaching their last test trial or two. Then their questions often were about a feature of a phonic pattern, or about particular words that remained confusing to them.

This research continues beyond the results reported here. Three more semesters of students have taken the same phonics tests via computer and, according to our ANOVA analysis of their mean scores, they do not differ significantly from the original paper and pencil treatment group's test performance. Likewise, several years of collecting students' phonics tests scores in the paper-and-pencil form mirror the comparison group's mean phonics test score. A small number of students, perhaps 15-20 percent, score 26 points or higher. About the same percentage of students score below 20 points, leaving the majority of students earning from 20 to 25 points out of 30 points possible. It also appears that, when repeatedly taking the test, there is clear improvement with increase of trials--often across three trials. However, a plateau effect for many students seems to occur around 18-21 points. If they remain confused about features of particular phonic patterns, students at these times are open to instruction and often their next test score jumps several points. These observations need to be examined more closely and systematically; future studies need to include an item analysis to determine which of the ten phonic categories are proving easiest to learn, and which most difficult. An examination of test scores by item suggests that the predicable patterns CVC, CVCE, CVVC, and CV are difficult because some students struggle to remember short and long vowel sounds, especially when local dialect makes some short vowels sound like long vowel sounds (eg. the /i/ in ring, or the /a/ in bang). Students also struggle to identify vowel patterns that are irregular, such as the /a/ in wander or the /ou/ in famous. The other eight vowel and consonant patterns do not seem as difficult for students to learn well.

In summary, this study compared administering a paper and pencil test of phonic knowledge to preservice teachers with the same test presented via computer. Group mean test scores were comparable, as were number of test attempts. While no improvement in student learning the patterns was evident in these data, significant improvements in cost-effectiveness, scoring accuracy, and scoring objectivity were observed. Future study of this procedure for assessing teachers' knowledge of phonic content may lead to an economical, accessible, and reliable way for preservice and practicing teachers to check their knowledge of phonics as part of their demonstration of content knowledge necessary to effectively teach all children to read.

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Empowering Masters Students to Become Researchers: An Australian Case Study

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Abstract: This paper describes a case study in which Masters students at an Australian University, undertaking a subject on Research Issues in Technology and Language Learning (TELL), were involved in the interactive simulation of applying for a small Australian Research Council (ARC) grant in the area of TELL. Through participating in this research simulation students became aware of current research methodologies and issues in the field of TELL, as well as becoming conversant in a meaningful way with the relevant literature of this area. Students gained first class experience as potential candidates and assessors of one of Australia's major research grant schemes. The paper discusses the theoretical framework, method of implementation, outcomes and evaluation of using this type of learning experience in a Masters of Arts in Applied Linguistics.

1. Introduction

Nuthall (1999: 245) discusses that *having knowledge is as much a process of engaging in acquiring, sorting, connecting, inferring, reorganizing, using and reusing information as it is possessing some kind of knowledge object.* Somehow, in any learning experience the object and procedural knowledge can be present. In order to make more specific these terms, let's think for a minute about my own writing of this paper, a learning experience, in which I am in the first place using my initial object knowledge to write a paper to share with my audience. I am involved in the process of writing the paper and editing it to take into consideration other people's views. As a result of the process, my object knowledge is being changed as I am adding new knowledge or modifying the construction of what I already know notionally as well as about the writing process of papers in itself. The process is taking me to find out where I need to research more in the discipline knowledge to make my point more effectively. Both types of knowledge complement each other and are interrelated by the feedback, which is received from other people commenting on a draft of this paper, or myself providing feedback to myself as I read through different section and drafts of this paper. The feedback makes me think and reflect on what needs to be deleted, changed or improved at different levels to communicate my message clearly to my audience. So what is more important, the object knowledge or the procedural knowledge?

Many teacher education programs in the area of Applied Linguistics seem to have a strong emphasis on students acquiring the object knowledge of the area of study, as they are strongly influenced by teacher-centered models of instruction. According to Johnson (1999:4), "*many courses have followed a traditional model, in which the lecturer provides pre-digested course content, in the form of lectures, and all students submit their version of the same assignment*". In these traditional models the lecturer is still considered to possess some kind of knowledge object [1]that can be passed to the students and the main focus is on object knowledge. These models of teacher education fail to place learners in authentic real-life situations for active learning to take place[2]. They miss the opportunity of creating learning environments capable of engaging students in the acquisition of procedural knowledge as well as object knowledge, to allow them to become part of the research community not only as consumers but also producers. These models of teaching in undergraduate and postgraduate Computer Assisted Language Learning (CALL) programs foster passivity as students are seldom challenged to take responsibility over their own learning[3]. There is a need to encourage more autonomous learning and self-reflection on learning in teacher education, in the same way that there is a need to advance the research agenda in the effective design and use of CALL[4]. We need reflective autonomous learners who will be able to contribute to our field with their own research. But can our current Master students contribute actively to the advancement of the research agenda in the area of CALL or other areas when they finish their teacher education? And if not, what is stopping them?

[1] Lemke 1990
[2] Kolb 1984
[3] Johnson 1999
[4] Chapelle, 1997, Levy, 1997

The research performance of Masters students has been said to be affected by their lack of confidence and security, due to their limited understanding of scholarly research and writing, as well as never having had a real audience for their academic work, which has been read only by their instructor or lecturer. Moreover, writing at a scholarly level has been identified as creating anxiety and insecurity as in general postgraduate students have very little understanding of the academic research genre [5] and are afraid of academic audiences.

In recent years, we have witnessed innovations in teacher training influenced by learner-centered approaches to attempt to develop graduate and postgraduate students into researchers placing more importance on procedural knowledge[6]. The research reported here was motivated by the desire to explore the implications of using the notion of knowledge as a process as well as an object to design a Masters course in Research Issues in Technology and Language Learning. This would mean that as much attention would be paid to provide the students with the relevant and critical knowledge of the area of study (the knowledge as object), as to provide them with the learning environments necessary to develop and acquire a repertoire of research, writing and publishing skills to be able to participate and contribute to the research body of the area (the procedural knowledge). In order to achieve this, the course was designed to include more real life research simulations to promote the learning of research as a process and as an object of study. It was envisaged that this type of training would also contribute to increase the levels of confidence and security that postgraduate students might experience when considering stepping into the real research community for the first time after completing their studies in a supportive academic environment. This paper is an attempt to empower postgraduate students to become future researchers conversant with the conceptual and procedural knowledge of research by involving them in a research simulation to apply for a competitive small ARC grant.

2. The Small ARC (Australian Research Council) grant: How does it work?

The Australian Research Council is one of Australia's major research grant schemes. In order for a candidate to be successful s/he has to go through a very competitive process made of five stages:

A. **Submission Stage**. The candidate writes the application and submits it to the selection board of the ARC.
B. **The Cull Stage.** The submission goes to a general panel of assessors which makes a judgement about whether the submission is worth more detailed consideration by assessors who are expert in the field of the submission.
C. **Assessment Stage**. If the ARC board selects the application of a candidate, then it would be sent to three assessors in Australia and/or overseas, who have to write an assessment report commenting on the quality of the different aspects of the research proposal and research ability of the candidate/s, which are submitted to the ARC selection board.
D. **Rejoinder Stage.** The ARC board sends the confidential assessors' reports to the candidate to allow her/him to reply to them with a rejoinder. The reply is sent to the board for its consideration.
E. **Final Selection Stage.** The ARC board makes the final selection of proposals to be granted by taking into consideration the reports from the assessors and the response of the candidate to those reports.

3. The Small ARC grant simulation

3.1. Aims of the Process

Research can be a satisfying and stimulating experience for many people with a trained and inquiring mind[7]. Researchers contribute to the existing body of knowledge, to solve problems and expand knowledge[8] by using methodical processes to discover non-trivial facts and insights [9], and conducting the

[5] Crawford 1999
[6] Crawford, 1999; Johnson, 1999; Mumma, Bentley, & Walker, 1999; Smith & Mandlebaum; 1999
[7] Howard & Sharp 1983
[8] Drew (1980)
[9] Howard & Sharp, 1983

process with a systematic approach [10]. This learning experience aims to help students to increase their research skills, ability and confidence, and requires them to be creative, critical, methodical, communicative and reflective, and to become aware of academic genres and audiences. The use of this learning environment has been influenced by social constructivism [11], as it is trying to encourage personal learning through using a meaningful social context to create an active learning environment[12]. It aims to promote the development of critical knowledge and skills in students in the areas of TELL and CALL, as well as to create a direct relationship between what is learned in the classroom and what is needed outside the classroom, one of the most valuable principles of the situated learning approach[13]. Furthermore, it encourages experiential learning [14] through exposing students to conceptual and procedural knowledge of research in a simulated real academic situation. In summary, the aims of this learning experience are:

- to help students to learn about what makes a good research proposal in a meaningful context;
- to help students to learn how to develop a sound research grant or proposal through participating in a supportive environment;
- to increase their ability to understand better the research process[15] as they are doing it;
- to become critical about their own research proposal and other students' research proposals through conversational and reflective experiences;
- to promote awareness of an academic audience by having a real audience;
- to increase the postgraduate student's confidence and security as potential researchers by having a supportive environment for their first attempt at a grant submission;
- to increase their conceptual knowledge in the area of Technology and Language Learning through their involvement in the process of developing a grant proposal.

3.2. The Participants

There were fourteen students participating in this simulation with a diverse cultural and linguistic background including Australian, British, Chinese, Korean, Samoan and Spanish. A total of 80% of the class was made up of females. Their ages ranged between 26 and 55, eighty per cent of the class being between the age of 36 and 55. The majority of them were experienced teachers in the areas of English as Second Language (ESL) and/or Language Other Than English (LOTE). None of them have had previous knowledge of the area of Technology and Language Learning, and most of them did not have prior experience using computers to enhance language learning and teaching. The research background and experience of the participants was very limited.

3.3. The Process

A. Preparation Stage

(a) **In class (in small groups):** Students examined the guidelines provided by the ARC to write a small ARC grant proposal. Two samples of small ARC proposals were examined for the students to become familiar with the structure and to identify what were the good elements in each of them and the elements that could be improved. Out of this initial analyses the class as whole ended up writing a list of the characteristic of a good research proposal, which at the same time became the evaluation criteria to assess the research grant proposal that the students were going to elaborate.

(b) **Outside class (individual):** Students were given the assessors reports attached to one of the successful small ARC samples analysed in class. They had to write a response letter dealing constructively with the relevant and irrelevant comments made by the assessors.

(c) **In class (in small groups):** Students shared their response letters and tried to identify the strengths and weakness of each letter. Then they created a single response letter containing the best elements of each member in the group. Each group shared their outcomes with the rest of the class.

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[10] Bell, 1993
[11] Vygotsky, 1978
[12] Bandura, 1986
[13] Anderson, Reder & Simon, 1996
[14] kolb, 1984
[15] Bouma, 1996

B. **Developmental Stage:** Each student developed a small ARC grant proposal on a topic of her/his interest and submitted four copies to the lecturer. The lecturer kept one copy and gave the others to the three blind assessors of that proposal.

C. **Evaluating Stage:** The assessors read the proposal and wrote a report commenting on the research question/s, critical analysis of the literature and references, and evaluation of the methodology and data collection. Their aim as assessors was to provide constructive and coherent feedback to the author on the strengths and pitfalls of their research proposal. The assessor reports were given to the lecturer who gave them to the author of the proposal to keep the refereeing process anonymous.

D. **Reflective and Responsive Stage:** The author of the proposal wrote in a clear and coherent way a rejoinder to the assessors' reports or evaluations, addressing the different issues raised in the reports in a constructive way and dealing with irrelevant comments effectively. S/he took this opportunity to reflect on the aims and content of her/his initial proposal and improve the quality of the initial proposal prepared by the candidate. The rejoinder was submitted to the lecturer, who took the role of the ARC board.

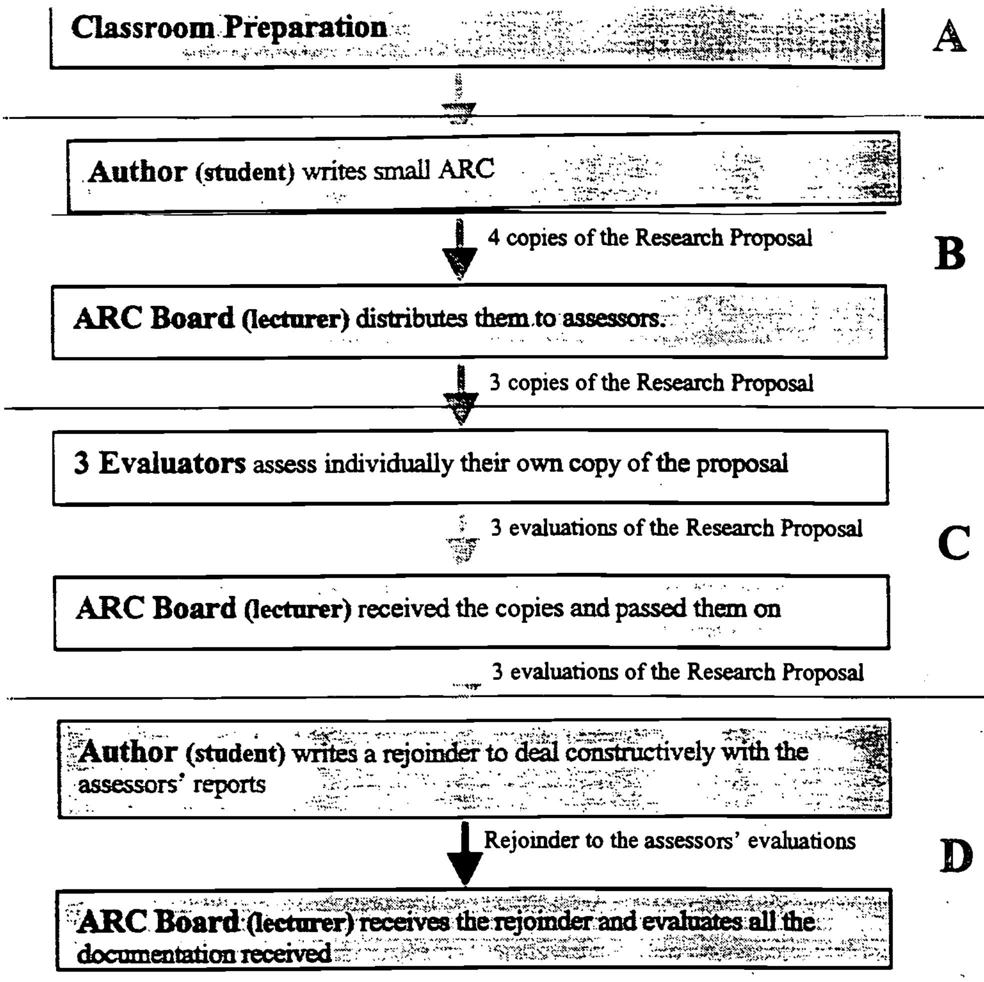

Figure 1: The ARC Grant Simulation Process

3.4. The Learning Outcomes

The Small ARC research learning experience conducted was evaluated based on the results of a student questionnaire, feedback obtained from informal conversations with the participants, lecturer's observations of the process, as well as the analysis of the different documents generated by the students as a result of this research simulation. Due to the lack of space in this paper, only the results of the questionnaires, to which ten participants replied, will be discussed in depth. The questionnaire aimed to gather information from the

participants on their research skills, their participation in the small ARC simulation, their current levels of confidence as researchers in the area of Technology and Language Learning, the place and nature of this item in the course, and the general participant profile. There were ten responses to the questionnaire. Most of the student benefited in one way or another from participating in this learning experience as represented in the following table.

What did you learn from preparing your own small ARC proposal?	%[16]
Gathering information on current research issues relevant to TELL.	100%
Stating a clear research question for a small ARC proposal.	70%
Selecting the best research methodology and instruments for a particular research proposal.	70%
Realizing the importance of good research design and timeline.	70%
Using electronic media to search for relevant literature.	60%
Elaborating a current and relevant literature review to support a research proposal.	60%
Ways of dealing constructively with the research limitations of a research proposal.	60%
Elaborating a research budget.	50%

In addition the participants reported to have benefited from having assessed constructively the research proposals of other candidates. It is worthwhile to notice how all the participants reported that they learnt to be critical towards other people's research and almost all of them to recognize the elements of a good research proposal as a result of this learning experience, as reported in this table.

What did you learn from assessing constructively the ARC proposals of other candidates?	%[17]
To be critical about other people's research.	100%
To recognize the different elements that make a good research proposal.	90%
To find out inconsistencies in the research methodology and instruments of a proposal.	80%
To assess the impact that using clear and correct language has in a research proposal.	70%
To analyse critically the theoretical framework of a research project.	70%
To determine the soundness of a research proposal.	60%
To evaluate the soundness and appropriateness of the research question/s.	60%
To see the importance of using a consistent referencing style.	60%

Replying to the assessors' reports helped some students to become more critical about literature reviews, as well as to adopt the useful suggestions received about their initial proposal, and to gain experience in having to deal with some of the suggestions from assessors with whom they disagree. This experience seemed to help most of them to see things from different perspectives (candidate versus assessor), and to learn that the quality of a proposal can be improved by the comments received from the assessors. I would like to add, based on my own observations of the process and the documentation generated by the participants, that through their involvement in this research process students improved their conceptual and procedural knowledge of research in order to put good grant proposals in place with a sound methodology and research design. Most important of all is the impact that this learning experience has had on the student's confidence as a researcher.

Confidence as a researcher in the area of Technology and Language Learning	Average[18]
To apply for a Small ARC grant **before** taking part in the subject (1 to 10 being best)	2
To apply for a Small ARC grant after taking part in the subject **now** (1 to 10 being best)	8.5
In ability as a researcher **before** taking part in the subject (1 to 10 being best)	3.5
In ability as a researcher **now** (1 to 10 being best)	8.5

Their confidence and security in their ability as researchers improved substantially after having participated in this learning experience during one semester. The majority of students thought that participating in this simulation should be a component of the subject ~~on~~ *Research Issues in Technology and Language*

[16] Percentage based on a total of 10 participants.
[17] Percentage based on a total of 10 participants.
[18] Based on 10 participants.

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Learning, because it can be useful for their future careers and provided them with a good research experience in a safe environment. For two of the students, time was too limited to concentrate on this simulation, as there was already enough new content in the subject without the research component. Some of the students mentioned that some of the aspects they liked about the process were having to write a grant application, gaining experience that could help them to avoid any problems in the future if applying for a grant, and gaining confidence. One of the students reported that s/he found stressful having to read negative things and felt s/he did not have enough time to complete the process. Some of the suggestions made by students to improve the process were: that no candidates names should be mentioned on the research proposals, and that the lecturer's comments on the proposal should be received at the same time as the comments from the three assessors.

4. Conclusion

The ARC grant research learning simulation described in this paper has promoted experiential learning through encouraging students to become familiar with the process and concepts of research in the area of Technology and Language Learning. As a result of participating in this learning experience, their research skills and knowledge have benefited, becoming more critical, methodical, constructive, communicative, and reflective, as well as aware of academic genres and audiences. It helped them to expand their knowledge of research methodologies, design, and instrumentation, but most important of all was that their confidence and security in their ability as researchers increased dramatically as a result of taking part in this experience. This paper advocates the importance of including procedural knowledge and real life learning simulations as part of postgraduate research programs. In this way, we educators will be able to empower our students to become potential researchers able to contribute to the field with confidence and in a constructive manner, and one day being able to add to the object knowledge of us, their educators.

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Delivering a Distance Education Graduate and Professional Development Program: Integrating Multiple Technologies

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Abstract: This paper describes a three-year collaborative university and public school distance education ESL endorsement program designed to lead to a Masters degree for 450 educators in one rural and five urban school districts. The program uses multiple technologies integrated into an instructional and curricular design plan for 8 graduate level courses. The paper also describes the initial evaluation results gathered during the first year of implementation.

Introduction

With the increasing population and urbanization of city centers within Utah, the complexion of Utah's children is rapidly changing, mirroring the changes taking place throughout the United States. By the year 2005, one of every three school children in the United States will have a primary or home language other than English. These population changes created a growing demand for professional development programs to prepare educators to meet the specific needs of Utah's children. School administrators and teachers in the urban school districts surrounding the capital city of Salt Lake City became more demanding of local teacher education programs to provide quality and large scale professional development programs for the preparation of teachers of ESL (English as a Second Language) students. However, the ESL preparation programs at institutions like the University of Utah were very small endeavors incapable of producing no more that a few ESL teachers. Out of such a dilemma came a unique and innovative partnership among the five urban school districts and the University of Utah. Working together, a collaborative team created and implemented the Distance Education ESL Endorsement Program (DEEEP). Consistent with calls from the literature, "distance education has the capacity to deliver instruction to a wide array of diverse populations, but that capacity will require partnerships among institutions of higher education, and . . . sectors of the community" (Parker, 1997, p.9).

Integrating distance education design principles (Garrison, 1990 and Parker, 1997), team members created a program in which technology strategies followed pedagogical and content goals. Taking a distance education approach in an urban setting provided access for a large number of teachers to a quality university program and a more adult centered approach (Crotty, 1994). The program is organized into a three-year format, with each year using distance

education strategies (Collis, 1997). Years One and Three integrate multiple technological delivery systems into the instructional design plan.

The Program

The purpose of DEEEP is to prepare teachers to address the needs of all students in their classrooms. The program assists teachers in working specifically with children learning English as their second language. The overall goal was to develop a high quality program delivered to a large number of educators in an economical manner. The implementation objectives were: 1) to use distance education strategies to deliver an ESL endorsement program on-site to the schools and 2) use a collaborative model in program design, course development, program management, and decision-making. The brief program description below highlights these two implementation objectives.

<u>ESL Endorsement Program</u>: The program consists of eight graduate level courses (26 semester credit hours). These courses are delivered to different teaching sites in one rural and five urban school districts. The DEEEP school districts comprise about 75% of Utah's public school population. There are three courses in Year One delivered using satellite technology and on-site facilitators. Because of the heavy theoretical base of the courses in Year Two, the program developers decided that these courses should be delivered using on-site instruction provided by clinical faculty members from the Department of Linguistics. Year Three consists of three courses delivered to the participants through video-based instruction, web-enhanced curriculum strategies, and on-site facilitators.

<u>Collaborative Model</u>

In operation since 1989, the Utah Education Consortium (UEC) is funded through a joint effort by the Graduate School of Education, the Utah State Office of Education(USOE) and the participating school districts (Davis, Granite, Jordan, Murray, and Salt Lake). An executive committee governs the Consortium consisting of district superintendents and associate superintendents, coordinated from USOE, the dean and associate deans of the Graduate School of Education, and each department chair.

During the past several years, the executive committee of the Utah Education Consortium explored possibilities and guided efforts to develop an ESL program for their educators. As a result, an ESL Task Force was formed and composed of the five district bilingual/ESL coordinators, University of Utah professors from the Departments of Educational Studies, Linguistics and Special Education Program, and key university administrators. From September 1997 through June 1998, Task Force members created DEEEP by planning and overseeing the implementation of all logistical tasks, program design, course development, contract negotiations, personnel selections, and participant recruitment.

Integration of Multiple Technologies

The courses and instructional strategies were designed around several general principles. First, the courses needed to reflect the quality of university graduate level courses. Second, the

courses needed to provide educators with knowledge and strategies relevant for K-12 classroom teachers. Third, the distance education strategies should allow course instructors to teach high quality content to a large number of participants while providing consistent and manageable content and course organization. Fourth, the pedagogy should lead the technology decisions. The resulting program design provided a varied and integrated use of technology and instructional strategies. The program content and distance education delivery strategies are organized into a three-year format based on the four program design principles. The description outlines the program year by year. Additionally, a very brief section describes the program's web site.

Year One

The program participants are taught three courses. These courses are Multicultural Education, Bilingual/Bicultural Education, and Second Language Learner Methods. Each course provides 3 semester credit hours. The courses are delivered to 17 teaching sites in six school districts. Approximately 20-25 students and one on-site facilitator participate at each teaching site. Two courses (Multicultural Education and Bilingual/Bicultural Education) are taught consecutively during fall semester. Each course is 7 ½ weeks long, taught two days/week from 4:30 - 7:30 p.m. Spring semester is host to the Methods course taught one day per week for three hours. Year One courses were taught to 240 students during the 1998-99 school year. Year One courses were repeated to a new group of students during the 1999-00 school year.

Each teaching site is equipped with a satellite dish and receiver box. During the 1998-99 school year, the Year One courses were delivered through the Educational Management Group (EMG) Corporation. EMG was an educationally oriented technology company dedicated to producing and broadcasting educational programs to public schools. Because of corporate restructuring, Pearsons Publishing Corporation obtained EMG and dissolved it. After extensive contract negotiations between the University of Utah, EMG and Pearson representatives, an amended contract with Pearsons provided only satellite transmission of live broadcasts by the EchoStar Corporation. DEEEP tapes, for the Year One courses (1999-00) would be distributed to the teaching sites.

From January 1998 through May 1999, EMG curriculum designers and videographers worked closely with the course professors to create 17 Utah-based videos for a wide range Year One topics. Most of the videos are approximately 20-35 minutes in length. Course professors developed video scripts and gave final editing approval.

A 3-credit semester course at the University of Utah is composed of approximately 33 "contact hours" (university instructor and student contact). The Year One DEEEP courses consist of 10 hours of live professor broadcast time, 3 hours of video broadcast time, and 20 hours of group work and assignments guided by the on-site facilitators. Although the satellite transmission allows for only one-way audio and visual, interaction between students/facilitators and the professor during the broadcast times is achieved through the use of a dial-in 800 telephone number connected to the professor at the University of Utah broadcast studio. Students call in with questions, comments, and reactions to specific professorial directives.

Each course has a Facilitator Guide and Student Guide that outlines each class session's instructional events, group activities, assignments, expectations, and reading assignments. Master ESL teachers from the school districts serve in the role of on-site facilitators supporting student learning and developing a community of learners. The course instructor and 20

facilitators met approximately for 2 days prior to the beginning of each class for the purpose of the discussing and coordinating class objectives, assignments, and activities. Facilitators and course professors also met occasionally throughout the duration of the course as well as communicated almost daily through email interactions.

Year Two

Because the two courses Graduate Survey of Linguistics and the Pedagogical Structure of English (both 4 semester credit hours) are primarily foundation-type courses, Task Force members believed that these classes should be taught with face-to-face instruction by clinical faculty. Like all DEEEP courses, these two classes are taught on-site in designated schools. The first group of 240 students is enrolled in these courses during the 1999-2000 school year. The second group of educators/students will complete the courses during the following school year.

Year Three

The last three courses of the endorsement program incorporate a variety of distance education technologies and strategies. Working with the University of Utah's multi-media and broadcast personnel located in a division called Media Solutions, the project directors and course professors are creating the most technically sophisticated and innovative instructional components of the project. Currently, in the design and production phases, the three courses will be on-line for the 2000-01 school year. Year Three courses (all 3 semester credit hours) consist of Content-Based Language Teaching, Minority Language Issues and Materials Development/Practicum.

All three courses are being designed using Lotus Learning Space as a framework. Students access course content and resources through web-based curriculum. Interaction with course professors, on-site facilitators, and students occur in both synchronous and asynchronous environments. Video developed specifically for these courses is either streamed through the web site or provided on-site. For all three courses, there will be approximately 2.5 hours of originally produced video and 17.5 hours of edited and repackaged short and long video clips obtained from a variety of sources.

The Year One teaching sites and on-site facilitators will serve as Year Three teaching sites and personnel. While specific class dates and times for these courses will mirror the first year schedule, students will also be able to access the materials at times convenient to their schedules and locales. Email and web-site communication sectors will provide interaction between professors, facilitators, and Year Three students. In addition to the designated DEEEP teaching site, all participants will have computer access at their own work sites located in the elementary or secondary schools. Many students/educators also have computer access in their homes.

Web Site

The DEEEP web site will provide an array of information and communication links for program students and those interested individuals not directly involved in DEEEP. Expected to be on-line around June 2000, the site will enhance the quality of the endorsement courses by creating an electronically connected learning community. DEEEP students, professors, and facilitators will be able to engage in conversations through structured class activities or student

initiated chat sessions. Additionally, open web areas will encourage more free-flowing conversations between DEEEP participants, district ESL coordinators, interested teachers, university faculty, community leaders, parents and K-12 pupils. All DEEEP web participants will be able to pose questions and offer solutions to a variety of ESL and classroom issues. Furthermore, the site will act as a resource area containing K-12 topics such as multicultural education and ESL lesson plans, strategies and classroom-based activities. The resource area will also encourage the exchange of cultural activities, events, and perspectives within the larger community.

Evaluation Findings

For this paper, the evaluation design focused on three major questions: 1) the quality of course instruction using multiple distance education technologies, 2) the effective use of multiple technologies and 3) the characteristics of quality on-site educators responsible for facilitating the technologies and instructional plan. The primary methods of data gathering for questions one and two were a questionnaire completed by all course participants, facilitator focus groups, and informal interviews with a variety of students, facilitators, technicians, and district personnel. For the third question, a research assistant conducted a field study of two teaching sites involving about 50 participants. The assistant used weekly observations and participant interviews as data collecting methods. The findings centered on Year One Courses for 1998-1999.

To understand the quality of instruction and the effective use of technology, course participants completed a 20 question survey administered at the end of each course. The questions covered specific areas of instructional strategies, professor effectiveness, on-site facilitator quality, learning outcomes and technology. The questions asked respondents to show strong agreement or strong disagreement to statements by circling a number from 1-7 (1 indicating strong disagreement and 7 strong agreement). Additionally, three open-ended questions were posed to understand the participants' perspectives of their belief systems as well as the relationship between course instruction to K-12 classroom teaching practices. Finally, general demographic information was obtained from the DEEEP students.

<u>Demographics</u>: On the average, there were 242 student responses per course. Of these respondents, 71% were female. Thirty-eight percent were secondary educators, 59% were elementary school teachers and 3% did not declare. Concerning years of teaching experience, 43% of the respondents had 1-5 years, 19% had 6-10 years, 17% had 11- 15 years, 9% had 16-20 years, and 11% of the respondents had 21-3 1 years of teaching experience.

<u>Course Quality</u>: The participants' responses indicated that they perceived a moderately high degree of quality for all three Year One classes. Almost 98% of DEEEP participants agreed that courses would impact their teaching practices. There was an increased awareness of multicultural, bilingual and methodology issues. The overall mean response was 5.01 regarding the effectiveness of the course in increasing participant understanding of course issues. Additionally, the mean response was 5.7 for participants reporting on an increased knowledge of strategies. Similarly, when participants were asked to respond to the ways in which the multicultural education, bilingual/bicultural, and methods courses would impact their teaching practices, 98% provided positive remarks. Additionally, participants reported the courses would influence there teaching practices by averaging a 6.35 response, the highest response of all the questions asked.

Effective Use of Technology

Of all the evaluation questions, the technology questions consistency received the lowest ratings from students, facilitators, and instructors. Specifically, the question prompt of "satellite lectures were a useful instructional delivery approach" elicited a mean response of 3.67 on a scale of 1-7 indicating that participants were ambivalent about the usefulness of the technology. The second course respondents answered the same question with a mean response of 4.28, and the spring semester course students responded with a mean response of 3.73. In all cases, this technology question elicited the lowest mean average of the 20 questions.

Much of the dissatisfaction occurred because the satellite technology failed to function properly and consistently during the first four weeks of the fall semester course. All of the participants' complaints centered on reception issues of foggy images and poor audio reception. Occasionally, students missed the live and video broadcasts. While on-site facilitators were master ESL teachers and pedagogical leaders, they were not technically trained to troubleshoot and solve difficult satellite transmission and receive site challenges. However, working with EMG engineers, University of Utah broadcast technicians, and satellite repair people, teaching sites were fully operational by the start of the second fall semester course.

Quality of On-Site Facilitators

Several themes directly related to the use of multiple technologies emerged from the field observation work conducted at the teaching sites. First, distance education site facilitators must have cooperation and support of the school building principal and staff. Most facilitators were not classroom educators at the DEEEP teaching sites. Therefore, they needed to establish new and positive relationships with an unfamiliar building administrator sand media center coordinators (satellite receivers were located in media centers). These school personnel people were the first line of support for satellite and other technological challenges. Second, the actual teaching location must be physically comfortable and equipped with large television sets to view broadcast lectures and videos. Meeting in school auditoriums, cramped classrooms, or multi-purpose media centers distracts student learning and attention during satellite broadcast times. Third, while facilitators were chosen and should be selected because of their pedagogical leadership in adult education, they still must receive basic preparation in managing the technology. During the first few weeks of the fall semester Year One course, facilitators and program administrators were frustrated because the basic technology education received from EMG personnel seemed insufficient. Much of their dissatisfaction occurred because the satellite technology was new and not fully operationally at first. With increased familiarity and function, satisfaction increased among all participants. Throughout the remainder of Year One, facilitators were able to handle site technology problems with more confidence and ability because of increased experience and ease with the new delivery approach.

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Creating Technology Workshops for Modern Language Professors

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Abstract: This paper describes the process of developing technology workshops for language faculty. First, brief needs analyses were collected to determine faculty preferences for workshop topics. Later, informal interviews were conducted with individual faculty members to learn in more detail about their pedagogical and technological needs. Workshops were designed and taught based on those results. Following the workshops, faculty members evaluated the usefulness of each session. This feedback was then used to improve future workshops.

Introduction

By 1998, the Language Learning Resource Center (LLRC) at Saint Michael's College had been directed by a series of several employees on a temporary basis over a period of almost five years. When a new position was filled to direct the LLRC with the title Language Technology Coordinator, one of the main tasks of the job was to offer resources and services to better assist the faculty of the Modern Languages and School of International Studies' English as Second Language (ESL) departments in the use of technology. Traditionally, these two departments had not used the LLRC in the same manner as was reflected in their differing styles of language teaching and in the differences in their respective students' needs. The intensive ESL program is taught on a rolling enrollment basis with new classes beginning every four weeks, with students in classes six hours a day, while one hour, daily classes in Russian, Japanese, Italian, French, Spanish and German are taught during two sixteen week semesters. Reasons for taking language classes differ greatly as well. ESL students learn English primarily for academic purposes, i.e., to achieve a high enough proficiency level to study other subjects at an American university, whereas the American students, native English speakers, study foreign languages principally to fulfill a foreign language proficiency requirement for graduation. To determine which services and resources would meet the needs of both departments, the Language Technology Coordinator designed a needs assessment questionnaire.

The needs assessment questionnaire asked which tools instructors currently use and would like to use in the future. Questions were asked about the use of audiocassettes, audio CDs, videotapes, software, tools for materials creation, Internet tools and included an open-ended question asking about tools not listed in the questionnaire. The questionnaire was distributed to both language departments, which comprise twelve Modern Languages and thirteen ESL and MATESL instructors. Fourteen questionnaires were returned, evenly divided by department, with seven from each. Current use of technology in language teaching and expectations for future use varied widely between and among departments. Based on the questionnaire results as well as informal one-on-one interviews, the Language Technology Coordinator drew up a list of twelve workshop topics. The twelve topics were sent to instructors via email and further explained at faculty meetings so they could choose which they would like to have offered to them. In this way, the list was narrowed to seven workshops offered during the spring and fall of 1999:

- Putting a course syllabus online using a web editor
- Using tracking and revisions features of word processing programs for teaching process writing
- Using alternate character keyboards for Modern Languages
- Creating online quizzes and tests using JavaScript templates
- Evaluating the software selection process
- Integrating Internet resources in language instruction
- Using computer mediated communication: email, threaded discussion, and online chat

Preparation for the Workshops

The first three of the seven workshops involved using features of software programs offered on a campus-wide basis. Step by step instructions for using these programs, developed by Library Information Services (LIS) staff, were posted on a Help Zone web site. These instructions, as well as the date and time of all seven of the workshops were advertised by email. For those who felt comfortable working on their own, these instructions were available for self-taught tutorials. Without the workshop however, discussion of the instructional rationale for why, when and how to use these tools was missing. The idea that each instructional tool should be assessed for its pedagogical usefulness before implementation was emphasized in each workshop as is recommended in the literature of language learning and technology (Bradin, 1999; Levy, 1997; Pusack & Otto, 1997; Warschauer, 1995). The three main goals of all of the workshops were:

- to establish a comfort level with the technological tool;
- to integrate technology into the curriculum; and
- to critically evaluate the use of technology. (Kassen & Higgins, 1997)

Materials for learning to use Hot Potatoes, the JavaScript templates for creating online quizzes, are available at the web site from which one can download the free software so preparation for this workshop did not involve much writing and research. The web site includes a Power Point presentation that offers general information about using the six software programs included in the Hot Potatoes suite as well as an online tutorial that explains how to use the software step by step. The process of downloading and installing Hot Potatoes requires decompressing files using decompression software. This process proved difficult for some instructors who learned to use the templates in one on one sessions, so the workshop facilitator copied all of the decompressed files needed to install the software to a zip disk for easy installation during workshops. Faculty members then used the disk after the workshops for installation on their office computers as well.

The final three workshops involved more research and planning on the part of the Language Technology Coordinator than the previous workshops did. The basic principles of using each tool were researched beforehand and then discussed at the outset of each workshop. Next, examples of how to integrate these tools into existing classes were given, which also needed to be collected ahead of time. For "Evaluating the software selection process," for instance, individual professors requested commercial software programs for learning specific skills, such as pronunciation. Instructors evaluated demonstration copies of these programs using three different evaluation instruments. These instruments were

discussed in terms of how well they assessed both the feasibility and quality of the software. Before this workshop, the facilitator researched the appropriate software programs, ordered demonstration copies, tested the software, and found evaluation instruments for assessing the software's usefulness. Once the software programs were evaluated and compared, the faculty then discussed which particular needs would be served by these programs for achieving specific goals within the context of their classes. The "Integrating Internet resources in language instruction" workshop also required considerable preparation. Research was conducted into the various web sites available for language learning and appropriate ways to use them in the context of a given class, and an evaluation instrument was developed for assessing their usefulness in specific teaching situations, in much the same way as had been done for evaluating software.

The computer mediated communication workshop required research into the various modes of online communication, the development of written instructions for how to use them and guidelines for how best to integrate their use into existing classes. The Language Technology Coordinator made recommendations about how best to use chat rooms available to instructors, as well as how to create them. Threaded discussions can be created fairly easily using Microsoft Front Page, the web editor supported by Saint Michael's College, so instructions for adding a threaded discussion to a class web page were written for this part of the workshop. Directions for how to use some of the features of Microsoft Exchange were also written, as well as ideas for how to integrate email into language learning classes following suggestions from Warschauer (1995) and Sperling (1998).

Conducting the Workshops

The Language Technology Coordinator led each workshop in the LLRC, a computer lab with 13 PCs and a ceiling mounted projector, at a date and time that would conflict with the least number of instructors' schedules. For those who wished to attend, but could not, arrangements were made for one-on-one sessions at a more convenient time. The workshops began with presentation and demonstration, followed by opportunities for hands-on practice and discussion. Most lasted for an hour to an hour and a half. In all workshops except for "Evaluation of the software selection process," the participants came from both the Modern Languages department and the School of International Studies. The software evaluation workshop was offered to each department separately, since the respective programs evaluated were not applicable to each other. What follows is a description of the way in which each of the workshops was conducted.

Using class web pages seemed to be a daunting task to many language professors since only a few class web pages had been produced by a few of the early adopters in their departments. (Jaffee, 1998) While many instructors were adept at searching the Internet for personal and professional reasons, most did not feel capable of creating a web page of their own. To lessen the anxiety level, the workshop was advertised as "Putting a course syllabus online using Microsoft Front Page" rather than "Creating a class web page." The Language Technology Coordinator found many opportunities in informal conversation with instructors to reiterate that the workshop could be viewed as a first step toward developing a more elaborate class web page. Since most already used a word processor to create syllabi, converting these files to html format would be easy. Instructors were asked to bring their

syllabi on disks and had filled out an application for a web page before the workshop took place. The facilitator explained the basic principles of using Front Page to the participants and outlined the goals of the workshop: to create a homepage, organize information using a table on that page, add a graphic image, include a link to a syllabus page and a mail-to link. Step by step, using printed instructions with screenshots as a guide, professors were taught how to create their pages.

"Using tracking and revisions features of word processing programs" was offered to instructors teaching writing in language classes at the intermediate and advanced levels. Process writing is an approach to teaching writing that involves stages of planning, drafting, revising and publication. These word processing features allow instructors to make editing comments as part of the process of revising and draft writing without changing the original student text. Instructors are free to write as much as they wish without the restrictions of the margins or the stigma of the red pen. The comments can then be offered as a means to improve subsequent drafts, rather than an evaluation at the end of a finished product. (Grabe & Grabe, 1998) Additionally, these features create a system for keeping track of student drafts to easily review changes.

The use of different character sets for typing in languages other than English had been a source of problems for many of the Modern Languages professors at Saint Michael's. Suffering through frequent operating system changes and several word processing programs, professors had nearly given up on ever having a consistent set of keyboards to allow them to type easily in the languages they teach, much less having tools for student writing. In 1998, a set of keyboard sets for use with Windows NT 3.5 was purchased and installed. Instructions for their use, along with screen shots of the keyboards were made available to instructors. In addition, it was discovered that the proofing tools (spell check, thesaurus and hyphenation rules) for Spanish, French and German purchased for use with an earlier version of Word would work with Word 97. Instructions for using these tools were written as well. A few one-on-one workshops for using the character sets and proofing tools were offered for those who did not feel comfortable using the instructions on their own. Workshops for using these tools were again offered, this time to classes of students, co-conducted with their language teachers.

Hot Potatoes, a suite of six authoring programs based on JavaScript templates, were developed Arneil, Holmes and Street of the University of Victoria Language Centre. The programs were designed to allow language instructors to easily create their own exercises and quizzes, including cloze, multiple choice, matching, short answer, scrambled sentences and crossword puzzles. Since several instructors indicated a desire to learn how to create their own exercises with immediate feedback and had realized the shortcomings of exercises included in commercially produced software, a set of tools that allowed them to create exercises based on their own choice of content was deemed appropriate. This workshop required two 1 ½ hour sessions to cover the tutorial as well as enough time to practice using four of the six programs.

In the past, commercial software selection for use in language instruction had been a process conducted by individuals within the department of Modern Languages, and by small groups of instructors within the School of International studies. In neither department had a formal selection process with a true evaluation procedure been implemented. Budget changes indirectly forced such a process upon the faculty to some extent when the Library Information Services department became the sole purchasing center for the college and

created a mandatory acquisition procedure that includes critical questions about the necessity and feasibility of using software programs. While the decision to purchase and use a software program lies with the individual instructor making the request, assuming there are no budgetary or technical prohibitions, the role of the Language Technology Coordinator is to guide language faculty in the selection of software to meet their pedagogical goals. Workshops to assist in this acquisition process serve to demonstrate new programs as well as to involve instructors in the process of evaluating these programs.

Ongoing discussions about the kinds of software programs used in language teaching, individual recommendations, as well as the results of the needs questionnaire were used to determine which programs to order for review. Instructors were asked to read articles (Bradin, 1999; Healey & Johnson, 1997; Robb & Susser, 1999) about selecting and evaluating software before the workshop. During the demonstration of programs, each instructor was asked to answer portions of three different evaluation instruments (Bradin, 1999; Healey & Johnson, 1997; Long & Johnson, 1994) in order to assess the usefulness of each program. These instruments included questions about pedagogy, preparation, technical requirements, program design and operation, preview options, pricing options and support issues. Fewer software purchases were made after these workshops than during the previous year without the workshops, as problems were identified during the evaluation process.

It is only in the last two years that language instructors have begun integrating Internet resources into their classes. Four modern language professors have not only put their syllabi on class web sites, but have links to sites through which students complete tasks necessary for homework assignments. For example, a French professor has her students visit online French clothing catalogs and select a wardrobe appropriate to a particular geographic region and season with a limited amount of French currency. This use of authentic materials and tasks provides opportunities for language learning that are not possible in regular classroom-based settings. (Vosniadou, 1994) The impetus for searching for ways to include Internet resources in teaching language, then, like the use of other technologies, has been primarily peer-driven at Saint Michael's College.

The workshop entitled Integrating Internet resources in language instruction began with tours of the course web pages of the instructors' peers to highlight how they had integrated information from the Internet. The discussion then expanded beyond the use of email and links to reading, writing and listening practice pages to include tips for how to use the Internet as a source of authentic material for preparing lessons as well as an interactive medium for student learning. Possible uses included accessing Lexis Nexis and other subscription databases for foreign language articles, finding pictures and music, making use of online news sources, finding an authentic audience for student writing, and using online maps. Finally, textbooks designed for use with Internet sites were displayed for possible adoption and to demonstrate additional ways to integrate online resources. These included Dave Sperling's Internet Activity Workbook and Internet English by Gitsaki and Taylor, which both make use of companion web sites. The companion web site for Prentice Hall textbooks for foreign languages were also demonstrated to make instructors aware of the lesson plan ideas available there as well as additional practice material for students. For evaluation of all of these sites for language teaching, instructors were prompted to ask themselves many of the same kinds of questions they asked when evaluating software, such as those about technical requirements, usefulness in achieving student goals, authenticity of material, difficulty of level of language, etc.

Incorporating email, online chat and threaded discussion into classes recently became important to SIS professors as some began the process of redesigning their MATESL teacher training classes for distance education. As a few of these instructors started experimenting with adding these forms of communication to their face to face classes, in anticipation of conducting classes completely online, others realized the need to educate themselves about possible applications for their classes as well. Most professors already understood how to use email for sending student writing to teachers, posting to discussion groups and sending announcements to students. What teachers wanted to know was how email differs from asynchronous threaded

discussion and synchronous online chat forums. This workshop opened with demonstrations of class web sites using email and threaded discussions to illustrate how they might be used to extend in-class discussion. A hands-on session in a chat room followed, with online classroom management issues as the topic for discussion. Finally, instructors were directed to a Library Information Services web site where they could find instructions for how to create threaded discussions using Microsoft FrontPage and sites to create their own chat rooms.

Conclusions

These workshops were rated highly in anonymous evaluations for usefulness, quality of delivery and content, averaging 4.5 on a scale of 1 to 5, but suffered from low attendance. Although many professors wanted to attend and learn about these various uses of technology, they could not find time in their schedules between publishing projects, administrative duties and heavy teaching loads. Others preferred to have one on one instruction. Of these professors, some clearly indicated that they felt more comfortable learning individually, some wanted to learn more slowly and others simply wanted a different date and time. After the workshops, between one third and one half of the attendees said they were using the tool learned in their teaching.

Future workshops will be ongoing and offered each semester. Some of the original seven workshops will be repeated to reach those who want more practice, were unable to attend earlier sessions or were previously not ready to learn to use a new resource. Since many teachers preferred individual sessions, even if the number of attendees is low, the workshops will not be postponed or cancelled, as is the policy with other technology workshops offered at Saint Michael's.

The workshops will be improved in a number of ways. Although attendees often had to leave immediately after the sessions finished, they also said they wanted more time with each tool. In response to this feedback, some workshops, such as "Integrating Internet resources," will be divided into two sessions for a slower, more thorough treatment of the material, as well as to allow for more practice time. In addition, a three part series of workshops will be offered on the use of Microsoft Front Page for creating class web pages, including useful links, and adding a threaded discussion page. A three part series with workshops given every two weeks will allow for additional practice of skills that will build upon each other over a six-week period. This series will be offered during the last six weeks of a semester to prepare for the following semester. An additional change will be to include some of the language professors as co-facilitators in more of the workshops, as some feel more comfortable learning from colleagues than those they see as technology experts. The most important lesson to be learned from offering these workshops was that giving instruction in the use of technology is a process, rather than a project with a beginning and an end. This process will continue on as many different levels as there are individual professors with expanding needs and varying levels of experience with rapidly changing technologies.

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Educating Foreign Language Teachers in Instructional Technology: A Report on Faculty Development at the University of South Carolina

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Abstract: Foreign language instructors are some of the most innovative teachers in education today, and educational institutions worldwide are encouraging their foreign language faculty to increase their use of technology in the classroom. To that end, the University of South Carolina has created a new role for the Academic Director of its Foreign Language Learning Center. One of the key aspects of the position involves conducting a series of instructional technology workshops designed specifically for foreign language faculty. This paper is a report on the nature and design of these workshops, who is taking part in them, and how those participants are then subsequently incorporating what they have learned into their own classrooms.

Introduction

In their article, "Teacher Training for CALL and its Implications", Curtin and Shinall (1987) assert that "to ignore advances in technology is to be left behind" (p.256). This is especially true for today's teaching faculty. Not only do instructors in traditionally technological fields, i.e., physics or engineering, need to be current in their knowledge of instructional technology, but faculty in the humanities and social sciences are now equally expected to incorporate technology into their curricula. This challenge fills some faculty with a sense of dread, afraid, as they are, that the computer will sound the death knell for their profession, while in others, it incites a whole new love of teaching and curriculum design. What accounts for the formers' "technophobia" is often the result of a lack of familiarity with very basic technology. A substantial percentage of the teaching faculty in humanities programs has followed traditional "book-based" programs. This is especially true of foreign language teachers. There are still relatively few institutions in North America that offer an instructional technology component to their graduate programs in foreign language. Such programs tend to be literature-based, and, if there is any teacher training at all for graduate teaching assistants, it is often woefully lacking in any mention of or instruction in CAI or other technological applications for teaching. Nevertheless, asserts Michael Bush (1997), "ready or not [. . .], technology will play an ever-increasing role in each of our institutions. It therefore behooves foreign language education professionals to better understand technology and its potential for foreign language learning" (p. xiv).

The result of the present system is that many foreign-language Ph.D.'s enter new assistant professorships without having any real knowledge of technology-enhanced instruction. Furthermore, the pressure placed on new faculty to produce a significant amount of research in order to attain tenure does not leave them with much time to try out new technologies or to be particularly creative with their teaching. Many of the same traditional departments that do not offer adequate training in teaching with technology are also reluctant to accept research done in this area as meeting the criteria for tenure: "Without an excellent research record, one cannot expect a promotion in other than teaching institutions. However, in teaching institutions the teaching load is so high [...] that there is insufficient time" (Solomon, 1994, p.29). Thus the cycle continues.

A New Approach

How, then, do we remedy this situation and assist foreign-language faculty in incorporating technology into their curricula? The University of South Carolina in Columbia has addressed this concern by creating a new job-description for the Academic Director of its Foreign Language Learning Center – a position that I have recently filled. While the position to this point has been more or less strictly administrative, the new job description calls for a foreign language professor as well. As the new director, I, myself, graduated from a literature-based program with very little technology involved in my instructional duties. However, my first post-graduate teaching position involved establishing a German program at a small, two-year college in Georgia. This first assistant professorship afforded me the opportunity to become knowledgeable in many areas of instructional technology. Not only did I do fifty percent of my teaching via interactive distance learning, but I also established a Macintosh-based foreign language lab and a German-studies Web site. The nature of my first teaching position helped me to become proficient at technology-enhanced instruction and, as such, to move into the area of faculty development, where I have held several workshops for faculty in all areas of instruction.

In addition to fulfilling the traditional administrative role of center director, the new position carries an instructional component. As director, I must teach one course per year in my area of expertise, in this case German or French language, and must design and hold a series of faculty development workshops covering a variety of topics in instructional technology.

According to the Department of Education's 1993 paper, "Using Technology to Support Education Reform", the challenges faced by today's faculty include:

- Learning to use a variety of technology applications;
- Using, adapting, and designing technology enhanced curricula to meet students (sic) needs;
- Expanding content knowledge;
- Taking on new roles; and
- Responding to individual students.
  (Means, 1993, http://www.ed.gov/pubs/EdReformStudies/TechReforms/chap4c.html)

Furthermore, Kassen and Higgins (1997) include the following necessities in their list of requirements for faculty development programs:

- Establishing a comfort level with technology;
- Integrating technology into the curriculum;
- Developing the critical skills to use technology effectively. (p.264)

These are the criteria to which I adhere in designing my faculty development workshops. In this first year of the new directorship, most of the workshops will illustrate elements of computer-enhanced instruction. In later workshops, such topics as using audio and video resources in the foreign language classroom will be addressed. The first three workshops I conducted concentrated on uses of Microsoft PowerPoint in the foreign language classroom. Other workshop topics include a series on teaching with the World Wide Web and hypermedia, web course delivery software, html editors and other web development software, authoring programs and courseware creation, and how to work effectively with email and discussion groups. My intention is to provide the foreign language faculty at the University of South Carolina with as much variety and as many topics as possible in the workshop series so that they will be able to decide for themselves which applications fit best into their curricula and teaching styles.

The Workshops

Workshops are set up in the following manner: notices are sent out a month in advance of each workshop, and faculty members are asked to sign up to participate. Attendance is generally capped at ten so that there is adequate time and space for each participant to receive individual attention. The workshops are held in the Foreign Language Learning Center Computing Lab. Participants each work on their own computer, and, depending on the subject of the workshop, are able to choose between PC and Macintosh

platforms. The instructor machine is connected to a MediaPro LCD projector, and the desktop image projected onto a screen. Workshop participants are asked to follow along with the instruction for the first half of the workshop, and are then "turned loose" in the second half and encouraged to work on their projects on their own. This format has proven to be the most effective in helping faculty to master new software applications. The hands-on structure of the workshop allows them to follow along with the instructor step-by-step, and to learn the basic functions of the new program. Having them subsequently work on their own allows them to learn for themselves further capabilities of the new program while at the same time permitting them to create language-specific materials that they can use in their teaching. Each workshop is tailored towards foreign language faculty and their specific needs. For example, PowerPoint and Web-design workshops include modules covering foreign language fonts and Web-based information sources for individual languages and cultures.

One of the more important aspects of incorporating new technologies into the foreign-language classroom involves identifying student needs and subsequently tailoring the use of technology to them. For example, the student who is a visual learner will likely respond more positively to a multimedia-based grammar lesson that includes several colorful illustrations, while a student who learns a language more easily through aural channels may prefer an application with plenty of audio examples, and so on. The workshop series takes these particularities into consideration and illustrates teaching techniques that utilize several media. Individual professors are free to design their projects using as many or as few media types as they wish. Naturally, in the area of foreign language instruction, audio is the most commonly utilized medium. Video, too, is becoming more and more popular as MPEG cameras come down in price and products such as Real Networks' Real Publisher make digitizing video easier. Naturally, the more media types an instructor can include in her educational materials, the more students she will reach and, thus, assist in language acquisition.

Evaluation

An important aspect of any educational venture is ascertaining whether, in fact, the material covered by one's students is actually learned, and, in the case of faculty development, subsequently used by instructors in their classrooms. In order to measure these criteria, the following questionnaires are distributed to workshop participants, a) immediately after the workshop (Fig. 1), and b) at the end of the semester following the workshop (Fig. 2):

1=agree strongly 2=agree 3=disagree 4=disagree strongly 5=no opinion	
Question	**Av. Response (24 Respondents)**
The workshop was helpful to me.	1
I will use the technology covered for my teaching.	1.5
The material covered was easy to follow.	1.16
I would recommend this technology to my colleagues.	1
I would like to learn more about the technology covered.	1.3
I plan on incorporating more technology into my teaching.	1.3

Figure 1: Questionnaire A – distributed immediately after the workshop.

In which workshop(s) did you participate?

1=agree strongly 2=agree 3=disagree 4=disagree strongly 5=no opinion

I have used the information learned in the workshop(s) I took.

I used the project(s) I produced in the workshop(s) in my teaching.

I regularly use multimedia in my classroom

Since taking the workshop(s), I spend more time in the Language Center.

I encourage my students to submit their assignments electronically.

I require my students to work in the Language Center.

My students receive an orientation to the Language Center each semester.

I plan to continue using technology in my teaching.

I plan to take more instructional technology workshops.

Figure 2: Questionnaire B – distributed at the end of the semester following the workshop.

As the workshop series has only been ongoing for one semester, questionnaire B has not yet been distributed to foreign language faculty. Initial results of questionnaire A are promising, however, and workshop attendance has progressively increased throughout the course of the semester. While the results of these surveys do nothing to indicate the efficacy of the various technologies used, one must recall that the ultimate goal of these questionnaires is to ascertain whether foreign language faculty are increasing their use of technology both in terms of quantity and variety. Accurate measurements of technology's effectiveness in improving language learning are notoriously difficult to attain (see Ehrmann 1997 & Trotter 1999), and will not be sought in this series of evaluations.

Conclusion

Traditionally trained foreign language faculty must be given the opportunity to develop their teaching skills in a non-threatening environment where support is available if it is necessary, and where creativity is encouraged and appreciated. All too often, faculty balk at attempting to incorporate technology into their curricula because the amount of technology available is too staggering and the amount of time necessary to learn it is simply unavailable. A program like that currently in place at the University of South Carolina removes some of the unknowns that prevent many instructors from introducing technology into their courses by letting them take the technology for a "test drive" ahead of time. Teachers are free to use the technology introduced according to their own personal instructional needs and wishes. Moreover, while individual departments often hesitate to purchase equipment such as scanners and digital cameras along with large presentation programs for only a few interested faculty, housing such tools in a central location such as the Language Learning Center, allows faculty from all language departments access to them when they need it. Ultimately, I hope that all foreign language faculty at the University of South Carolina will feel comfortable enough with instructional technology to make it a part of all of their courses. In the meantime, it is encouraging to see language professors attending the workshops, working in the faculty development center, and taking an interest in what they can do with technology in the classroom, as

well as what technology in the classroom can do for them.

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Fostering Divergent Thinking in the Mandarin Language Classroom through IT-Enhanced DRTA

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Abstract: Directed Reading Thinking Activity (DRTA) is a teaching strategy used in English language classrooms through using predicting questions to enhance students' thinking. Since it is very important for Mandarin language teachers to incorporating thinking into classroom activities, so students can analyze, synthesize, and evaluate information, instead of just drilling information. We conjecture the DRTA can also be used for the Mandarin classroom activities. In this paper, we first describe how the DRTA can be used in the Mandarin classroom to foster students' divergent thinking with the integration of IT tools. Secondly, we will discuss recommendations for implementation of this approach.

Introduction

Directed Reading Thinking Activity (DRTA) is a teaching strategy developed for enhancing students' thinking in the English language classroom. We conjecture it can also be used for the Mandarin language class. In this paper, we explore how DRTA can be used in the Mandarin classroom and how IT tools can be used to enhance this strategy and thus students' divergent thinking.

Singapore is a multi-cultural society and English is the main vehicle of communication among different ethnic groups (e.g., Chinese, Malay, Indian, Eurasians). Also, being an international business center, English is the most common language used in the commercial sector. In Singapore schools, according to Soh and Chia (1997), English is the primary medium of instruction for its practical value, and the mother tongue (i.e., Mandarin, Malay, or Tamil languages) is taught for its cultural significance.

On the issue of learning the Mandarin language, many people still perceive it primarily to be a process of information receiving. This approach has been effective for exam-driven type of learning. Pupils learn the Mandarin language by memorization, accept what they are told and do not ask many questions. However, in this learning process, little thinking is fostered, especially divergent thinking (Chen, 1998). Research has shown that pupils who did well in the curriculum-based tests fail to perform well on life-based

tests. One possible explanation of this discrepancy is that "Mandarin language lessons tend to be more teacher-centered than student-involved" (Soh & Chia, 1997, p. 82).

Lin (1997) suggested that one way to move from teacher-centered to student-centered pedagogy is to encourage students to think actively. Through active participation in the thinking process and by expressing their thoughts using Mandarin in a lively way, pupils can improve their mastery of the language, and develop their thinking ability. Therefore, it is important for Mandarin language teachers to incorporate thinking strategies (e.g., DRTA) into their Mandarin language lessons.

In addition, IT is perceived as a potential tool to encourage and promote pupils' thinking (Jonassen, 1996). This article proposes an IT-enhanced DRTA that can be used to foster students' divergent thinking in the Mandarin Language Classroom.

In this paper we first introduce what DRTA is. It is followed by the discussion of potential limitations of implementing DRTA in the Mandarin language classroom. We then suggest two IT-enhanced solutions for DRTA. Finally, recommendations for implementation of this approach are discussed.

Directed Reading Thinking Activity (DRTA)

One of the strategies used by Singapore English teachers to develop students' thinking is DRTA (Tan, 1996). The DRTA is a group comprehension activity that emphasizes the use of predictive questions at the beginning of a story and throughout the reading process (Stauffer, 1980). Many researchers agree that predicting is a fundamental part of the process of comprehending and it should be a strategy regularly used in reading discussions (Person & Fielding, 1991). The DRTA involves breaking a story into sections, and students are encouraged to predict possible outcomes before reading selected sections in the story. Students are encouraged to make use of story clues, own life experience, and prior information. After the prediction, students read the story to prove or modify their hypotheses.

In contrast with traditional comprehension questions which students have to look backward into a story, DRTA increases children's motivation to read because it arouses their curiosity and involves them actively in discussing it, rather than simply answering a teacher's question about the story. Specifically, potential benefits of using DRTA are threefold (Temple & Gillet, 1996):

- Foster divergent thinking at the outset (title, illustrations, or small parts of the text)
- Develop convergent thinking as more information unfolded
- Develop inferential and critical thinking throughout the process

Potential limitations of using DRTA in Singapore Mandarin language classroom

Although DRTA is good strategy for fostering students' thinking in English language classroom, there are some potential limitations of using the DRTA in Mandarin language classroom:

- Large class size causing lack of divergent thinking
  The average class size in Singapore primary school is forty students per class. In the predicting stage, if the teacher has to write down all the possible predictions, it will be quite time-consuming. Hence, most students may remain silent because the class size, and the time-limitation only allows the teacher to write out a few predictions on the blackboard. This would defeat the training of developing divergent thinking.

- Students' prior access to stories leading to lack of motivation
  The use of DRTA is currently adopted in Singapore English Language classrooms. The materials are pre-printed onto the students' worksheets booklet known as the PET'S worksheet. In English Language classroom situation, some faster readers are able to read ahead and know the whole story while they are waiting for the slower ones to complete the required paragraph. The nature of using predicting in DRTA is totally killed when the students already know what will happen next in the story.

IT-enhanced DRTA

IT is perceived as a tool which provides students with opportunities analyze, synthesize, and evaluate information in new ways. The tool may offers students practice with certain cognitive strategies for making use of information. These strategies may be important for developing students' thinking (Sheingold, 1991). The following points discuss the use of IT tools to enhance the effectiveness of DRTA in CL classroom:

- Fostering divergent thinking and promoting active discussion
  The SmarttSchool system is classroom management software. It allows the teacher to broadcast multimedia materials to one, selected or all students. The Mandarin language teacher may pair up the students for discussion and keying in their predictions using the same terminal. The teacher can easily view and project the students' computer screens onto all students. At that moment, all students can view other students' predictions and the teacher may ask students to elaborate or explain their thinking behind their predictions. Through SmarttSchool, the teacher could involve more students in the discussion. Therefore, development of divergent thinking is greatly enhanced through the multitudes of variations in the predictions from students, instead of the three or four using the traditional chalk and board approach.

- Restriction of student access to stories to sustain students' learning interests
  PowerPoint is a multimedia presentation package that allows teachers to produce their presentation slides including in a variety of formats, such as graphics, texts, sounds, video clips, or animations. Using PowerPoint would be a solution for preventing the students reading ahead and knowing the 'standard answers'. The story would not be printed on the students' worksheet, but stored in the teachers' computers. The teachers would present the story, already broken up into different slides through the PowerPoint and show the students only the slide they are required to read. This would maintain students' learning interest on the 'suspicion' of the story while they eagerly predict the next outcome.

Recommendations for Implementation

In order to use IT-enhanced DRTA successfully in Mandarin classroom, there are a number of recommendations for Mandarin teachers to keep in mind (Temple & Gillet, 1996).

- Prepare prerequisite computer skills and knowledge
  The teacher should have PowerPoint and Chinese word processing skills and knowledge. S/he should ensure that students are familiar with Chinese input, so they can key in their answers into their terminal.

- Select fiction rather nonfiction
  It is more difficult to ask pupils to predict what might happen next with nonfiction than in fiction, because the nonfiction is organized differently from fiction. Instead of encouraging pupils'

predictions, the teacher wants them to recall and organize what they already knew in nonfiction. Therefore, the fiction is more appropriate for the DRTA.

- Prepare key questions for prediction. Table 1 lists some key questions for predictions.

Stages	Key questions to ask
Look at the title	What might this story be about? Will it be a true story? How can you tell? How can we find out if our predictions are correct?
Look at the illustrations	What do you think now? Do you still think it is a ....? What might you find out by reading this story?
After reading one section of the story	Where does the story say that your predictions are correct? Do you like what the author is doing with the story? Would you like to change any part of the story? What would you write next if you were the author?

Table 1: Key questions to ask at different stages

- Ensure students work collaboratively
  After presenting a question for prediction, the teacher should instruct students to think about possible answers to the question for one minute roughly. Then the teacher pairs the students up and instructs students to discuss in pairs and key in their answers on their terminals. The teacher may ask students to elaborate or explain their thinking behind their predictions.

- Accept all predictions without adding any evaluation
  The teacher should not indicate which predictions are better than others. "Guessing right" is not necessary in the predicting. It is more important for students to come up with possible and reasonable alternatives

- Should not use value terms
  Instead of using terms, such as right or wrong, the teacher may use likely, unlikely, or confirmed.

- Respond positively to all students' efforts
  Most of Singapore students feel predicting is quite risk-taking. If the teachers can keep giving reinforcement for taking risk of making predictions, students will be more willingly to do it again.

- Have a postreading discussion
  It is important for students to do reflective thinking after a story is completed. Students may evaluate strategies how the group used story clues to make predictions.

- Plan follow-up activities.
  The follow-up activities could be comprehension questions, or ask students to identify events in the story in the chronic order by doing a story map.

- Use audio clues and hyperlinks for comprehension
  Inserting story audio allows students to recognize the pronunciation of the word to enhance their reading comprehension. In addition, using hyperlinks within the text, teachers can explain difficult words which students may face, so students can concentrate on the meaning of the passage.

Conclusion

In Singapore schools, traditionally, most students learn Mandarin language through rote learning, so that they may perform well in tests and examinations. However, this approach focuses less on divergent thinking and application of the Mandarin language outside the school context. Hence, it is very important for Mandarin language teachers to incorporating thinking into classroom activities, so students can analyze, synthesize, and evaluate information, instead of just drilling information. With the integration of IT tools, the DRTA has a high potential be used effectively in Mandarin language classrooms to enhance students' divergent thinking through active participation.

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Learning on the Web or Learning through the Web

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Abstract:
It is not difficult to see why the World Wide Web is the latest technological favorite of the educational literature and educational policy makers. Here is a media that can be used as a library, a publishing house, a television, a television broadcast station, a radio, a radio broadcast station, a postal service, a telephone, and as an interactive practice quizzing station. The diversity of the Web is awesome. But to what extent is the Web being used to learn in new ways and to what extent is the Web merely a case of old wine being packaged in new bottles? To ascertain the difference the Web is making in the learning process, this paper will examine the use of the Web in two technology rich classrooms, one a foreign language classroom, the other a history classroom.

Introduction

Networked communications have a fascinating pedigree. In 1961, Leonard Kleinrock published a paper entitled "*Information Flow in Large Communication Nets*". The paper essentially introduced the idea of networked communications on computers. Four years later Thomas Merrill and Lawrence Roberts set up the first WAN (Wide Area Network) between the MIT Lab and a California organization. In that same year, Ted Nelson also introduced the word "hypertext". Four years later, in 1969, the first ARPANET was created between Stanford, the University of California at Los Angeles, the University of California at Santa Barbara, and the University of Utah. In 1971 ARPANET grew to include 15 sites and in 1973, ARPANET expanded to include two international nodes: one at the University College of London in England and one at the Royal Radar establishment in Norway.
Even with an international networking of computers, no one was yet speaking of the Internet. The term Internet was first used in a scientific paper in 1974 (Cerf and Kahn). Then the break-through. In 1989 at the European Particle Physics Laboratory (CERN) in Geneva, the British computer scientist Tim Berners-Lee developed a protocol that he

called the World-Wide Web. The growth of the Web has been astonishing. In 1994 the number of pages on the Web grew at a mind-blowing rate of 341,634% per year (Anderberg 1999). The advent of Web browsers such as Netscape and Microsoft's Internet Explorer really opened up cyberspace. In the fall of 1994, there were somewhere around 10,000 Web sites around the world. By 1998, there were over 10,000,000!

For the last two decades, educational literature and educational policy makers have been singing the praises of computers. By 1992, speeches stressing the necessity of introducing computers in schools had already become firmly anchored in the political landscape as the President's National Education Goals and AMERICA 2000 Education Strategy makes clear. The goals of that program emphasize the importance of

> Preparing this nation's youth to be productive and thoughtful adults, able to compete successfully in a global economy and to exercise the rights and responsibilities of citizenship, is a key objective of the President's National Education Goals and AMERICA 2000 Education strategy. Achieving this objective will require education students in the uses of computers and other new technologies which are opening career possibilities unheard of just a few years ago.
> (U.S. Department of Justice 1992: 2)

American governmental organizations have invested heavily in the effort to place computers in the nation's schools. "There was a time when computers were a luxury item for American schools, but that time has clearly passed." (Bangert-Drowns, Kulik, and Kulik 1985 - cited from Cotton K. nd). The use of microcomputers first expanded rapidly during the 1980s (Cotton K. nd). Between 1981 and the end of the decade American schools acquired over two million microcomputers. The placement of computers in schools has escalated even further since. In 1988-89, there was one computer for every twenty-two students in America's schools. By 1995, there was one computer for every twelve students (Hayes & Bybee 1995).
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The Internet is the latest technological favorite of the educational literature and educational policy makers. In 1996 President Clinton made schools' connection to the Internet a national priority.

> In our schools, every classroom in America must be connected to the information superhighway, with computers and good software, and well-trained teachers. .... I ask Congress to support this educational technology initiative so that we can make sure this national partnership succeeds.
> (President Clinton 1996)

Clinton's Internet initiative has had mixed results. Internet access in public schools increased from 35 to 78 percent between 1994 and 1997. That said, Internet access in classrooms falls far short of Clinton's hopes. In the fall of 1997, only 27 percent of instructional rooms had Internet access (National Center for Educational Statistics 1998).

It is not difficult to see why the World Wide Web is the latest technological favorite of the educational literature and educational policy makers. Here is a media that can be used as a library, a publishing house, a television, a television broadcast station, a radio, a radio broadcast station, a postal service, a telephone, and an interactive practice quizzing station. The diversity of the Web is awesome. But to what extent is the Web being used to learn in new ways and to what extent is the Web merely a case of old wine being packaged in new bottles?

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"Historically, as Marshall McCluhan often reminded us, we tend to fill a new medium with old content. Early films seemed like recorded plays. Television was treated like illustrated radio. Word processors were thought of as fancy typewriters (i.e., as still working on paper documents." (Marcus 1999). The differences that the Web makes in education may be characterized as the difference between learning *on* the Web and learning *through* the Web. In learning on the Web, students and teachers use the Web much as they would use another vehicle. A game of concentration placed *on* the Web to drill French vocabulary items might be an example of learning *on* the Web. The exercise merely replicates a game of concentration that might be played with cardboard French vocabulary cards. In learning *through* the Web, students and teachers use the Web in quite a distinct way that is not easily replicable through other media. Take the game of French vocabulary concentration again. If that Web-based game pronounced the vocabulary items each time they came up, it might be offering students something quite distinct, namely an interactive, multi-media resource with both a visual, textual, AND audio component.

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To better ascertain the difference the Web is making in the learning process, this paper will examine the use of the Web in two technology rich classrooms, one a foreign language classroom, the other a history classroom.

Use of the Web as a library-like resource center

The use of the Web as a library is almost certainly the most common use of the Web and the experiences of the French classroom and the history classroom are quite similar. The traditional French and history classrooms rely almost completely on textbooks. The Web-connected French and history classrooms do not even use a textbook. Instead, they rely primarily on resources available through the Web.

Does this use of the Web as a library fall into the category of learning on the Web or learning through the Web?

Almost certainly the greatest impact of the Web on the history classroom experience has been in the breadth of materials students have to draw from. For instance, in the history class, the Web enable students to carry out in-depth examinations of 18th and 19th century explorers that would otherwise have been possible only with access to a fairly sizable college library. In particular, the Web enabled students to study half a dozen female explorers of that period, women assuredly less important in their immediate impact than many of their male contemporaries, but on the whole, far more remarkable and intriguing.

Perhaps more noteworthy, though, are the individualized learning experiences the Web has allowed. Rather than being limited to four core eighteenth, nineteenth, and twentieth century explorers about whom a school library has sufficient resources, there is now sufficient information to sustain studies of two dozen explorers. Students can choose who they wish to study and tailor their studies to their interests. Thus, a student intrigued by Asia might choose Sir Edmund Hillary, while a student with her eye on Africa might choose Mary Henrietta Kingsley. Finally, the Web seems to allow far greater adaptability to multiple intelligences than would otherwise be available.

A significant advantage of using the Web as a library in French class is that it offers extensive access to complete, authentic texts as opposed to "prefabricated" texts that give a false sense of the language and culture. The use of the authentic texts – and lots of them – provides exposure to a full range of authentic cultural experiences in the foreign language.

A second significant advantage of using the Web as a library in French class is that it compensates for the fact that the normal American school library will have few texts written in a foreign language. Teachers and students can now access complete French literature texts as well as secondary literature in a mouse click. See for example, the primary and secondary sources on Jean-Jacques Rousseau's *Confessions* at http://www.lettres.net/confessions/

A third significant advantage of using the Web as a library in French class involves the dynamic features of the Web. The Web creates more discovery-based opportunities than a conventional foreign language textbook offers. For instance, in one French class, the teacher created a web page with two frames. One frame contained the authentic text, the other frame contained questions that help students to pick up linguistic and/or cultural information embedded in the authentic text. An activity using this two-framed method to introduce a unit on hotels may be found at
http://faculty1.caryacademy.pvt.k12.nc.us/fabienne_gerard/cyberbook/activits/hotel/carlton_hotel.htm
An activity created to introduce a unit on politics may be found at
http://faculty1.caryacademy.pvt.k12.nc.us/fabienne_gerard/cyberbook/activits/politique/inst_default.htm

A fourth significant advantage of using the Web as a library in French class revolves around the interactivity features of the Web being used to provide quick translations. See for instance the document from AZURLINGUA de Nice et le CIEL de Brest at http://www.bonjourdefrance.com/n4/a11.htm .

Use of the Web as a teacher and student publishing house

The Web offers a rich variety of media for students to present their understandings of material. Thus, in both the history and French class, students might make a presentation on their understanding of explorers in a variety of media. One student might create a PowerPoint posted on the Web about his explorer. Another student might create a radio show reporting on the challenges faced by the explorer and on the explorer's triumphs and failures. A third student might create a pretend radio interview with the explorer for broadcast over the Web. A fourth might create a photojournalism essay on the explorer and post it on the Web. A fifth might even create a conventional essay and post it on the Web. What one sees here is a case of the Web offering the unique ability to cater to students with multiple intelligences.

The Web seems to be extremely effective as a publishing house for teachers to present assignments and supplementary materials.Ê Both French and history classes present their homework and supplementary materials on web pages. This use of the Web helps students do their work. Students lose handouts. Fifteen years ago, the in-item on school campuses was something called a Super Trapper, a Velcro notebook that promised never to lose one's papers. One might think of the Web as the ultimate Super Trapper.

Many teachers also use the Web to publish what might be thought of as flat activities, that is activities without hyperlinks and that need to be printed to be completed. These flat activities are particularly prevalent in foreign language classrooms. Examples of flat activities may be found below.

Find the errors!	http://www.ergonet.com/sdl/ques.html Sans Faute! Service de dépannage linguistique (SDL)
Fill-in-the-blank	http://www.class.csupomona.edu/efl/french103/pronoms2.html California State Polytechnic University Ponoma
Reading comprehension	http://www.acelf.ca/of-texte/0371t.html Ministère de l'éducation (Ontario)
Crossword	http://dspace.dial.pipex.com/town/square/fk26/xwords/french/home/html/home5/french5.htm (Alcester Grammar, UK)

Use of the Web as a radio, an audio archive, a television, a video archive, and a visual museum from which to draw information

The Web is a multi-media resource. In French class, students make particular use of online audio archives and online radio broadcasts to enhance students' skills in aural comprehension. In history class, students use audio materials found on the Web for entirely different purposes. For instance, students use the Web to listen to recorded speeches and songs such as the *Marseillaise*. These uses of audio bring the history alive, though their role in many cases merely replicates that of a CD player. That said, the Web does offer the unique opportunity for students to practice materials introduced in class at home. For instance, history students in one class are required to memorize the Marseillaise in French and to sing it to the Berlioz tune. They can only get sufficient

practice to do this effectively by listening to the music through a connection to the World Wide Web from home.

The quality of video broadcasted over the Web is of less help at present as video broadcasts are still of rather poor resolution. Nonetheless, videos are of some use in foreign language classrooms where they help students' develop their skills in oral comprehension. This is especially important in that it allows students to work on their oral comprehension at home through a connection to the Web. Videos available on the Web are also excellent transmitters of cultural information. One French class has made use of a video clip of a Renault commercial that shows the sorts of cars people drive in France. An example of useful video clips filmed and posted by a teacher may be found at Marie Pontario's terrific web site at http://www.cortland.edu/flteach/civ/vacance/vacan.htm)

Both the history and French classes make extensive uses of the Web as a visual museum from which to draw information. When studying World War I, for example, history students look at Expressionist paintings posted on the Web to get a better understanding of the disillusionment that followed the war. In French class, the web pages of French clothing designers help students expand their vocabulary, as well as to develop that all-important French sensibility for fashion.

Use of the Web as a radio station or television station to broadcast information

The web may also function as a radio station or television station used to broadcast information. Few history or French teachers seem to have made many recordings of moving video images for their classes. Similarly, history teachers seem not to make many audio recordings for their classes. By contrast, foreign language teachers seem to make extensive use of this recording capability. Foreign language teachers frequently use the audio recording feature to record morphemes, phonemes, isolated vocabulary items, and texts. For examples, see Léon's web page at http://www.jump-gate.com/languages/french/french1.html, Gérard's at http://faculty1.caryacademy.pvt.k12.nc.us/fabienne_gerard/voca/novice/chp1.htm, or Scheffel's at http://anarch.ie.toronto.edu/people/patrick/site/html/SimpliciteQCM.html

Use of the Web as an interactive practice quizzing station

The Web may function as an interactive practice quizzing station. "Interactivity" is defined here as a dialog activity between the user of the computer and the machine itself through a screen. Once again, foreign language teachers find themselves using a technology little used by history teachers. In French class, multiple choices, fill in the blanks, and matching activities make use of the interactivity offered by the Web. All those activities give immediate feedback to the students. The feedback can be more or less extensive. The feedback might simply note whether the response was right or wrong. The feedback might provide the correct answer. Or the feedback might give not only the correct answer, but also an explanation for why that answer is correct. The advantage of these activities is that the student can have an independent language learning-experience.

Some examples of **multiple choices activities in foreign language may be found at the pages below.**

	with explanation	http://pages.infinit.net/jaser2/gramm11b.html Ê (Mr.Jaser)
	with answers + score	http://www.quia.com/quiz/10787.html (QUIA - Sandra Howard)
	with answers + score	http://www.nyp.ac.sg/fl/fl_fx010.htm (Nanyang Polytechnic)
	with explanation	http://pages.infinit.net/jaser2/AccAdjEpith.html (Nanyang Polytechnic)
	reading comprehension	http://www.nyp.ac.sg/fl/fl_fx027.htm (Nanyang Polytechnic)

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Some examples of fill-in-the blank **activities may be found at the pages below.**

	with answers	http://strindberg.ling.uu.se/call/french/persa06.html (Uppsala University)
	with correct answer	http://www.nyp.ac.sg/fs/fs_hxex3.htm (Nanyang Polytechnic)
	whole sentences	http://www.nyp.ac.sg/fl/fl_fx008.htm (Singapore Institut)
	crossword	http://www.nyp.ac.sg/fl/fl_fx013.htm (Nanyang Polytechnic)
	with pictures	http://www.nyp.ac.sg/fs/fs_hxex5.htm (Nanyang Polytechnic)
	words in context	http://www.cortland.edu/flteach/civ/ecoles/ecoles.htm (Marie Pontario)

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ÊÊÊSome examples of matching activities may be found at the pages below.

	right or wrong	http://www.nyp.ac.sg/fl/fl_fx021.htm (Nanyang Polytechnic)
	with pictures	http://pages.infinit.net/jaser2/PpavDessin.html (Jaser)
	images + words	http://www.bbc.co.uk/education/languages/french/index.shtml (BBC)
	Find words	http://www.quia.com/custom/4093sear.html (QUIA)
	Oral production	http://pages.infinit.net/jaser2/OrdIm.html (Jaser)

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Conclusion – Nouvelle Avenue or Vieille AvenueÊ?

In many ways, the World Wide Web has mimicked old ways of learning and teaching, but done so in ways that make the learning and teaching process somewhat easier. The use of the Web as a library, the posting of homework and supplementary materials on the Web, the use of the Web for so-called flat activities, the use of the Web for drills, and the use of the Web as a visual museum are all examples of how foreign language and history classes have merely married old ways of learning with a new technology.

In many other ways, though, the information highway created by the Web has opened up new avenues of learning and teaching. The use of authentic texts on the Web, the use of a range of texts which would not otherwise be readily available, the use of audio and video archives available through the Web, and the broadcasting of phonemes,

morphemes, and vocabulary items on the Web are instances in which the Web has transformed not only what may be learned, but more fundamentally, how it may be learned.

Thus far there has been more learning *on* the Web in history classes and more learning *through* the Web in foreign language classes. This may not always be so. The use of the Web by teachers and students is constantly changing. As Seymour Papert remarked, "[i]n the presence of computers, cultures might change and with them people's ways of learning and thinking." (Papert 1993: 23).

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I-Maestro: Adaptive Writing Instruction via the Internet

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Abstract: I-MAESTRO, part of the suite of tutors developed by the Fundamental Skills Training Project, is an intelligent tutoring system designed to deliver adaptive, individual training to increase writing competencies anywhere, anytime via the Internet. I-MAESTRO is an adaptive, supportive learning environment for strengthening the critical thinking skills associated with varying writing tasks. Its comprehensive instructional approach provides instruction in the three stages of the writing process: prewriting, drafting, and editing. While this instruction takes place, the computer-based tutor provides individualized adaptive advice at critical points in each workspace. Incorporating motivational features that address individual characteristics such as learning styles and interests, I-MAESTRO presents dynamic interfaces, tailored instructional modules, and tutoring advice statements. The student's writing process is monitored and coached by an intelligent advice system. I-MAESTRO supports expository, persuasive, research, and practical (business letter, cover letter, memo, and e-mail) writing styles with over 100 challenging, multi-media writing assignments.

Introduction

In recent years much attention has been spent researching the effectiveness of implementing educational technologies, especially distance learning/education. Primarily the effectiveness studies have consistently demonstrated that when used in business, military training, and adult learning, there is no significant difference in effectiveness between distance learning and traditional instruction methods, and student attitudes are generally positive about the experience (http://www.usdla.org/). However, most of this research has been conducted at the collegiate level. Unfortunately, the majority of the efficacy research conducted in the K-12 population has been extremely limited. The existing research, project evaluation, and anecdotal evidence on this population strongly suggest that distance education, in the appropriate environment, is an effective means for delivering instruction just as it has been proven effective in adult learning and training settings (http://www.usdla.org/).

In 1998, with distance learning gaining recognition and accreditation, the Air Force Research Laboratory and the Department of Labor Employment and Training Administration (DOLETA) began a collaborative effort to develop, evaluate, and transition/transfer adaptive Internet-based training systems. Motivated by three related national-level initiatives including the Department of Defense's Advanced Distributed Learning Initiative (ADL), the America's Learning eXchange (ALX) project, and the Instructional Management System (IMS) project the Air Force's Sustainable Intelligent Training Systems for Global Mission Applications (SIGMA) project was created. SIGMA seeks to provide instructors with the availability of Intelligent Tutoring Systems (ITSs) delivered via the

Internet that have been developed on sound theoretical framework, has proven results, offers instructors in the high schools and Job Corps Centers with a form of distance learning, and provides learners with the opportunity to "learn anywhere anytime."

Background

Since 1990, the Air Force Research Lab and the University of Texas at San Antonio, have been engaged in a long-term research project (Fundamental Skills Training Project) to bring state-of-the-art intelligent tutoring technology to bear on our nation's growing literacy skills problem in areas such as mathematics, writing and science. After nine years of evaluation of the local-area- network (LAN) based intelligent tutor systems, The Word Problem Solving Tutor (WPS), Maestro: the Writing Tutor, and the science tutor, (Instruction in Scientific Inquiry Skills) the Air Force has begun a new endeavor to develop intelligent tutoring systems which are delivered via the Internet.

Software Description

I-Maestro is a student-oriented writing process tutor that facilitates learning through a series of instructional presentations and writing process workspaces. Students complete the assignments in workspaces that, when properly used, help the student acquire the skills underlying effective composition (including goal-setting, generating and organizing ideas, generating a writing plan, drafting, revising, and publishing). I-Maestro guides the learner through the writing process by scaffolding expert support. During use of the I-Maestro composing workspaces, the student's writing process is monitored, and the student is coached by an adaptive advice system.

I-Maestro includes: 1) tailored instructional modules (TIMs) that are adaptive to the interests and learning styles of individual students for each stage of the writing process; 2) student-controlled workspaces designed to facilitate the development of skills associated with the stages of the writing process; 3) situated assignments that help motivate the students to use the workspaces by using multimedia-based realistic writing tasks; 4) an adaptive advisor that tutors the students by providing diagnostic advice, selecting appropriate TIMs, managing workspaces, and monitoring student progress during assignments.

Advantages of an Internet Writing Process Tutor

I-Maestro has the same instructional approach as the LAN version. In addition, I-Maestro has the capability to deliver adaptive individual training to increase writing competencies anywhere, anytime. I-Maestro operates utilizing a client-server architecture (see Figure 1). The student work is stored on the server side; therefore users can run the software regardless of their location.

I - Maestro

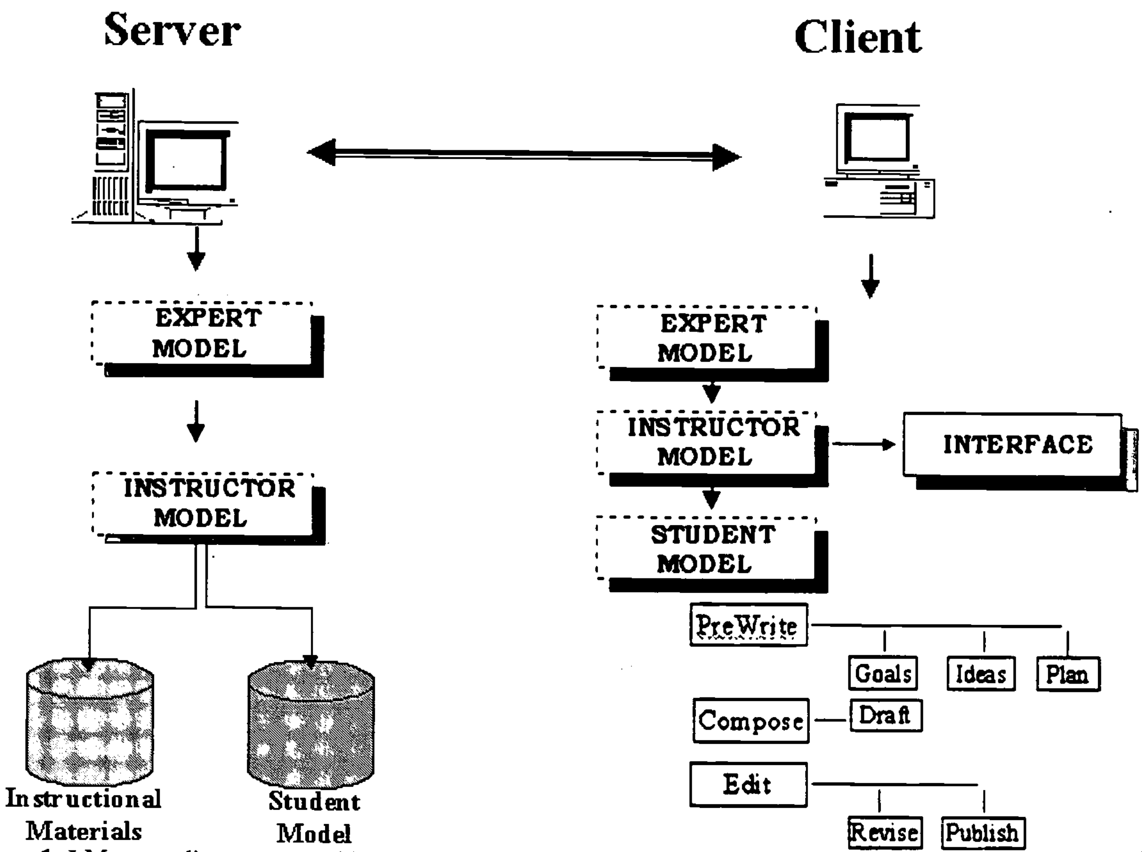

Figure 1: I-Maestro client-server architecture.

Another advantage of I-Maestro is that it is JAVA based and is therefore is a cross platform application. Furthermore, this design is consistent with the ADL initiative which seeks to ensure access to high-quality education and training materials that can be tailored to individual learner needs and can be made available whenever and wherever they are required (http://www.adlnet.org/).

A review of software industry trends indicates that many companies believe that an object-based approach facilitates software reusability needed for the large-scale development and dissemination of powerful and cost-effective applications. These factors are considered essential for the sustained investments necessary to create the kind of dynamic ADL environment that is needed to meet the education and training needs of a 21st century military and national workforce (http://www.adlnet.org/). I-Maestro fits these needs as it platform independent and the software reusable. Currently, it appears that the development of a robust object-based and platform-neutral environment, such as I-Maestro, for distributed learning will become widely implemented over the next 2-5 years.

Lastly, I-Maestro allows teachers to share assignments that they develop. The teacher tool allows the user to add, delete, or modify the assignments in the class lessons. The I-Maestro software also allows teachers to author their own assignments. The instructor may add text files, graphics, or videos to one of the one hundred existing assignments or to one of their own. Teachers will then have the option of uploading the new assignments to a server which will hold a generic pool that will be available for instructors to download and use anywhere anytime. I-Maestro will be distributed with over 100 assignments dealing with expository, persuasive, research, and practical writing assignments.

Implementation

In addition to making this new Internet ITS available to the host of Fundamental Skill Training Sites in the public schools, the SIGMA project has selected a test and evaluation (T&E) sample of 5-7 Job Corps Centers (JCCs) to participate in implementing and evaluating the software. AFRL in conjunction with DOLETA selected the T&E sites so that the entire set has a mix of characteristics. This mix includes student/client demographics, their needs for seeking training, the use and/or availability of technology at that center, and a supportive and cooperative administration towards the use of technology. The current JCCs have each sent two instructors for training and have implemented the three LAN-based FST tutors in those centers. This has allowed the centers to address implementation of technology issues prior to the use of the Internet-based version of the writing tutor. Concurrently, AFRL has been developing and testing the Internet-based version of the writing tutor. After the initial studies, the Internet-based version of the writing tutor will be installed on a Job Corps Data Center server for use by the center instructors and students.

Summary

The development and integration of instructional software has been impeded by many factors such as a lack of standards that would permit sharing across institutions and across a wide range of technical environments (http://www.imsproject.org/). In addition, finding relevant, valuable, and interesting information on the Web is a difficult process due to the lack of an inherent structure or standards for describing available content.

The future of educational software being delivered via the web is dependent on several factors including increasing access, implementing standards, improving quality, and reducing costs of learning environments. Much progress has been made on the hardware side, especially in terms of the global networking potential for linking learners, teachers, and providers of materials and services (http://www.imsproject.org/). What is needed, however, is an increase in the availability of effective distance learning software.

It is through the efforts of the Department of Defense, the White House Office of Science and Technology Policy (OSTP), the ADL initiative and the IMS project that effective software may be created. Software, as guided by the above initiatives, will ensure access to high-quality education and training materials that can be tailored to individual learner needs and can be made available whenever and wherever they are required.

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Department of Defense's Advanced Distributed Learning Initiative (ADL), http://www.adlnet.org/

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The Professor, the Bookie, and Technology: A Terrific Trio for Developmental Reading and Writing Students

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Abstract: Critical thinking serves as the foundation for strong, effective reading and writing. And, as the authors of this paper discovered, technology and electronic library resources are excellent vehicles to improve the critical thinking, reading, and writing skills of underprepared community college students. After a brief overview of research on the interrelationship between and among critical thinking, reading, and writing and a mention of the research on the effectiveness of technology to improve the critical thinking, reading, and writing skills of underprepared postsecondary students, the authors discuss their collaborative efforts to implement this research in the community college classroom. The team also shares some library-based projects that incorporate electronic resources, promote critical thinking, improve reading and writing skills, and foster diversity.

Background Information

The work that the authors do as a team is based on the research that finds that critical thinking serves as the foundation for solid reading and writing skills. They've also based their work on research that demonstrates that building students' fund of general information enhances and strengthens students' reading and writing skills. In addition, their work with developmental reading and writing students stresses the interrelationship between and among critical thinking, reading, and writing. Finally, they began to emphasize and integrate more and more electronic resources into their developmental reading and writing assignments after they read a Chronicle of Higher Education article that touts the Web as an effective tool in developing students' critical thinking and writing skills (McBride and Dickstein, p. B6).

The authors build critical thinking into all their assignments through the use of Benjamin Bloom's taxonomy of cognitive skills (1956). Burmeister's adaptation of this taxonomy (1976) serves as a guide for their research and as a barometer for all their assignments.

Also, early each semester, the Professor introduces her students to Bloom's taxonomy and the need for higher level thinking skills in college and in the workforce. Throughout the semester, she refers to the taxonomy and gives concrete examples of answers, paragraphs, and essays that are or are not written at the higher level of thinking. She begins the classroom work on critical thinking by using a handout that explains Bloom's taxonomy as adapted by Lou Beimeister: memory, translation, interpretation, application, analysis, synthesis, evaluation (pp. 147-148). She stresses that short answers, paragraphs, and essays that demonstrate lower level thinking traditionally receive grades of C- and lower. Finally, she tells students that one way to guarantee that they've completed assignments that reflect higher level thinking skills is to include references outside of themselves in each written assignment. Further, she insists that each written assignment include at least one current event – an example from the news that is no more than six months old. At this time, the Professor suggests that students visit the TIME, Newsweek, Boston Globe, or New York Times websites to find and stockpile current events for future reference.

The team builds students' fund of general information through a wide range of print-based or electronic-based assignments. Both work. However, one of the major benefits of electronic library references is that students gravitate to materials at their independent reading level.

Because the Professor stresses the interrelationship between and among critical thinking, reading, and writing, her writing students often remind her that she's teaching a writing, not a reading course, and her developmental reading students often complain about the amount of writing they're required to do.

Birthday Assignment

In 1982, the Professor developed her very first electronic-based library assignment. The birthday project asks students to find a copy of either The Boston Globe or The New York Times on the day they were born, read it and then either write one paragraph summaries of the front page and two other pages or write an essay that summarizes the front page and two other pages, or write a comparison and contrast essay that compares and/or contrasts the newspaper on the day the student was born and the students' last birthday. This particular project has had many lives. The Professor first introduced it to her developmental reading classes, then to her English Composition I classes, then to her developmental writing classes. She uses this assignment to introduce students to the library and its many resources and to make sure that each student has a library card.

The Professor and Joanne Jones, a senior reference librarian at Massasoit, developed the birthday assignment before the Bookie's tenure at Massasoit Community College began. Their objectives were to incorporate the technology of the time - microfilm - into class assignments, to involve students in locating information, to provide an assignment with student interest, to give students library experience, and to encourage critical thinking.

Considering the giant leaps the form of knowledge has taken over the past few years -- CD's and online sources -- it seems strange now to think of microfilm as "technology." However, this one assignment became so popular with instructors and students alike that it was, and still is, used in many courses at the College.

Newspapers provide a current source of information and are particularly suited to developmental reading and writing assignments. The articles in the papers are short with a lower level vocabulary, giving students early success in their course work. And, for the birthday assignment in particular, the College's newspaper backfiles to 1851, leaving no one's birth date out.

In addition, using the newspapers in the Professor's birthday assignment create interest and a different assignment for each student. On occasion, students find a film reel missing, so the Bookie suggests substituting a different date for the birthday. Because the assignment loses something in this, students prefer a substitute date, a first birthday, for example.

Over the years, Massasoit looked at newer technologies -- CD-ROM's, online sources, subscription services, the Internet, and the Web. Like other college and university libraries, Massasoit had trials with different vendors and discussions about products in the library and at Board of Trustee meetings. Like other colleges and universities, some administrators were not sure that they wanted to spend the money needed on products they saw as relevant only in research universities and libraries.

However, because the librarians and faculty persevered, the College acquired newer technologies - some CD products, online subscription services, and Internet access. As the College acquired these formats, the library staff and faculty saw a rise in student interest. The new technologies did not, however, affect the birthday assignment. There were limited backfiles for the birthday assignment until a few years ago. Now, the Library's CDs and some online sources include access to information back to 1980 - the birth year of the College's traditional entering freshman class!

With this first library assignment, the Professor gives a lesson on plagiarism and citing references using material from Diana Hacker's Rules for Writers (1996) and a lesson on evaluating website sources. All electronic resources must meet the Professor's approval and be turned in with the completed assignment. If the Professor suspects a student has plagiarized, she simply checks the material attached to the assignment. Finding plagiarizers is easy: students who plagiarize usually highlight, underline, or circle the material they're copying.

When the Professor's classes go to the library, the Bookie reinforces the idea of crediting sources. The Bookie also feels strongly that if students search online, they should learn how to tell the difference between good and bad sources of information. Therefore, the team worked with the idea of source evaluation. Although important when using a print source such as a newspaper, evaluation becomes critical when electronic sources are added to the mix. Students need to be fully aware of the idea that online sources provide a vast array of information -- some are not good choices for a college paper; others excellent. While subscription services have a built in safety -- reliability -- as the sources used are recognizable publications, the Web includes information from everywhere and from everyone.

The College's library home page includes a link to several evaluation sites - a good beginning for students. Some Massasoit professors have created evaluation sheets for their classes and the library has put

together, from several sources, an evaluation checklist. Students who carefully evaluate their sources improve their computer skills, critical thinking skills, and their reading and writing skills.

Five-Year Career Plans

The team's second tried, but true and about to be retired library-based assignment focuses on three, five-year career plans. After students complete the Harrington-O'Shea Career Inventory (1998), they select three careers that interest them and research them for the following information: specific career title, education required, area colleges which offer the appropriate courses and/or degrees, skills required, work experience required, demand now and anticipated demand in five years, and annual income now and expected income in five years. Again, this assignment has many lives: the first in the Professor's developmental reading classes, then in her basic writing classes, then in evening English Composition I classes, then back to her developmental reading classes, now in her freshman seminar classes. Although the Professor has had her students write a five-paragraph essay for this assignment -- the three different careers in the body of the essay -- she generally has them write a paragraph for each career. She recently added an interview paragraph and found it so successful that she's decided to incorporate it into the assignment. In this paragraph, the students summarize an interview with someone in their chosen fields that includes the following information: official job title; time in service; required training, education, and experience; personal qualities and skills need for the field; specific responsibilities; salary range; what interviewee likes most and least about his/her job.

As the Professor's career assignment evolved over time, library sources kept pace. From the beginning, the College's library included new career sources in its acquisitions. The College is, after all, a community college and found that, in addition to enrolled students, community groups needing access to career materials used the Library as a resource. The College's counseling center acquired the Discover (1999) database that allowed students to take an interest inventory and skills profile to determine a good career fit. The same database provided career exploration for students.

The library put together a career guide - first for print sources. Then, as the library acquired computers with online capabilities and as the librarians became more and more computer literate, they included both print and online sources to assist students in their career searches. The guides included web addresses that linked students to the online Occupational Outlook Handbook (1999) and the Dictionary of Occupational Titles (1999) The address plug-ins are a safe way for students to explore the web.

National/International Issue

The third library-based assignment revolves around major national or international issues. The Professor asks students to select a major national or international issue that interests them, to read extensively on the subject, to formulate a position on it. Then, students must write a well-organized 350-400-word essay in which they clearly state the issue and argue their position on this issue. Both members of the team caution students that they must base their arguments on fact, not emotion. The facts for their argument must come from at least three newspaper and/or magazine articles, and these articles must be stapled to their papers. Students' essays must include in-text citations and a Works Cited page. Traditionally, this assignment serves as a final examination.

Evaluating Journalists

The next two library-based assignments are relatively new and inspired by Alexander and Lombardi's Community of Readers (1997) and Brenda Smith's, Bridging the Gap, texts the Professor uses with her lower and upper level developmental reading classes. The first – evaluating journalists – received raspberries from students — much too hard and long, they whined until the Professor thoroughly reviewed the difference between fact and opinion and denotative and connotative meaning of words. Also, the team and their students discussed vacuous papers: shallow, hollow, superficial essays and paragraphs. To help students with this assignment, the Professor had the students examine journalists' objectivity and subjectivity by critically analyzing various

newspaper and magazine articles. After much reluctance, students settled into the assignment and submitted, for the most part, well-documented, strong essays.

The Professor's use of newspaper and magazine articles for research in this assignment means a class visit to the library for instruction in the use of our on-line subscription services. This is also a time to reinforce the difference between searching subscription services and surfing the web. When using a subscription service, such as InfoTrac Searchbank, students access information from recognizable sources – the New York Times, U.S. News and World Report, New England Journal of Medicine, etc. When surfing the web by using a search engine, such as Altavista, students access information from familiar and unfamiliar sources. If, for example, a student were to search the term "Y2K" in Searchbank, the results would include an article from the Washington Post entitled "A Glitch That Won't Steal New Year's?" Because the search was done in a subscription service, the student should feel comfortable with the source and the article. However, a similar search using Altavista brought up the "Y2K Survival, Food, Water and Protection Site". This site advertises a one-page "kit" of information, has little information about the author(s) and appears biased. Students are encouraged to use a variety evaluative techniques to assist them in making good choices.

Diversity in the Armed Forces

The diversity assignment, the final library-based assignment discussed in this paper, received an A+ from students. In this assignment, the Professor asks students to use print or electronic library reference materials and research diversity in the US Armed Forces during any three of the following military conflicts: the American Revolution, the Civil War, World War I, World War II, the Korean Conflict, the Vietnam Conflict, or the Persian Gulf Operation. Then, students must write a 350-400-word essay that answers the following question: During each military conflict, did the nation's Armed Forces reflect the diversity of the country?

This is another assignment that uses Web address plug-ins. However, students, accessing the sites, find that there are many links to additional information about their topics. This assignment requires computer skills to move around the web sites and critical thinking skills to determine the relevance of information.

The first time the team used this assignment, the Professor and the Bookie found that students refine something besides their computer and critical thinking skills. When classes visit the Library, there are always more students than there are available workstations. Therefore, the Bookie assigns groups of students to workstations, making sure that each group has at least one computer competent student. In one class, Amelia, an insecure, but computer literate ESL student became the leader in her group and showed others how to manipulate the mouse, where to plug in the web addresses, how to move from link to link, and how to print information. By the end of the period, a beaming, confident Amelia realized that she became a star for that day and the team made its first accidental step into collaborative learning. With the Professor's encouragement, Amelia's confidence at the computer screen transferred to the classroom where she became more willing to contribute and a more successful student.

The Professor, the Bookie, and Technology: The Future

Gradually, the Professor plans to move away from developmental reading texts like Brenda Smith's Bridging the Gap (1997) and Alexander and Lombardi's A Community of Readers(1997) to nonfiction books and a study skills book for her developmental reading classes and a grammar text and nonfiction books for her developmental writing courses. More and more, library-based assignments, specifically electronic reference-based assignments, will serve as the core for all of these courses.

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Writing in 3-d: Using Simultaneous Media to Enhance the Quality of Student Writing

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Abstract: The traditional "process approach" to writing popularized in the early 1970s restricts students to two-dimensional conceptualizations in which the student must translate abstract thoughts into language. Students who are not particularly successful abstract thinkers do not improve the quality of their writing much using this model. Instead of the two-dimensional model, a group of "remedial" adolescents were given the opportunity to compose using a variety of visual, auditory and other sensory appeals. By utilizing stimultaneous media, these "remedial" students were able to transcend the limitations of the two dimensional box and add depth and substance to their writing.

Despite the myriad recent advances in technology, most teachers still follow the process approach to teaching composition made popular through the National Writing Project some thirty years ago. Students brainstorm, draft, peer edit, then turn in their papers for a grade. Obviously, there is much to recommend such an approach. However, as a teacher, even the writing process was not sufficient to reach many of my students, especially those students who seemed to struggle with fundamental aspects of vocabulary and syntax.

For many students, writing is an arduous, frustrating process in which they are constrained by their current grasp of the language and their ability to build words into sentences, then sentences into paragraphs. From years of asking students to revise and reconceptualize their papers, I have come to understand that many students perceive that changing the word *large* to *big* or *brave* to *courageous* constitutes significant revision. For struggling writers, the process of revision seems even more unfathomable. Once when I asked a group of ninth graders to write a paragraph describing a pizza as accurately as possible, one earnest boy named Jake wrote, "It tastes great!"

I called Jake up to my desk and asked him, "If I told you this pizza tasted great, would you know what kind of pizza it was?"

"All pizza tastes great," he said.

"But does it have pineapple on it or does it have pepperoni?" I asked.

"I like sausage and mushrooms," he said.

"Aha! See, I couldn't tell you were thinking of a sausage and mushroom pizza it was unless you told me that with words," I said, convinced that I had finally broken through.

For five minutes, I noticed Jake at his desk thinking and writing. Finally, he brought his paper up to my desk.

"The pizza had sausage and mushrooms on it," is what Jake had written.

Writing in two dimensions

A traditional two-dimensional diagram for the teaching of writing, the one that most teachers use, might look as follows:

Knowledge of the topic, ideas

Text creation

Mastery of syntax and vocabulary

The difficulty with the two-dimensional approach to teaching writing is that it relies upon talents that struggling writers have somehow never managed to develop over the course of their academic careers. To break out

1879

of this routine, we performed a little experiment with a class of juniors in high school that utilized simultaneous media as a way of getting students to truly reconceptualize their thinking about word selection and placement.

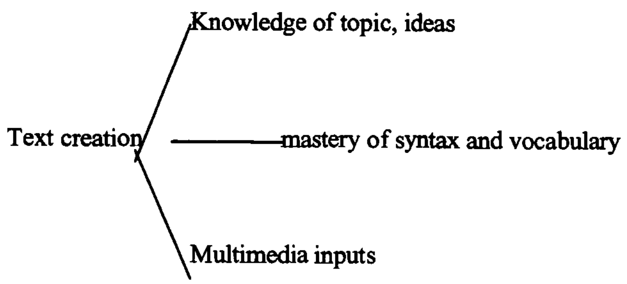
The class with whom we chose to work was the lowest level English class at a high school in northwest Georgia. In terms of standardized test scores, these students ranked in the lowest 20% in the state. Although the class had an enrollment of 18, although only between 12 and 15 students would show up regularly. In this article, we will describe the experiment step-by-step and focus upon the works of two students, Derkis and Titus, who showed up for every period during the two weeks we worked with the class.

Derkis was a short, ebullient, young man who played halfback for the football team. Although he was the smallest player on the team, he carried the ball often and was so successful that he had become somewhat of a celebrity within the school. Although Derkis could be cooperative, he had much energy and would often get out of his seat and walk around the room just to expend energy. Sometimes, he broke into spontaneous raps in the middle of class. His teacher, a smart and innovative man, attempted to get Derkis to put his powers of rap to good use by creating and performing a song based upon Poe's "The Raven," which the class had studied earlier in the year. But, Derkis said that he preferred making up his own songs and declined.

Like Derkis, Titus had some major difficulties with writing and reading. However in addition to his obvious distaste for writing, Titus was one of the worst spellers we've ever seen. Although he seemed to have a relatively sunny disposition, Titus often acted bored and, at times, tried to sleep through class. At the time of the experiment, Titus was the only student in class who had not passed the composition exam with a score high enough to earn him a high school diploma.

The sequence of activities

The idea behind the experiment was to ascertain to what extent students could enhance the quality of their writing through the use of simultaneous media. In other words, we wanted to change the traditional approach to writing so that these students would draw on some of their talents outside of the purely linguistic realm. We wanted the students to write in 3-D. The 3-D approach might be diagrammed as follows:



To get students to write at all, we knew we had to choose a topic to which they could relate, as well as one that they would want to share with one another. Also, we wanted a topic ripe for artistic interpretation, something that could be performed. After some discussion, a scripted poem was created with the topic of HOMETOWN. The format required students to write one line of text per prompt. The prompts were as follows:

Name of hometown
Two verbs that fit it
The landscape (hilly? Dry? Buildings?) – 4 words
Smell/tastes of your hometown – 6 words
Music, song, or sounds that remind you of your hometown – 8 words
King of people who live there – 10 words
An important event in your life – 12 words
Another important even (repeat the previous line if you can't think of anything else) – 12 words
A dream or nightmare – 10 words

An influential person – 8 words
Specific advice – 6 words
Weather – 4 words
Your hometown plus and adjective

After a discussion in which I reiterated that poetry used very descriptive words and pared down expression to the bare bones, I read the prompts aloud one at a time, giving all students ample time to respond before reading the next one. After I'd say the line, I'd write the prompt on the whiteboard as well. Sometimes students asked questions and I walked around the room to see what individual students were writing as they wrote.

When all students had finished the poem, I asked them to share what they had written with two other students. Next, I handed out a purposefully bad poem that I had written about my hometown of Dallas.

Dallas

Big, dusty
Flat and gray land
It smells like a bowl of soup
An old, out of tune guitar that plays
Nice people, old people, smart people, and friends
I got my driver's license there when I was 16 but not before
I got a job that paid me $250 per week part time
A man with an axe was chasing me around a park
My dad used to be 6'5" and mean
Don't do anything stupid, stupid
It's cool
Dallas cools.

I asked students to find all the "wimpy words" in my poem *Dallas* and to suggest revisions.. With students' help, most of the nondescriptive words were replaced with more appropriate terms and some lines were rewritten completely. Then, I asked students to re-examine the HOMETOWN poems that they had just written and revise them individually as we had just done as a class with *Dallas*. I passed out thesauruses and encouraged students to "make every word pack a punch."

Using the HOMETOWN format and this revising strategy, Derkis had written the following poem:

Rome
Cheers, bores
7 hills, small, nice weather, smells
sewage, rivers, chitlins
whopper, big mac, pancakes
dumpster beep, birds, sirens, barking, cats, screaming car horns, bus
mean, ghetto, friendly, talkative, nasty, tough, rough, poor, crazy, outrageous
scored my first touchdown of the year on a 58 sweep for 14 yards
I scored my second touchdown of the year when we played ringgold on 59 sweep for 28 yards
My dream is to go to FSU and play football and go to the NFl and play for the Dallas Cowboys.
An important person that I like is Bobby Bowden because he is the best college football coach alive
Never let anybody talk down on you, keep your faith.
Summer when it's hot
Small rome.

Derkis felt pretty good about the quality of his poem. When I asked him if he needed to revise anything, he said, "It's perfect, ain't it?"

Titus' poem is as follows:

Rome Southside
Small

Gray bumpy street curve
Fresh cold waltmelon with hot coca
Dogs, cars, winos, train, radio, and the shower
Kind, friendly, outgoing, happy, relax, smooth, bout-bout, and fighting people
On a hot summer day when I first start to take my drive lessons
I first got my three wheeler and phone line for my thirdteen birthda
My head was in a shoe box and someone were sticking knifes in it
Martin luke king who sacrifice his life for all people.
Don't go outside with your shoes off
Summer hot steaming weather
Wonderful georgia

As did Derkis, Titus felt fairly confident that he had created a solid poem, though when I asked Titus if he needed to revise anything, he said, "Is it bad?"

Infusing simultaneous media

To begin the next part of the sequence, I told students that I wanted them to illustrate each line of their poems. I brought in several stacks of magazines from the public and college libraries that were going to be thrown out, bunches of scissors, and told students to cut out images in the magazines that fit the descriptions from their poems. Also, I asked each student to draw at least one image themselves. For a day and a half, students scoured through magazines, cutting out photos, making drawings, trying to find images that could fit the lines from their HOMETOWN poems.

After they matched images to lines from their poems, I asked students to paperclip the line number to each image they found. They handed in their collected and numbered images on a Friday. Over the weekend, each set of images was scanned into computer images (either JPEG or GIF files) and inserted into a Powerpoint presentation in the appropriate order. The following Monday at school, we divided the class into four groups. One grad student (Fishel) took those students who had been absent the following week (only one student, it turned out) to catch up with the assignment, while I and two others worked with laptops, showing individual students how their images had been put into the Powerpoint slide format.. The students were asked how they wanted to place the text on the screen, about font choice and size, and other matters of aesthetics. About half of the high school students inserted the text themselves. The other half asked me or one of the graduate students to do it.

At the end of the day, we told students that they would be presenting their poems in two days. For their presentations, we told them that they would be reciting their poems to the rest of the class while the images and the words from their poems were cast against a wall. We mandated that all presentations had to have some background music and that presentations should be dramatic and appealing. Students could bring their own music (though songs could contain no cursing or lewdness), or they could select from a variety of CDs that we would provide.

The next day was a final rehearsal day for students. No one brought their own music, so they all chose from among the CDs I brought with me -- Bob Marley, Celtic Harp, DJ bass, guitar and drum mixes, Beethoven, and other (mostly) classical music selections. Students fiddled with the final details for their presentations, listened carefully to a variety of musical selections, and rehearsed. We printed each student's Powerpoint presentation (six slides per page) and handed them out so that they could practice. Every student in class seemed deeply immersed in the tasks.

For the presentations, we brought in a mini-amplifier and a microphone so that even those students who liked to whisper could be heard. The lights were lowered, the appropriate CD was played, and students recited their work while the images they selected shone against the wall – a scholarly bit of performance art.

In transferring his poems into a Powerpoint presentation, Derkis changed several of his later lines to better match the images that he found – the person he admired changed from Bobby Bowden to Michael Jordan for example because he couldn't find any photo of Bowden. When learning that his words would be cast against the wall with a projection device, Titus became very conscientious about his spelling. He corrected *waltmelon* (watermelon), *luke* (Luther), *knifes* (knives), *coca* (cocoa), and deleted *winos*. For their soundtracks, Derkis chose the bass, guitar, and drum DJ mix and Titus chose a Bob Marley CD.

A return to words

For the final piece of the experiment, we asked students to consider their poems, the images they selected with their poems, and the music they selected to play in the background together. Then, they were asked to communicate the content of the images and the feel of the music back into their poems so that, through the meanings of the words alone, someone reading their poem could visualize the images and sense the sounds that might go with it. Surprisingly, students took to this task with much enthusiasm. They rifled through dictionaries, asked questions, worked very intensely for a day and a half to complete this task.

For his revised poem, Derkis wrote the following:

Rome vaults
Camper searches for the seven hills
Twang of Aunt Jemima's pancakes in the a.m.
Nimbleness of cars on the highway out
Fastidious and pleasant, a token of remembrance
Milestone celebrated
Carrying pigskin for the seminoles
Hard worker, the desire to win
When people talk, I listen
To pick up stanzas
Hot sun, outstanding looking women
Atom-sized rome

Unfortunately, a day and a half were insufficient time for Titus to completely revise his poem. Although he worked constantly and meticulously during the class time, he never finished revising the second stanza. Still, the changes he made in his initial poem are striking. For his revised poem, Titus wrote the following:

Yearning rome
Small, stainless
Gray impulse street curve
Newness, cold pungent watermelon
Dogs barking, radio playing, shower raining
Smooth and relaxed
Excited when I first began my driving lesson
Thirteen with a three-wheeler and my own line

My head in a shoebox and someone sticking knives through it
Mlk who sacrificed a life
Don't go otuside with your shoes off
Summer hot steamy
Astonishing rome

Advantages of a Third Dimension

In today's media-enriched environment, the attention cues of many students begin with the eye and simultaneously engage the ear. Although movies, music, video games, and TV are often perceived as antithetical to students' intellectual development, aspects of these media could actually enhance learning. During our experiment, using images and sound during the writing process stimulated student interest in writing and revision.

As students created HOMETOWN poems, they focused upon the prompts and their linguistic responses to them. In the next step, they made sure to select images that were reflective of what they wanted to communicate. In essence, the pictures served both as a bridge in the revision process and as a reference point between teacher and student. Instead of having no idea where to begin revising, students were able to use their self-selected images as focal points for the reconsideration of linguistic choices. Students would ask each other and the teacher how exactly to capture aspects of the images that they had selected into words.

Music enhanced the writing process in two ways. First, the music seemed to make it easier for many students to read their poems aloud. Shy or reluctant students who had not read aloud in years seemed fairly comfortable when they were accompanied by background music of their choosing. Second, the music added an intangible emotional quality to the experience that seemed to give students even more opportunities to attach nonlinguistic responses -- emotions, memories, and ideas -- to the existing work.

Although this experiment in using simultaneous media to enhance student writing was dependent upon technology – laptops, a projection device, Powerpoint software – much of the same effect could be accomplished through cutting and pasting paper or using videotape. The important lesson to be learned from the experiment with this class of remedial writers is that using simultaneous media seems to enlist students' visual and auditory senses in the cause of the written word.

Somehow, by using visual and auditory appeals, students were able to think in novel ways about their uses of words and the real meaning of what they wanted to communicate. Some teachers routinely go through the stages of the writing process as if it were some kind of inflexible process that will magically transform bad writing into good. Yet, the transformation in the quality of writing done by Derkis and Titus came about only after the use of multimedia prompts. Through their exposure to multisensory and simultaneous media, Derkis and Titus were able to reconsider their uses of language in ways that purely linguistic appeals would never permit.

Technology: The Answer to Early Literacy Success in the New Millennium

Dr. Jean M. Casey

"Imaginative progressive teachers who had computers in the classrooms and were prepared to give students the time and support to learn often created wonderfully fertile learning environments--children can learn to use computers in a masterful way; learning to use computers can change the way they learn everything else." (Seymour Papert,1993, Mindstorms)

The first question administrators, teachers and parents ask is, "Will computers make a difference in the learning that occurs in the classroom? Past studies failed to answer this question or answered it negatively because they used standardized reading test scores as their only measure. The Simi Star Project, a collaborative grant between six school districts and IBM tested the effectiveness of computers in the classroom and effects of integrating technology into the curriculum. As a University researcher and reading professor, I was asked to be the evaluator of the Simi Star Project. It resulted from a grant between IBM and Simi Valley, Ventura, Oxnard, Santa Barbara, Orcutt and Point Hueneme school districts all located in Southern California. Six networked computers were placed in 24 kindergarten and first grade classrooms to test integration of technology in the curriculum and measure the effect on writing and reading development of the students. I worked with a team of educators and developed a qualitative study to examine these classrooms. The software used in the study was Writing to Read, Stories and More, Children's Writing and Publishing. The teachers were carefully trained, parents were informed as partners, students were given daily access to the computers for writing their own language experience stories. The students also were given phonemic awareness and systematic phonics support. The researchers used observations, interviews, questionnaires, portfolio assessment as well as reading attitude tests to measure the students writing and reading development. The experimental classrooms were compared to control classrooms without computers but a similar approach to teaching.

The results were significant. All students in the experimental classrooms using Writing to Read, averaged at least two writing levels higher based on a holistic evaluation than those in the control classrooms. The experimental group had a significantly higher positive reading attitude score than the control group. (Casey 1997) Teachers and parents all rated this program excellent on a 5 point rating scale.

These classrooms became writing, reading and publishing labs; the teachers kept samples of the children's daily writing in portfolios that were used as assessment and in parent conferencing.

That was just the beginning. One computer in each room was connected to the Internet and children chose pen pals from other states and Europe. One kindergarten child proudly wrote his daily message to his friend in Alaska. A fifth grade classroom was working on a project about the world environment online with a fifth grade classroom in Paris, France. Children were not only experiencing the meaningful use of writing and reading, but developing life long friendships and understanding of children like them all over the world.

The teachers quickly were caught up in the enthusiasm they saw in their student writers. They produced more communications and newsletters for their parents than teachers in the control classroom were able to do; they also designed lessons and modeled stories that they wrote specifically on the computer and shared on the projection monitor with their students. Teachers became hooked on E-mailing each other, finding lesson ideas on the Internet, asking questions of

the university people pertaining to certain theories and ideas. The teachers spent time reflecting on their teaching with the university researcher and also building a community of support with their peer teachers in the project.

The 6 computers were busy all day. When the language arts block was over and children had written their own stories, it was time to use the computers with HyperStudio, a software authoring program for children to design their own multi-media research reports in science and social studies. Math, art, graph making was all a part of the daily curriculum, there never was an empty seat in front of a computer. Children received 90% more time using computers then those who visit a lab once a week for an hour.

The teachers also discovered that the daily writing of their students offered the best assessment possible of the skills the child had already mastered and those that were needed. Look at Brandon's work in the figure below. He is a first grade student. Without the computer, based on his immature drawing, a teacher would conclude (using Gesell Developmental Scales) that he was at a 3-year-old maturity level. He would be mislabeled and misplaced. But given the use of the computer we can see that Brandon has the phonemic awareness skills, sentence structure, punctuation and story sense of a six-year-old or older. How many students have we misjudged in the past based only on their underdeveloped motor coordination with a pencil. Giving them a new tool unlocks the intelligence they have and allows them to express it for all to see.

Insert Fig 1 diagram here

At What Grade Level Should We Have Computers in the Classroom?

Some administrators and parents might think that high school is the time to start computer use, some third grade. As the evaluator of the Simi Star Project, reading one thousand writing samples from five and six-year-olds was enlightening and taught me a valuable lesson. These young children could write much more than we ever imagined that children that age were capable of doing. It proved that they had many more ideas than they had been able to express with pencil and paper.

The time to have computers in the classroom is the first day children enter school. The computer is a sophisticated writing tool that gives the student auditory feedback, a visual display and control of their learning. A tool that can allow any student to feel like an author on the first day of school!

When I taught first grade twenty years ago and a child entered the classroom and said, "Teacher when will I learn to read?" We had to say not until you have mastered the three hundred fifty skills on our district reading scope and sequence chart. The first one is consonant b; there are three hundred forty nine more. The discouraged child went back to his seat.

Today when a child enters kindergarten and says, "When will I learn to read?" The professional teacher says, "Today!" Using KidWorks Deluxe (Knowledge Adventure) the talking word processor, a child can sit down write his name, mom's name, his dog's name, letters of the alphabet, whatever he wants to write. He prints it out and has immediate proof of his literacy and authorship. He can take home his printed piece that very day and have it posted on the refrigerator for all to see, he can write, he can read!

Another important aspect in integration of computers into the curriculum is meeting the needs of the mainstreamed students. Some are students who in the past, because they had not yet developed adequate motor coordination were often mislabeled learning disabled, dyslexic, or attention deficit disorder (A.D.D.) The computer really is essential for changing the lives of these children. The following stories are about two of the many children I worked with using the talking word processor.

Dyslexic Nicholas: The heavy label

Nicholas taught me the next lesson. He was coming to the remedial reading clinic at the university. He was flunking his subjects at school, his parents were frantic. I trained the reading clinicians and then they worked weekly one hour a week with the children labeled "remedial readers." Rose was Nicholas's tutor and she came to me distressed. She felt she had been trying all the ideas we spoke about in class but they were not working with Nicholas. I agreed to work with him at the next session and Rose would observe through the two-way mirrors. The next week I was waiting for Nicholas, when he arrived I told him I would be his tutor for this one session and asked him to tell me about himself. He said, "My name is Nicholas and I am twelve years old." "When I was six they told me that I have dyslexia and would never learn to read and I have not ever learned." "I not only cannot read, I get an F in handwriting and math." He couldn't understand it because he liked math. He was good at it and knew all the answers through mental calculation and could respond with them orally. However, the teacher insisted on written responses on timed tests. This approach made Nick nervous and with his poor handwriting he was always destined to get an F. Because of these grades his dad would not let him play with his friends after school, he was ordered to stay in his room and do homework. Nicholas was a very depressed twelve year old as he stated, "I hate my life; I wish I was dead!"

Amazingly, Nicholas had just diagnosed his problem. He was not learning to read because he believed he could not, he was bright and could respond orally but had trouble with handwriting and got tense under pressure. My first step was to work on this attitude of failure that he had held on to for the past six years. I told him about Albert Einstein, Nelson Rockefeller, Tom Cruise, to name a few who were dyslexic. Nicholas was very surprised to hear that and certainly did not think those men were dumb. I reassured him that he was not dumb either, but had not been given opportunities to learn the way he could most effectively. Nicholas was a case just like Patrick in Denny Taylor's book, *Learning Denied*; the school system had failed him (Taylor 1991).

As we continued to work together, I asked Nicholas if he had ever used a computer? " No," was his reply. I introduced Nicholas to the talking computer with KidTalk software. (Casey 1983) He immediately began to compose his life story. Then he was able to read it and print it out. "You are a very bright boy Nicholas, you just needed a more sophisticated writing tool to help you put all your great ideas down on paper," I told him. It took more than a talking computer, it took a teacher who understood Nick's particular learning strengths and needs and cared enough to encourage him and help him learn in other ways. But it was definitely a breakthrough and turned Nick on to learning once more.

David was a student in the first grade at one of the Simi Star Project schools, I entered his classroom and saw a 10-page story on the bulletin board, and I began to read it. David walked up to me and said, "Do you like that story? It's mine?" Follow me to the computer and I will show you more, it is twenty-six pages long now. I followed him with great interest. He took me to a computer, put headphones on my head and proceeded to play the story for me. I listened in awe as the computer began to read his long story of the Dinosaurs' lives, George Washington's life and his grandma's life.

At recess I could hardly wait to go to the teachers' lounge and speak with his teacher. "Mary," I said to her, " David must be a gifted first grader, his story is outstanding, well above what you would expect from an average first grader." She laughed, "Oh no, she said. You should have seen him at the beginning of the year, he was identified A.D.D. and he couldn't hold a pencil or write and he hated school. Now he doesn't want to go out even for recess when he is in the middle of one of his great stories!" I drove home thinking about a technology that had made a student write in a gifted manner even though he had been labeled a poor writer. A technology that

compelled a student, who had been labeled attention deficit disorder, to sit for long periods of time thinking, creating, imagining a twenty-six page story. If he could sit that long writing something of interest to him then sitting still was not the problem, having something worthwhile to attend to seemed more probable. Something is wrong with the labels, I concluded, the students are fine when given the right tools and environment.

Thomas Armstrong, psychologist, teacher, and consultant has years of experience working with children who have attention and behavior problems. He has the belief that these children are at core fully intact, whole, and healthy human beings...that the best way to help them is to provide the kinds of nurturing, stimulating, and encouraging inventions that are good for all kids.(Armstrong 1995) The computer provides the motivation, stimulation and control in the learning environment. All you need to provide is nurturing and encouragement. I worked with ESL, LEP, Down's syndrome students and the computer was equally empowering, an essential learning tool for them. For Gifted students the computer finally freed them from the boredom of classroom work too easy for them and allowed them to create, imagine and write far beyond anyone's expectations.

In summary, the time has come for us to integrate computers as tools in every classroom. Six networked computers worked well in a classroom of twenty-five students, but one per student as envisioned by Seymour Papert (Papert 1993) should certainly be our goal. We must help teachers recognize the power of the computer as a problem solving tool when used by the learner to construct his own literacy. They are as empowering to five year olds as they are to you once you discover you can use PowerPoint to produce a presentation that will impress your staff and parents. They need to be in every classroom, in every school. Money must be set aside for training to help teachers understand that this is a new paradigm, one in which students create stories directly from their mind into the computer and then have the control and power for easy editing. Untrained teachers think stories must be written out in pencil first, then corrected and then laboriously typed by the child into the word processor. There is no surer way to make children dislike technology than to use the approaches designed for the pencil. It is as if you had to wash your clothes on the washboard by hand before you put them in your washer! Wouldn't you hate that?

John Henry Martin, educator and creator of Writing to Read summed up the benefits of computer use for literacy for all students, he said," "The computer can give the learner the world's most beautiful feeling, the Greek "Eureka:" I got it, I know it, I can see it, I can understand it! That's a transforming feeling; to be awakened from dormancy, from sadness to strength, to dignity. I can write, I can read! Do this for your students today!

A 21st Century technology equipped classroom, trained teachers, a risk-free learning environment and you are ready; when the three and four year olds doing Broderbund's Living Books on their home computers today come to your classroom door next year and ask, "Where is the CD-ROM?" "When do I learn to read and write?" Your teachers will say, right over here! right now!

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AREAS OF EXPERTISE
- Early Literacy: The Empowerment of Technology
- TeacherNet: Supporting teachers on-line
- Reading Acquisition: K-8, RICA, technology integration

Conducted 14 years of research on early literacy and how technology can make early reading and writing successful.
Turning Language Experience into Language Processing!

Additional Information: Author of Early Literacy: The Empowerment of Technology, Englewood, CO: Libraries Unlimited. Consultant on KidWorks Software.
Website: http://www.csulb.edu/~jmcasey
Chancellors Distinguished Teacher Education Scholar on CALSTATETeach development team, co-developer of CredentialNet reading on-line course.

Recent Presentations:

May 8, 1999- Spring Computer Using Educators (CUE) Conference, Featured-Speaker- Emergent Literacy: The Empowerment of Technology, Palm Springs, CA.
May 3, 1999- International Reading Association 44th Annual Convention, Featured Speaker-Technology Lab Session, How Computers in the Classroom make a Difference in Reading Development, San Diego, CA.
March 20, 1999 – Hope of the New Century: Early Literacy, the Empowerment of Technology, 66th Annual Claremont Reading Conference, Claremont, CA.

February 13, 1999 – The End of the Reading Wars, Early Literacy Success: The Empowerment of Technology, 1999 Aloha State Reading Conference, Honolulu, Hawaii.
January 29, 1999 - Literate Lives: Empowering At-Risk Learners For Early Success in 21st Century Literacy, Featured Speaker, Technology, Reading & Learning Difficulties, San Francisco, California.
January 28, 1999 – Alameda County Education Office, Distinguished Scholar Presentation on Early Literacy, California Technology Assistance Center, Alameda, California.
October 24, 1998- Computers in the Classroom Promote Literacy, South Bay Area Reading Council, Conference on Literacy, Torrance, CA.
May 16, 1998- **Keynote Speaker**, Writing to Read for Literacy Success, Writing to Read Spring Fling, Los Angeles Archdiocese Conference, Los Angeles, CA.
November 5, 1998-Early Literacy: Leading the Way to the 21st Century, California State Reading Association Conference, **Featured Speaker**, Sacramento, California.
October 30, 1998-Connections to Literacy-Emergent Literacy: The Empowerment of Technology, Transparent Technology, Computer Using Educators National Fall Conference, **Featured Speaker**, Santa Clara, California.
October 24, 1998- Computers in the Classroom Promote Literacy, South Bay Area Reading Council, Conference on Literacy, Torrance, CA.
May 9, 1998- Do Computers in the Classroom Make a Difference in Literacy Development? CUE National Spring Conference, Harness the Winds of Change, **featured speaker**, Palm Springs, CA.

S C I E N C E

Section Editor:

Linda E. Roach, *Northwestern State University of Louisiana*

The 2000 SITE Annual Meeting Science section offers 20 presentations that encompass a wide range of topics related to use of instructional technology in a variety of classroom settings. Authors provide information about both preservice and professional development projects, literature reviews, and research studies for participants' utilization. Inquiry in teaching science is a common theme across the articles.

Yair, Mintz, and Litvak describe a CD Rom that allows middle school children to manipulate variables in a the Solar System and immediately realize the resulting motion on screen. The mouse becomes a spaceship to navigate a virtual world, thereby utilizing the powerful tool of visualization to teach science.

Comeaux describes, analyzes, and reports extensive results related to a project that uses field-based inquiry experiences in a middle school science class. Using a video conferencing and Internet-based collaborative effort, learners and scholars accomplish increased understanding of environmental concepts.

Irving and George provide a detailed report on a middle school inquiry project. Students use probes and portable computers to collect data in the field, then utilize computers to analyze the data collected.

Distance learning techniques with collaboration across university campuses is the topic of the paper by *Weaver, Klein, and Matkins.* Elementary education methods students are team-taught the methods course across three institutions. Positive outcomes are described, as well as possible problems that might be encountered.

Coverdale also reports on integrating technologies in teacher preparation courses. He adopted a science textbook that includes links to the Internet to teach K-16 preservice teachers. Students triangulate data among observations, web information, and the textbook to glean a deeper understanding of science concepts.

A Masters' program at Florida State University is presented by *Ruscher, Gallard, Cherrier, Hancock, Petrovich, Bisha, Lusher, and Ruscher-Rogers.* Collaboration among the Departments of Meterology, Curriculum & Instruction, Environmental Sciences, and Physics provide an inquiry-based project for both inservice and preservice teachers. Field experiences are provided and the GLOBE program is utilized for further collaboration among scientists. A detailed description of the model is provided.

Poirier describes how he uses instructional technology in his chemistry classes in a variety of ways. He discusses the pros and cons of instructional technology and provides hints about communication among teachers, administrators, and parents.

A project that investigates student gains while using technology, independent of teacher influence is the topic investigated by *Horejsi and Strickland.* They studied how instructional technology affects both the performance and attitudes of middle school earth science students who used probes and laptop computers to collect and analyze data by inquiry methods.

Described by *Rubio, Michell, Blackwell, Kondelik, and Albery*, is a technology class that teacher research using the web and library to create research papers with science content. Much emphasis is placed on the writing process and creation and manipulation of web-based home pages. Linear and non-linear text is discussed.

Duffield, Skokan, Nichol, and Saksek illustrate a professional development project in which teachers use probes to gather data in an inquiry-based learning setting. Data is both collected and processed using technology, then supported by Internet and distance communication with other schools.

Best, Fishman, Marx, and Foster provide information about a professional development program to integrate content based inquiry methodology with technology for a diverse population of middle school teachers. Positive results are attributed to collaboration and continuous support of teachers.

Another professional development project is discussed by *Helflich, Dixon, and Govett.* Inservice teachers are paired with preservice methods students in an elementary setting. This program promotes inquiry learning through the use of laptops and probes to collect data, which is then used in the classroom to create presentations of the experiences.

Site-based inservice is described by *Wetzel, Cleland, Buss, Rillero, Zambo, and Christie.* In this professional development project, teachers use computers in an inquiry-

based setting and developed web pages to use in their own classrooms. Teachers then had the opportunity to field test the technology before integrating it into their own classrooms.

Sperandeo-Mineo conducted research in secondary schools in Italy. Qualitative research about distance learning is reported on an experimental model tailored to train teachers to use constructivist methods in their classrooms.

An ethnographic study of three teachers was conducted by *Wallace*. The descriptive results provide insight into how K-12 teachers utilize the Internet in their classrooms.

Kupfer enlightens the reader to a clearinghouse for science teaching materials for secondary school teachers. There are many opportunities for acquiring materials from a variety of sources. Collaboration with industry to train teachers to use the equipment is also described.

A brief description of the GLOBE program is provided by *Williams*, of the GLOBE Training Center. He advocates the use of this NASA based program for professional development.

Another literature review of three programs to integrate technology into environmental education classes is presented by *Huber*. His paper described the congruence between the pedagogical approaches advocated by science education reform groups and three exemplary programs.

Another review of the literature is provided by *Stewart and Zaslavsky*. Two projects are described which addresses the gap between the computing environment and needs of the schools with the awareness of teachers and students about the fast-paced changes.

This year's papers are valuable to a wide-ranged audience of science and technology educators. This section leader believes that anyone interested in instructional technologies in science, whether at the K-12 level, university preservice teacher level or through professional development will find material of interest in this section.

A 3-D Journey in Space: A New Visual Cognitive Adventure

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Abstract: This work presents a new 3D model of the solar system with virtual reality (VR) features. It is based on powerful scientific visualization techniques and can be used as an effective aide in astronomy teaching. The learner "enters" a virtual model of the physical world, journeys through it, zooms in or out as he wishes, changes his view point and perspective, as the virtual world continues to "behave" and operate in its usual manner. The continual motion of the planets generates day and night, seasons, eclipses and phases – topics that are customarily hard to grasp, especially at young age. The model allows for a powerful learning experience, and facilitates the mental construction of three-dimensional space, where objects are varied and different, but share common features and obey the same physical principles. The new view helps to overcome the inherent geocentric view and ensures the transition to a scientific, heliocentric view of the solar system.

Introduction

Teaching astronomy at the primary and secondary school levels is a great challenge for science teachers. On the one hand, it is an extremely appealing modern science that fascinates and attracts children. On the other hand, it contains complex subjects in physics, requires an understanding of three-dimensional dynamics and demands advanced cognitive capabilities. To understand the basic astronomical phenomena – day and night, seasons, eclipses, phases of the moon and the motion of planets - one must have the capability of visualizing events and objects as they may appear from different perspectives simultaneously. Children have initial conceptions of celestial objects and phenomena, which are very reminiscent of ancient philosophical ideas and that are probably influenced by erroneous information presented in everyday culture and mass media (Lanciano, 1999) such as science fiction films and TV series. A simple example is the notion that spacecraft can fly faster than the speed of light, as depicted in many scenes in the films "Star Wars" and "Star Trek" . These ideas become deeply rooted beliefs, that are often inconsistent with the accepted scientific view.

Indeed, many researches pointed out that children evoke their own explanations for the easily observed astronomical phenomena, long before they receive any formal education in either Earth sciences or astronomy (Nussbaum and Novak, 1976). Baxter (1989) found that children construct alternative frameworks for explaining astronomical events that become less naive as age progresses. He also found that many pupils leaving school at the age of 16 years were unable to explain correctly ordinary astronomical events. Some of these alternative frameworks continue well into adult age, and are even found in university students (Broughton, 1999). Comins (1993, 1995) identified common misconceptions students have in astronomy and derived a set of origins that account for them. This set includes, among others: factual misinformation, mythical concepts, language imprecision, misinterpreting sensory information and, incomplete understanding of the scientific process and of scientists.

In our modern society, space research – and the implied science of astronomy - has become an integral part of daily life. Space shuttle flight, the latest pictures from the Hubbell Space Telescope (HST) and photographs from weather satellites appear regularly on television and in the newspapers. The Internet is literally flooded with information on scientific discoveries, among which astronomical topics. It is therefore essential to enhance the basic concepts of astronomy at an early age, so that children can grow up to be literate in science and astronomy.

Astronomy Teaching in Israel

In 1994, a curriculum change took place in Israel, introducing astronomy and Earth sciences to the primary and secondary school level study program. Extensive resources were allocated to teacher training programs and to the development of teaching materials. The Center for Educational Technology (CET) in Tel-Aviv, in cooperation with Tel-Aviv University's Science and Technology Education Center (SATEC), developed a new program for teaching astronomy at the middle school level. The program includes three components: a text book with an accompanying teacher's guide, and a multimedia-web hybrid learning environment named "Touch the Sky – Touch the Universe". The latter is a multimedia learning environment dealing with the multiple aspects of space such as location, movement, time and the physical components of objects. "Touch the Sky - Touch the Universe" emphasizes the technology and the power of modern research, and features the various means by which man has chosen to explore space. The learning environment also describes the history of the socio-religious role of astronomy from ancient times until the present day. Stories illuminate the key personalities responsible for the development of the scientific ideas which revolutionized the history of human thought. The learning environment includes a knowledge-base, research assignments and Internet Web site.

The knowledge-base contains 36 subjects in astronomy and space research. The information is arranged under the names of the various objects in the universe: galaxies, gas clouds, stars, planets, comets, meteors and constellations. Within each subject there is a further division of information into categories of common characteristics (for example - size, structure, composition, phenomena etc.) which enables comparisons between objects and the reaching of conclusions about the consistency of the materials and the processes and laws of physics in the universe. Extensive use has been made in the database of video clips and animation. The CD-ROM offers a broad spectrum of active research projects which strengthen the ability of the students to gather information from a variety of sources. Students learn ways to present scientific information and are encouraged to develop the ability to generalize, summarize and draw conclusions. The activities also promote creativity and self-expression: "Postcards I sent from space and "The views from the Spaceship window" are a few examples of the rich possibilities offered by the learning environment.

The "Touch the Sky" Web site (http://www.most-sites.org/space/) can be accessed to obtain updated information in the following areas: the astronomical event of the month, information on astronomical observatories and their activities, research news, lists of scientific periodicals, reading recommendations, FAQ and email connection to experts. The site also serves as the crossroads for surfing to additional sites.

The Virtual Solar System

The novel and powerful component in the "Touch the Sky – Touch the Universe" CD-ROM is a 3D model with virtual reality (VR) features, which is based on powerful scientific visualization techniques. Virtual Reality in this sense is a medium where a user can operate within a realistic representation of 3-dimensional space, in real time. It is a non-immersive experience, which is different from the traditional VR in that it does not entail the use of gloves or masks. By simply clicking on the appropriate icon, the learner "enters" a virtual model of the physical world. The computer mouse becomes a spaceship and enables the user to journey through space, to zoom in or out as he wishes, and to change his view point and perspective. The virtual world continues to "behave" and operate in its usual manner - the planets rotate and revolve continuously, as the program continuously computes their location and the location of the observer with respect to them. The model includes the sun, planets, moons, asteroids and comets, revolving and rotating in their orbits against the constant background of the Milky Way, the stars and constellations. Although the relative sizes and distances of the objects were shrunk and scaled, the Keplerian motion was kept unchanged and at the true relative rates. High-resolution NASA images were used to construct the objects, and their numerical data was calibrated with great accuracy. The user can navigate in space, "fly" above and below the ecliptic plane, approach any object and view it from many angles. The numerical data and orbital parameters, as well as other information, are displayed when a specific object is touched. The continual motion of the planets generates day and night, seasons, eclipses and phases naturally in this 3D-VR, and these can be easily explored.

There are 4 modes of observations which the user can choose from: (a) The Free-Mode: no object is chosen and a free flight in space is enabled. (b) Sun-in-Site view: the chosen object is shown

together with the sun, from a vantage point. This position illustrates the respective distance and order of the planet from the sun. (c) Planetary view: the planet (or moon, asteroid, comet) is shown in the center of the screen, and the user is "locked" onto it as if travelling in tandem in its orbit. He can zoom in and out and position himself wherever he likes, but the planet always remains at the center, rotating in its nominal rate. This view is useful for a detailed study of atmospheric and surface features, and for astronomical phenomena such as day-and-night, seasons, and phases. (d) Planetocentric view: this option positions the observer as a geo- (planeto-)centric satellite, rotating at the same rate as the object he observes. The effect is that the object seems to be "frozen" at the center, and the entire "world" rotates around him. Although disconcerting at first, this view is extremely useful in overcoming the basic difficulty of compromising the inherent geocentric view which children possess (Lanciano, 1999) with the correct Copernican model. The user has an option in which he can change the speed of the entire system, by accelerating or slowing the rotation and revolution rates. This is a strong exploratory tool which enables to investigate how basic phenomena would change as a result of this modification. "What if" questions are a strong tool for elucidating complex astronomical phenomena (Comins, 1999). The present model allows a direct study of questions like "what if the Earth rotated faster", where the consequences are apparent immediately on the computer screen.

Darken (1996) showed that a representation of spatial coordinates is essential for orientation in large-scale virtual environments. The lose of orientation and "vertigo" feeling which often accompanies learning in a virtual-reality environment is minimized by the display of a traditional, two-dimensional dynamic map of the solar system. A camera symbol represents the location and observation point of the user with respect to the object and to the entire solar system. This map helps to navigate and orient the user, and facilitates an easier learning experience. It also helps to overcome the sense of bewilderment which is sometimes induced by the fact that there are objects (such as the planet Uranus) that rotate in an unfamiliar manner. Upon entering the new virtual representation of space, the user has to project himself into this "reality" and to adopt to new looking points, which is by no means an easy cognitive task, especially at young ages. A set of structured inquiries has been added to the learning environment, which aim to orient and teach the student various aspects of astronmy. These activities navigate the user to specific observations, and ask guided questions which deal with the basic observations. For example, the user is positioned above the Moon's orbital plane with both Earth and the Sun in view, and is asked to note the changing angle between the illuminated part of the moon and the Earth, and to relate his observations to the phases. Another example is the identification of the sun as the only source of light in the solar system, by noting the dark and illuminated sides (night and day) of all the planets.

Scientific Literacy and Visualization

The use of computer-generated images and of other visual sources of information in present-day scientific research is generally referred to as ***scientific visualization***. Scientific visualization provides a way of observing natural phenomena that, perhaps due to their size, duration, or location, are difficult or impossible to observe directly. In the realm of astronomy, data sent back by the HST and by other space probes are transformed into images that are enhanced, edited, and analyzed to reveal important new details about our neighbors in space. These scientific visualization tools and techniques are helping scientists to gain a better understanding of how our solar system formed and how it continues to evolve and change over time.

The "Touch the Sky, Touch the Universe program" enables students to interact directly with various forms of multimedia that simulate primary resources used by practicing scientists. Journeys through the virtual simulations of the solar system and the Milky Way help students bridge the gap between the concrete world of nature and the abstract realm of concepts and models. As students examine images, manipulate three-dimensional models, and participate in these virtual simulations, they enhance their understanding of scientific concepts and processes. Students are not simply passive recipients of prepackaged multimedia content. In "Touch the Sky, Touch the Universe", students can use a variety of navigational tools to view, navigate, and analyze a realistic three-dimensional representation of outer space. The included research activities challenge students to keenly observe and interpret the events as they unfold before their eyes during their VR "flight" in space. Students' search for understanding should prompt repeated experimentation with the 3-D simulations and consultation of other information sources in the program. Students should also try to put their observations into the context of their own experience to help them understand the information presented in the program.

Such learning activities provide students with a more intuitive understanding of astronomy and contribute to the development of essential visual literacy and information-processing skills. Many contemporary students are quite adept at processing and understanding visual information as a result of their experience with television, films, and computers. As they become more confident in their ability to constructively interact with the VR elements in the program, students should increasingly use these new technologies as a medium for sharing information and discussing ideas and conclusions.

Summary

The new model holds substantial didactical advantages that can be used as an effective aide in astronomy teaching:

- It allows for a powerful learning experience. Space and astronomy have always captured the human imagination, and children are naturally drawn to space science. The new model enables students to explore space as if flying in their own spaceship. they decides by themselves where to go, what to watch and from what distance and angle.
- It facilitates the mental construction of three-dimensional space, where objects are in constant motion. The new view is remarkably different from the traditional two-dimensional representation of celestial objects. Complex planetary motions are made simple when observing, for example, the Earth rotating as it revolves around the sun.
- It enables the learner to discover the relation between distance, motion and time. The user can explore the physical laws governing the universe by observing planetary motions, and to deduce their uniformity ("Day and night occur on other planets, too").
- It offers a tool that helps to overcome the inherent geocentric view of the world, thus ensuring the transition to a scientific, heliocentric view of the solar system.

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Using Collaborative Inquiry and Interactive Technologies in an Environmental Science Project for Middle School Teachers: A Description and Analysis

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Abstract: Scholarly literature in teacher education and science education advocates collaboration as an essential component of their educational goals/programs. The video conferencing network and the Internet are dynamic tools that support collaboration among learners and scholars. This paper describes and analyzes a project, *Students As Scientists*: Pollution Prevention Through Education (SAS) that uses collaboration as its' central educational goal and focus and uses interactive technologies to accomplish that collaborative goal.

Introduction

What does teacher education, environmental science education and interactive technologies (video conferencing network and the Internet) have in common? They all have a strong focus in and potential to create a community of scholars through collaborative endeavors. Scholarly literature in teacher education and science education advocates collaboration as an essential component of their educational goals/programs. The video conferencing network and the Internet are dynamic tools that support collaboration among learners and scholars. This paper describes and analyzes a project, Students As Scientists: Pollution Prevention Through Education (SAS) that uses collaboration as its' central educational goal and focus and uses interactive technologies to accomplish that collaborative goal.

Collaborative learning scholars emphasize the interdependence of the learners and the communal nature in their construction of knowledge. (Bruffee, 1993; and Johnson, Johnson, & Smith, 1991). Bruffee (1993) describes a university education as "an enterprise engaged in promoting change" and as such "we construct and maintain knowledge not by examining the world but by negotiating with one another in communities of knowledgeable peers. Similarly, collaborative learning assumes that learning occurs among persons, not between persons and things (p. 9). Thus, in these pedagogical models, knowledge emerges from the interaction between and among instructors and students as they engage in problem solving, real world (authentic or contextualized) experiences.

Likewise, environmental science education programs influenced by the National Science Education Standards (National Research Council, 1996) strongly advocate collaborative inquiry in the context of real word problems as the focus of their science classrooms. The vision that the *Standards* advocate and support is one of dynamic collaborative learning communities working within enriched learning environments supported by an educational system that has been overhauled to provide the support those communities will need. Within these learning communities, students will be actively engaged in inquiry-driven, experiential, "hands-on and minds-on," learning activities (see National Research Council, 1996, pp 20-21) directed towards the central goal of "scientific literacy for all students" (pp 2 and 21). In these central tenants and additional supporting details, the goals of the standards-based reform effort appear very congruent with the goals of science education programs.

In sum, it seems clear that collaborative inquiry is strongly advocated by scholars of collaborative learning and science education. This paper examines the collaborative nature of the SAS project and its impact.

Project Description and Goals: Centrality of Collaboration

The "Students as Scientists: Pollution Prevention through Education" http://smec.uncwil.edu/glaxo/sas/index.htm) is a three year teacher training program (in its final year) offered through the Watson School of Education, University of North Carolina-Wilmington for middle school science teachers throughout North Carolina. The specific objectives of this teacher training project are: (1) to update teachers on environmental issues affecting North Carolina, particularly water pollution prevention; (2) to engage teachers in collaborative learning and problem-solving methodologies they can use in their classrooms; (3) to provide teachers with environmental monitoring equipment and training in the use of this equipment, (4) to educate a cadre of teacher leaders who will educate other teachers in their districts; and (5) to teach the teacher leaders to learn to use the World Wide Web and the distance learning network so that, after the institute, they can continue information gathering and networking. The project creates Web Pages (that teachers may use collaboratively; they are be able to download curricular information and environmental monitoring data from the web to use with their classes.

During the summer 1997 workshop teachers from New Hanover County Public Schools conducted environmental monitoring activities on the Cape Fear River. Working with University of North Carolina-Wilmington scientists, they performed water analyses and determined dissolved oxygen and solid levels, salinity, temperature differences, and pollution indicators. Participants graphed their data using spreadsheet software and compared their data to the river monitoring activities of the Cape Fear River Project, a consortium of local industries, environmentalists, and state environmental department experts. Guided by project staff, they learned to locate environmental science resources on the Internet. Discussions focused on presenting the project's activities in lessons that reflected the national and state science education standards. Participants developed lessons that incorporated cooperative learning strategies, hands-on science inquiry, and best practices for the Cape Fear River.

During the following academic year, the teachers and their middle-school students spent one day per week on the Cape Fear River replicating the summer's monitoring activities and recorded their measurements on the project's World Wide Web site. The students learned how to graph their results, use environmental science terminology to describe their activities, and analyze local environmental conditions and water-quality tests performed by the state environmental department.

During the summer 1998, teachers from Clay and Graham County Public Schools and Charlotte Public Schools, as well as additional New Hanover County teachers, attended the workshop. After completing the same objectives as outlined above, these teachers conducted water monitoring activities on waterways in their regions with assistance from Western Carolina University and University of North Carolina-Charlotte scientists and environmental education faculty. Participants and their students enter their data on the project's Web site and compare their results throughout the year. In summer 1999, new teachers from the four school systems participated thus completing the three-year project funded by Glaxo Wellcome foundation.

The "Students as Scientists" project emphasizes hands-on science activities which require higher order thinking and problem-solving skills. The project challenges teachers to learn to use their surrounding physical environments and real problems as teaching tools. This expertise allows teachers to better implement the new State Science Curriculum (1996) and help their students understand the nature of science.

The WWW provides a forum for the presentation of environmental education concepts. "Students as Scientists" created a number of interactive web pages where teachers track the project's development and growth, and participate by using interactive forms for the posting of data to the project's home page. Thus middle school science teachers and their students compare and contrast data collected by participating schools and by university scientists throughout the state of North Carolina. In addition, these students develop interpretive skills and begin to understand the fundamental scientific processes that shape and control water basins. With these field experiences, students become involved in "real" environmental science, impact implications and, ultimately, the social and political issues that affect their community's water resources. Furthermore, the WWW component includes modules of information that can be downloaded by teachers for integration into the curriculum and for working collaboratively with other teachers in the project. Thus, it will be possible for teachers around the world to share "Students as

Research Methods

As a communication education specialist, I have evaluated a number of education and technology grants. Patterning my research design after similar evaluative projects, I designed a program of evaluation to study the effectiveness and impact of the SAS project. The evaluation purposes were (1) to determine the effectiveness and the impact of the project; and (2) to secure information for project program changes that would improve the initial design and future projects.

To evaluate the effectiveness of the program design, I used a qualitative evaluation methodology advocated by Michael Quinn Patton (1990). As Patton explains: "When one examines and judges accomplishments and effectiveness, one is engaged in evaluation. When this examination of effectiveness is conducted systematically and empirically through careful data collection and thoughtful analysis, one is engaged in evaluation research" (p. 11). I also followed the naturalistic inquiry approach (Lincoln and Guba, 1985) and used inductive analysis (LeCompte & Preissle, 1993; Lincoln & Guba, 1985) to search for themes and patterns emerging from the data.

Data Collection and Analysis

Data was collected from a variety of sources to ensure completeness and thoroughness. Because the project is presently in its third year, this paper will focus on the analysis of data from the first two years of the project: 1997 and 1998. During the first year of the project (1997), all participants were middle school science teachers from the coastal site in North Carolina (Wilmington) and they completed a written open ended survey at the end of the institute regarding their responses to the summer institute and their plans on how to implement the project. During the second year of the project, middle school science teachers and university scientists from two other geographical sites (piedmont and mountains) participated in the project with a new group of participants at the Wilmington site. Participants at each site completed an evaluative questionnaire at the end of the summer institute. In addition, the 1997 coastal site participants and the 1998 participants from all three sites were mailed a set of open-ended questions to survey their response to the project, the use of the Internet, and their challenges of implementing the project and its impact on their teaching and their students. To provide more descriptive and detailed data, participants at the Wilmington site were interviewed and audio-taped in focus groups (3 groups of 6 each) three times throughout the 1998-99 academic year. The first taped interviews occurred at the end of the summer institute and focused on their responses to the institute and their implementation plans for using the water testing kits with their students and their curriculum. The second focus group interviews occurred during the "Comeback Session" on Saturday, October 23, 1998. At this time the focus groups discussed their successes and difficulties with their implementation plans. In addition, they shared ideas and suggestions for future implementation of the project. The final taped interview occurred the following spring with only one of the focus groups during a "Student Symposium Session" in which the "student scientists" presented their findings to each other in small groups.

The transcripts (from the interviews) and the open-ended surveys were read using inductive analysis to discover the emerging themes (Lincoln & Guba, 1985 and Patton, 1990). After comparing the themes (discovered from the interviews and the surveys), the data was re-read using a "clustering" strategy suggested by Miles and Huberman (1994, p. 248-249) to categorize the themes. Next, the themes were color coded to search for the "emerging patterns" in them (LeCompte & Preissle, 1993, p. 237).

For the purpose of verifying the credibility of the data, I followed Lincoln and Guba's (1985) suggestions for establishing "trustworthiness" of qualitative data (p. 301). Consequently, I used the following criteria from Lincoln and Guba (1985) to establish credibility of the data:

1) <u>triangulation</u>: by seeking perceptions of the experience from "multiple sources", by using different "data collection modes" through the written surveys, interviews, and observations, (p. 305-307);
2) <u>member checking</u>: by asking the interview respondents to attest to the accuracy of the data and its portrayal to verify the data as "adequate representation of their own . . . realities" (p. 384); and
3) <u>peer debriefing</u>: by sharing my findings and analysis with the project director (Richard Huber) and with other informed education researchers

who served as "disinterested peers" for the purpose of "exploring aspects of the inquiry" and keeping the interpretations "honest" (p. 308).

Collaborative Nature of the SAS Project: Findings and Discussion

Using analytic induction, this paper will focus on the one of the prevalent themes emerging from the data: collaboration. The theme is discussed in light of the goals of the program.

The major focus or goal of the project is inherent in the title *Students as Scientists*. As the project director explained, "it is important to help these teachers move from textbook science to doing science so that they and their students can understand more clearly what scientists do" (Huber, 1998). The heart of the project aimed at modeling the collection of data about the environment from local water sources and sharing that data with others throughout the state. Thus the very collaborative and public nature of science was emphasized.

The project modeled what scientists do in several ways. One of the most noteworthy was the collaborative nature of the summer workshops, which lasted from 8:30 to 4:30 for two weeks. Each site was responsible for engaging a local scientist to discuss environmental issues indigenous to their particular region. The video conferencing distance learning network enabled participants from each of the 3 sites to interact with the presenters and with each other during these sessions. Since the participant's would be posting and sharing their data from the water-testing project with others throughout the state, these initial presentations and discussions were necessary to lay the foundation for understanding the inquiry nature of science. Participants noted in both the interviews and the surveys how valuable they found this information particularly in light of environmental issues. As one participant elaborated:

> I thought it was interesting to learn about our area's health and our water health and to discover ways to implement the project. This project is extremely useful, not only to our students but also to our families, especially our children. We got a lot of history of the region and the river, how it's changed, how can we monitor it and what we can do in the future to preserve it. I think that's the best thing I got out of the summer institute (8th grade science teacher).

The above testimony was corroborated in other interviews and surveys as the teachers felt they received a wealth of information and resources to use in their classrooms. They were particularly grateful to meet and make connections with individuals in their community who "might be willing to come out to the school and talk with my students." The centerpiece of the summer institute was the water-testing kit provided to each teacher participant. Teachers were favorably impressed with and appreciative of the kits. As one teacher detailed:

> What struck me is there's this big drive now to make science inter-relate. You've got the interdisciplinary type studies going on and not just with science and English or with science and math, but within all the sciences. It amazed me how much biology and earth science and environmental science and chemistry are all related and can be related through this water testing kit. You're teaching your state objectives but you're also teaching all the other sciences and history and students will be learning to write and communicate and they will learn about how to use the Internet for this project (9th grade chemistry teacher).

As is the nature of any project of this magnitude, teacher participants had varying degree of success with it. That the project was a success was noted from the descriptions from teachers as their students "became" scientists. As one participant noted:

> I'm currently showing pictures of youngsters who are actually involved in the water quality testing. I guess I've never seen a group of young children so involved in a task. They approach the task with, I think, a great deal of intellectual prowess. I was amazed at how serious they took the project and got genuinely involved in it. As you can see in these pictures, they worked. They all are doing tests. They're all busy. They wear goggles and they wear gloves and feel like scientists and they act like scientists. They indeed were young scientists in the truest sense of the word. I was impressed, and I think the pictures

demonstrate the quality of the work they were doing at that time (5^{th} grade teacher).

In sum, the teacher participants found that the summer institute provided them with the information and resources they needed to implement and model inquiry science into their classrooms.

Interactive Technologies as Collaborative Tools: Findings and Discussion

As the teachers explained, the televised distance learning sites proved valuable to be able to interact with university scientists and community environmentalists across the state. The participants felt that these individuals were well selected and they were impressed with their knowledge, expertise and willingness to answer questions. However, the distance learning network has its limitations. Teachers spoke of the difficulty of "sitting for a two hour session" and "having more empathy for what their students

Without exception teachers, upon completion of the summer institute, were committed and enthusiastic about using the Internet to connect their students with other students and to implement the vision of *Students as Scientists*. With such positive feedback and a commitment from the teachers, the project staff were confident and looked forward to monitoring the projects web page for student data. By November of each year it became apparent that the dynamic interactions between sites was not going to take place and in fact very few teachers were sending data to the web page. This was a huge disappointment for the staff and caused us to seek out the answer to why such a low participation rate given the enthusiasm at the end of the summer and their apparent commitment to develop this community of scholars. However, several of the teachers indicated problems were that they:

- Transferred to another discipline and no longer teaching science
- Had difficulty getting on the Internet or having access to an computer
- Did not trust the student results and were leery of posting erroneous data
- Something had come up and they had not yet had a chance to initiate the project
- Were delayed and distracted by the hurricanes in Southeastern North Carolina

Furthermore, by the spring of each year only 20-30 % of the teachers were actively engaged in the posting of data. An analysis of the interviews and surveys indicated a high degree of satisfaction with the project and yet the vision of a dynamic exchange of data over the Internet had not occurred. Some possible explanations are:

- Teachers did not value and envision the public nature of science as viewed by the project director.
- Teachers were locked into the traditional view of their classroom being confined and defined by the classroom walls.
- Teachers still view the workshop as a resounding success because they were able to use information from the workshop in their classes.

It is highly possible that the vision and value of students acting as scientists by sharing their data on the Internet were not communicated effectively from the project director to the teacher participants. Or if it was, this public nature of science an alien idea to teachers that they could not appreciate it. Most likely the type of science most teachers have previously experienced did <u>not</u> involve data sharing or collaboration with other classes or institutions across the state.

Conclusion

Students as Scientist project by all accounts has successfully introduced middle school science teachers throughout the state of North Carolina to the possibilities of the collaborative nature of inquiry driven science. Although the use of the Internet has not been as successful for data sharing as the project director envisioned, the project has encouraged many teachers to ask for more technology equipment and support. That a university program would lead the way in the public schools for the inclusion of the use of technology in science education was the vision of the project director. Now, armed with the water-testing kits and collaborative inquiry methodologies, science teachers are requesting interactive technologies to assist them in their classrooms.

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From Instructive to Constructive: A Practical Guide to Implementing Mindtools in the Classroom

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Abstract: Making the transition from an instructive classroom to a constructive learning environment is difficult for the best teachers, and seemingly impossible for beginning teachers to manage. This paper presents techniques that were used for converting existing science units into constructivist experiences through the use of computer-based Mindtools (Jonassen, 1999) as the unifying principle. Students remain at the center of their own learning, even as direct instruction is added to the environment.

Introduction

There exists in American education a wide disparity of technological resources among schools. We have spent 30 years dismantling a race based, two-tiered educational system in which selected schools had the best texts, teachers, and laboratories; only to replace it with a technology based, multi-tiered system in which chosen schools have the best teachers, technology and training available. Where the post-Sputnik science education reforms saw resources poured into predominantly white, middle-class schools, today's reforms are pouring resources into educational institutions with the greatest access to financing. This leaves many of America's schoolchildren with inadequate access to technology, and aids in creating a new underclass in our country, the technologically disenfranchised. According to the 1998 Journal of Educational Statistics, 75% of elementary students had access computers in the classroom, and only 24% of the classes had Internet access. In addition, the level of minority enrollment correlated with low access levels. Before any meaningful implementation of nationwide science or technology standards can occur, a common base must be established within the scientific instructional community.

Jonassen (1996) has presented us with just such a common base in Mindtools. By utilizing computers in constructivist settings and incorporating common and inexpensive programs, Jonassen provides us with the ability to establish a minimum standard of technological integration for all students. Using computers to support constructive practice is cyclical in nature. Becker and Ravitz (1999) have shown that increased computer use leads to increase constructivist practice. With national standards and certifications, magnet and voucher schools, it is more important than ever to establish certain fundamental uses of technology that are accessible to all students and consistent with the latest research in learning theory.

How can new teachers integrate technology with constructivist principles? It has been established that students in constructivist science classes have outperformed their counterparts in traditional classes in all areas measured. (Lord, 1999) However, it is impractical, if not impossible, for most new teachers to design a thoroughly constructivist course for a variety of reasons. One component faced by many teachers is fear that these methods don't seem like "real" teaching. In a recent issue of Learning and Leading with Technology, Sprague & Dede (1999) reflect on the difficulty one teacher faced:

> A high school teacher was designing a project on finances for her students.... She had read about constructivist theory... and had seen it modeled in her university courses. However, when it came time to implement this approach, she was reluctant to allow students to be in charge of their learning. She said, "I don't see that as teaching. The noise level was very loud, and I was nervous when my principal walked in. What will he think about my teaching with all that noise? I just felt I was not doing my job. I know I should teach that way but it is not my style." (p. 7)

The same article, however, tries to ease this fear by illustrating how one teacher was able to demonstrate how effective the constructivist approach was to her normally "traditional" principal:

> When he sat in on [a parent-teacher] conference, Principal Helmquist was confronted with a new model of teaching, one that centered on the needs and interests of the student. He saw that [the teacher] was able to provide a richer assessment of [the student's] abilities, one that went beyond just his low-level skills and knowledge. He saw that students' learning... went further than [the 8th grade social studies] content area, including language arts and science as well." (p. 16)

The purpose of this paper is to provide new teachers with a guide for developing and integrating technology into a constructivist setting. I am pragmatic in my approach, setting aside for now discussions of various constructivist "flavors", in order to present a realistic plan for action that is usable by both new and in-service teachers. While this model was implemented in a middle school science classroom, it is easily adaptable to any subject.

Designing the Unit

Choosing a Topic

First, a topic must be selected that lends itself readily to inquiry-based teaching. The goal is to be able to provide initial experiences within the domain that can be further built on by the student. The chosen topic should meet the following criteria:

1. Is the instructor well versed in the content of the unit?

The novice teacher will be learning to master a complex environment during this unit. Content proficiency is essential for the project's success. I would suggest that a teacher weak in chemical processes choose a different area for their first attempt. A novice teacher should keep their first foray into constructivist teaching well within their domain of expertise.

2. Can a hands-on, student centered learning environment safely be created with a minimum of effort and expense?

Remember that students may well be learning how to learn in a constructivist setting at the same time that the novice teacher is learning how to teach in a constructivist manner. The tasks designed for the students need to be within their ability to achieve, with guidance from the instructor. Providing a set of acids and bases for students to experiment with would be inappropriate, for example, as an introduction to the study of chemicals. They would be lacking the prior knowledge needed to safely explore the topic. By the same token, a beginning teacher may not have the time necessary to prepare 15 different solutions for 5 different classes. A teacher must consider both the time and materials available for their use.

3. Will the use of computers to represent or process the information gathered during the activities significantly add to the learning of the students?

Jonassen insists that a computer application is used as a Mindtool when it "engages learners in critical thinking about their subject."(p.18) The use of the computer must be more than just a means of presenting information learned; it must be a means of creating new learning. Creating a spreadsheet that will predict the outcome of a given event requires the students to understand both the scientific concept and the mathematical laws that govern it.

This project focused on simple machines. The instructor was very familiar with the subject matter and materials were easy to gather. Students could be given simple, every day objects such as string, wood, pulleys and toy cars to explore how machines work. Spreadsheets would allow students to process their experience and demonstrate the mathematical relationships between force, work, and distance as well as calculating the mechanical advantage of various machines.

Setting the Standards

Once the topic has been established, the teacher needs to determine what standards the students upon completion of the project will meet. These vary from district to district, state to state. But it is important for the novice teacher to realize that standards met are not limited to those within a grade level curriculum. Correlating the simple machine's unit with the local district's standards revealed not only science content and process standards but also many within mathematics and technology as well. Document as many of these as realistically possible. Constructivist learning takes longer than direct instruction, and new teachers will have to justify not "finishing the book" or keeping up with their peers.

New teachers should ensure that all applicable standards have been noted by:

1. *identifying all content areas standards to be addressed*
2. *explaining what process skills will be needed to complete the unit*
3. *examining both the technology and mathematics curriculum guides for relevant standards*
4. *identifying what communications skills and techniques will be used by the students.*

Given the exhortation to save time in the previous section, this may seem like an unnecessary amount of work for the overburdened novice teacher to complete. However, this documentation is essential in gaining both administrative and parental support for the changes that will be implemented in the classroom. Parents will want to know why only two chapters were "covered" during first quarter, and principles will need to be assured that the cooperative classroom is truly producing results.

Establishing Criteria for Success

Detailing the standards and benchmarks achieved also focuses the novice teacher on which areas to assess. Not every skill, process and bit of knowledge can be tested or assessed each unit. While students in this project were manipulating mathematical equations and creating spreadsheets, they were expected to master only certain essential information:

1. *What is a simple machine?*
2. *How do machines alter distance and force to make work "easier"?*
3. *How can the mechanical advantage of a simple machine be predicted?*

For this project, it was decided that students were to be evaluated on this information using a traditional test, as well as the final spreadsheet they produced. Completion of the spreadsheet would be evaluated using a rubric (Jonassen, 1996) which established the standard for success. Additionally, interim performance checks would be conducted to determine how well each student was fulfilling his or her role in the group.

Gaining Administrative Support

Armed with this information, a new teacher should now present their proposal to their mentor or supervising administrator. The quickest way to gain their support is to ask for feedback and suggestions on how to proceed. This may result in long stories of "When I was in the classroom…" however getting the administrator to feel like a part of the project will pay off when it comes time to evaluate the teacher's classroom performance.

One of the biggest hurdles I faced was installing enough computers to meet the needs of my groups. The beauty of Mindtools as envisioned by Jonassen is that the programs used are standard installation on most computers. No further outlay of funds was required from the principal. There are also teachers in every school who would love to see their classroom computers removed, if not destroyed altogether. New teachers can take advantage of this by asking their supervisor for permission to "borrow" unused computers. I managed to gather up several 486 PC's in this manner, powerful enough to meet the students' needs.

Unit Implementation

Cooperative Essentials

One of the biggest challenges facing a novice teacher is the management of cooperative learning situations. It is not enough for the teacher to create heterogeneous groups and assign tasks for them to complete. Analyses of classroom interactions have demonstrated high-status students often dominate discussions in cooperative groups. Conversations rarely reflect deep processing of concepts and procedures. (Bianchini, 1997) A constructivist classroom, centered on the student as learner, depends upon functional communication between students for its success. While in no means a comprehensive list of effective cooperative learning strategies, the following techniques were used with good success during this study. Note this was not the first experience these students have had in cooperative learning. The roles and their responsibilities had been practiced in the classroom many times before.

Create heterogeneous groupings. Rather than looking just to grades, consider a student's ability to organize, communicate, manipulate and lead before assigning them to groups. A group with three natural communicators will be more likely to discuss the upcoming dance than a group with one. Similarly, a group with three natural leaders will be more likely to disintegrate into argument than a group with only one.

Have a role for each member of the group, and responsibilities that go with that role. I prefer groups of four, for the simple reason that if one child is absent, the others can easily absorb their duties. For this activity I chose the roles of Lead Scientist, Recorder, Materials Manager, and Communicator. Teach the students their roles as they are assigned. Clearly explain and demonstrate their duties and the expectations for their success. In the event a class has an uneven number of students, have students negotiate which extra duties they would each assume.

Spend the first day of the activity strictly enforcing the expectations of each role. Students will quickly forget their roles and assume their usual social activities without reminders. During this project, only Communicators were allowed to initiate conversation with me. If any student had a question, they had to phrase it so the communicator understood what was being asked. Then, the communicator would ask me the question, take my response and restate it for the other student and in the process the whole group. This may seem cumbersome at first, but after a period of asking students "Are you the Communicator?" they quickly learn to discuss questions among themselves before calling on the teacher.

Let the students know they are being evaluated on how well they perform their assigned duty within the group. I simply walk around with a clipboard, randomly checking five or six students at a time, marking + or – for each. This is accompanied by constant questioning the first day or so: "Who is the Lead Scientist?" "What should you be doing now if you are the Recorder?" This is done several times through the period, enough so that each student has 2 or 3 marks per class.

Let the students know they will not be penalized for the poor performance of another member of the group. This is perhaps the most common concern I hear from parents regarding cooperative learning. Maintain individual accountability. The goal is for the students to work together in order for them to increase their individual learning.

Avoid stereotypes when grouping students. I asked the groups to select their Materials Managers and Recorders first and their Lead Scientist last. The eager and vocal students often opted for the first jobs, leaving some of the more reticent students as Communicators and Lead Scientists. The Lead Scientists were all given the option of switching jobs with anyone in their group, but surprisingly, all held on to their positions; much to the dismay of some of their more assertive group-mates.

Unit Design

The simple machines unit was divided into 5 phases: *Exploration, Explication, Analysis, Construction and Evaluation*. It was designed to be open and adaptable to the direction of the student's learning.

The Exploration phase provided students with an opportunity to develop an understanding of how simple machines operated. It also provided the teacher with important information regarding the students' level of prior knowledge. Students were given three tasks to complete during this phase. A variety of raw materials were provided in a central location, including wood blocks and planks, weights, pulleys, toys and string. The assignment was to lift an object with a lever. They were asked to modify the lever to make the object more difficult to lift, and again to make it easier to lift. Their observations had to be recorded and diagrammed, with one student presenting the results to the class. This process was repeated with pulleys and inclined planes. A different student was required to present each time.

It is essential during this phase that the teacher resists the temptation to tell the students what to do. Instead, questioning techniques should be used to both assist the students through their reasoning process as well as redirect them when necessary. Some of my students attempted to lift a lever using a pulley to drag an object up a ramp. While they were not on target, they learned a great deal about each machine before I finally asked them to reread their directions. When other students had questions about the machines, I would question them in return regarding what they were doing rather than explaining it myself. Some students had to be coached to look at resources available such as their text and available science databases.

The Explication phase consisted of the presentations by the various groups, and discussions that resulted. Most groups had come to a good understanding of what simple machines do, and developed some intuitive ideas about why they worked. The discussion here focused on the relationship between work, force and distance. They discovered that the object moved less when the work was easier and vice versa. Some teams had gone so far as to take preliminary measurements that helped to support their conclusions. We also took the time at this point to discuss what problems or difficulties the groups had encountered among themselves and how they had solved them. This better prepared them to work together on the more challenging tasks that followed.

The next phase, Analysis, required the students to repeat the initial tasks and quantify the relationships between work, force and distance for each of the machines studied. Again, groups shared their results, this time with the discussion building towards an understanding of calculating work done and mechanical advantage. Direct instruction was necessary here to explain the proper use of scales and other equipment. Most groups had by this time explored the chapter and discovered formulas that related these variables.

The groundwork was now laid for the Construction phase to begin. Jonassen (1996) provides a series of learning activities for teachers to follow when having students use spreadsheets as Mindtools. My students had already had extensive experience with spreadsheets, so it was not necessary for me to follow all of the steps he recommends. The task before the groups now was to create a spreadsheet that could calculate work, force, distance, and mechanical advantage for any given simple machine. Here it was important to have the students plan their spreadsheets before moving to the computers. Once at the computer, most groups began with entering the data they had already collected in the Analysis phase, utilizing the graphing functions to see relationships among the variables. The greatest difficulty was in determining what calculations to embed into the cells. Once that was mastered, groups quickly achieved their goals. Two techniques were particularly helpful at this point. First, I frequently asked groups to change positions and duties while in front of the computer. Each student in the group was thereby assured the experience of working directly with the spreadsheet. Second, Communicators were allowed to consult with Communicators of other groups, to compare their progress and share ideas. Often, the Communicators were not the computer experts in the group. This meant the "experts" had to teach the Communicators the program's design, both reinforcing their own learning and increasing that of the other members of the group.

Assessment took many forms. Presentations at the end of the Exploration and Analysis phases served as informal assessments of student learning, indicating areas that needed additional scaffolding or even direct instruction. Final assessment of the spreadsheet came from the students themselves. Following Jonassen's model (1996) each group prepared a set of 5 "what if" scenarios to be tested on another group's spreadsheet. Students enjoyed trying to pose problems that other spreadsheets could not solve. When spreadsheets failed to function properly, the group was required to troubleshoot and repair the problem. Each spreadsheet was then evaluated using a rubric based on Jonassen's recommendations. A "traditional" test was also administered. Finally, more as celebration than assessment, each group was required to construct a "Rube Goldberg" machine using at least 3 simple machines.

Conclusion

This project focused on simple machines. First, I determined the standards that would need to be met by the lessons, as well as additional technology standards that would be met as well. This was key in obtaining the administrative support I needed. In a school with limited technology resources, I had to demonstrate the effective use of the computers given to me. Presenting this plan to the principal secured enough computers to ensure the project's success. Ten computers formed the core Mindtools of the project. The spreadsheet program was used by the students to create their own simulations of machines.

By carefully planning the sequence of instruction, student-centered experiences were effectively utilized. When formal instruction was required, it was driven by the students own questioning and anchored in their previous experience. By designing their own computer models of machines, the students were required to process their new learning in a deeper and more meaningful way. The use of rubrics allowed for evaluation of the student spreadsheets that took into consideration their accuracy, organization, and level of complexity.

Effective planning and implementation eased the transition from an instructive to a constructive classroom. Computers as Mindtools are an important ingredient in creating a constructivist environment that both challenges the learners and requires higher order processing of new information. These skills are mastered with time. It is important that novice teachers be encouraged and supported in their desire to create constructivist learning environments. It is in the doing that new teachers create their own knowledge and become masters of these techniques.

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TEACHING ACROSS COLLABORATIVE HIGHWAYS (TEACH)

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Abstract : This article describes the process of using collaborative technologies to team teach elementary science methods courses across 3 different institutions: two small state universities and a large research university. The project was initiated because of the isolation each of the faculty members felt serving as the only educator (or only elementary science educator) at each of their institutions. A description of the project and the Internet-based collaborative technologies at each site is provided. Each of the three faculty members involved in the project share their unique stories of implementation and outcomes as a result of participating in this project.

Introduction

Excellence in elementary science teaching requires teachers that have a strong self-confidence in their ability to learn and teach science processes and content in an inquiry-based manner (Penick 1983). Prior to the availability of collaborative technologies such as video linkages, meeting software and Internet program sharing, college science educators were often isolated in their own colleges and universities. The three elementary science methods course instructors who participated in this two year collaborative project have explored strategies for sharing instruction and resources while adapting the available technologies to the specific needs of elementary science methods course instruction.

The application of modern digital educational technologies in instruction in college and university education programs has been the focus of research during the past decade. The potential for enhancement of collaborations among students and among in-service teachers has been explored in a variety of venues, with applications of telecommunication technologies such as listservs, newsgroups, email, and the World Wide Web (Caggiano-Hatton & Abegg, 1998, Khan & Clement, 1999). A recent study (Hatton & Abegg, 1999) on the effect of use of a telecommunications network on secondary science teachers concluded that teachers in the project shared technology resources and classroom experiences with colleagues. The teachers also reflected upon their teaching practices, such as how they managed technology in their classroom, and how the technology worked for their students.

Collaboration in education classes has been explored and elaborated upon at the University of Virginia and Iowa State University (Heinecke, et al., 1999) by way of emerging "groupware" technologies such as Microsoft NetMeeting software, whiteboards, and full-duplex telephone systems. Initial models involved seminar-sized groups , two-way collaboration, and a course content focused upon technology issues. These collaborations were themselves a transition from the "one-to-many" model common in distance learning; and the new model was characterized as a "several-to-several" model, or "Collaborative Education" (Bull, et al., 1999).

The project described in this paper, Teaching Across Collaborative Highways (TEACH), examines collaboration across three institutions of higher education. Three assistant professors of science education developed a plan to use telecommunication technologies embedded within their elementary science methods courses. During the first semester, students and faculty at a Wisconsin, private 4-year college, St.

Norbert College (SNC), worked with students and faculty at a large research university in Virginia, the University of Virginia (UVa), and with students and faculty at a public Eastern Shore university in Maryland, Salisbury State University (SSU). During the second semester of the project, the professor at St. Norbert moved to The State University of New York at Cortland (SUNY-Cortland) and continued the project. Course enrollments at the three institutions ranged from 15 to 30 students.

The Technology

Planning for the TEACH project began in the summer of 1998, and plans were implemented in the spring and fall of 1999. Technology recommendations were obtained from persons involved with the UVa/Iowa State projects. The chart below (Bull, et al., 1999) describes various options tested by other faculty and recommended for our consideration in the TEACH project.

	Inexpensive (> $500)	Low Cost (> $2,000)	Moderate Cost (> $10,000)
Whiteboard	NetMeeting Software White board (free)	Graphics Tablet ($200)	Electronic Whiteboard ($2,000)
Real-time Audio	NetMeeting Internet Audio (free)	Full-duplex Conference Phone ($300)	Conference Phone with Wireless Mike ($1,000)
Projector	Scan Converter ($300)	LCD Tablet ($1,000)	Projector ($3,000)
Real-time Video		NetMeeting + Video Digitizer ($70) and Video Camera ($150)	NetMeeting + Video Digitizer ($70) and Camera & Tripod ($1000)
Document Camera		Adapted Video Camera (no additional expense)	Video Digitizer + Video Switch ($20) + Document Camera ($1000)
Streaming Audio		SoundBlaster ($60) + Sound Recorder Software (free) + NetShow	SoundBlaster ($60) + Sound Editing Software ($50) + NetShow
Discussion Group		Internet Discussion Group (Collabra);(free)	Internet Discussion Group (Collabra);(free)

Table 1. Designing a Collaborative Education Laboratory (Three Examples)
Note: From " Mining the Internet: Collaborative education," by G. Bull, G. Bull, W. Heinecke, R. Walker, L. Blasi, and J. Willis, Learning and Leading with Technology 26, p. 52. Copyright 1999 by International Society for Technology in Education. Reprinted with permission of the lead author.

During the initial stages of planning it was hoped that collaboration technologies enabling full three-way audio and video interaction, the "Moderate Cost" example detailed in Table 1, would be available to all three classes. It soon became apparent that each institution would have its own answer for the technology requirements of this collaboration. Each instructor had to work through the process of designing the collaboration procedures while considering the technological capabilities of the other institutions. The University of Virginia was the only institution that used a system recognizable within the examples proposed in Table 1. Dr. Klein and Weaver had similar setups that included a USB Logitech digital video camera, laptop computer, speakerphone, and portable projector.

How the Collaboration Worked in TEACH

Though the three instructors discussed a possible collaboration as early as the 1998, actual implementation did not begin until a year later. The three instructors decided on the six research topics that would be assigned to each cross-state group. The six topics, all focusing on elementary school science were: curriculum resource materials, methods of teaching, diversity, state standards, integration of other elementary curricular areas, and alternative assessment.

The spring semester began with Virginia and Wisconsin starting classes at the same time and Maryland starting 2 weeks later. Three individual collaborative sessions between Virginia and Wisconsin were later followed by state team presentations at the individual sites. During the timeline of the project, differences

in the semester schedule for each institution, as indicated on Table 2, complicated the student email collaborations across the institutions.

January	February	March	April	May
13-17 Planning meeting at AETS conference	1 SSU class begins	5 Individual team papers due for each institution	1-14 No UVa science methods classes	14 SSU class ends
20 UVa and SNC classes begin	20 UVa and SNC classes begin	12-26 Collaborative papers due	1-26 SSU team presentations	
	10 First UVa/SNC Internet collaboration	12-31 No UVa science methods classes	6-9 SNC team presentations	
	10-17 E-mail introductions for 3 schools	14-31 SSU team presentations	9 SNC class ends	
	17 Second UVa/SNC Internet collaboration		16-30 UVa team presentations	
	24 Third UVa/SNC Internet collaboration		30 UVa class ends	

Table 2. TEACH Collaborative Timeline for Semester 1

June - August	September	October	November	December
6/1-6/3 Reflection on 1st semester; refinement of 2nd semester project	3 SSU class begins	1 1st live collaborative session with SUNY-Cortland and UVa	2 Optional night seminar	1-14 All team presentations
7/21, 8/13 & 8/31conference calls to plan for 2nd semester project	30 UVa and SUNY-Cortland classes begin	5 Optional night seminar	9 Optional night seminar	14 Final Collaborative session
	13-17 Introduction to project	12 Optional night seminar	16 Optional night seminar	
	15 - Register on Blackboard.com, complete online survey and introduce team member via discussion board	20 2nd live collaborative session with SUNY-Cortland and SSU	17 3rd live collaborative session with SUNY-Cortland and SSU	
	21 Optional night seminar	22 2nd live collaborative session with SUNY-Cortland and UVa	19 3rd live collaborative session with SUNY-Cortland and UVa	
	29 1st live collaborative session with SUNY-Cortland and SSU	25 Individual State papers due	22 Collaborative state papers due	
		26 Optional night seminar		

Table 3. TEACH Collaborative Timeline for Semester 2

Initially, the students were introduced to the project via their instructor. Each faculty member gave a brief description of the six science education topic areas: standards, diversity issues, assessment, curriculum resources, teaching methods, and integration across content areas, for students to investigate; and the students selected the topic of most interest and created the state and cross-state teams. The students assigned themselves to one of six groups by placing their name on a sign-up sheet under the topic of interest. Each state team had a counterpart team at each of the other two locations. These three state teams formed the cross-state teams. For example, the New York group investigating state science standards would also work with the Virginia and Maryland groups that were also investigating state science standards. Each cross-team group was required to work together to develop a question (or questions) on their topic and then conduct an investigation at a local and state level. Teams accomplished this in a variety of ways including: classroom teacher interviews, principal interviews, education faculty interviews, reviewing state and local documents, and reviewing journal articles. Virtually the same process was used during the second semester. The topics were modified and one school was different but all else remained unchanged.

The Live Collaborative Sessions

Since the groups from Virginia and Wisconsin were able to arrange for the use of collaborative technology and a common time to conduct collaborative lessons in real-time over the Internet, they planned three live Internet-based collaborative class sessions during the first semester. Each of the sessions contained a PowerPoint presentation for part of the presentation so that copies of the PowerPoint materials in either HTML or native PowerPoint format and any supporting materials could later be shared with the Maryland group. During the second semester, three live Internet-based collaborative sessions were planned as well.

For the second phase of the project, class schedules only allowed fpr collaboration between schools at a time: SSU/SUNY-Cortland abd UVa/SUNY-Cortland Dr. Klein (SUNY-Cortland) split her class into two separate groups. One group would meet online with Dr. Weaver's (SSU) class on Wednesday during a collaborative week. The other half of her class would meet with Dr. Matkins (UVa) on Friday of the collaborative week. Approximately 45 minutes of live collaborative teaching was possible during each session.

During semester one, the three collaborative sessions included an introductory session, a session that focused on gender issues in science education, and one that focused on alternative assessment in science education. The introductory session included an overview of the project and a review of team responsibilities. This session, which included a PowerPoint presentation, was facilitated by both instructors. During semester 2, the introduction was done at each individual institution by each professor with no live collaboration. For both the first and second phases a session on gender issue and alternative assessment was conducted.

Dr. Matkins (UVa) led the gender issues session, which focused on her research about the lives of six women scientists. It included a reader's theater-style presentation of case studies. Six students, three from each location, played the part of the six women scientists in this interactive session. Following the case study presentation, the instructor facilitated a discussion, using a PowerPoint discussion outline, about gender issues in science education.

The session on alternative assessment led by Dr. Klein (Phase 1 - St. Norbert, Phase 2 SUNY-Cortland). Students were asked, via a listserv posting, to read a section of an online resource about alternative assessment. In this session college students reviewed samples of answers to an open-ended question created by fifth grade students. Students at each location created scoring criteria to evaluate the answers and shared their approach to the process and their results using the collaborative technology. This was followed by a discussion, using a PowerPoint discussion outline, on alternative assessment strategies for use in elementary science teaching.

During semester 2, Dr. Weaver (SSU) conducted a session that focused on using children's literature as a catalyst to begin the inquiry process in elementary school science. Once again a PowerPoint Presentation was created to emphasize key points. Students were introduced to the topic and instructed to use the science processes to design an investigation. Students were also provided with a rationale for using literature to teach science. During the collaborative session between SUNY-Cortland and SSU, Internet connection problems prevented a successful collaboration. However, in the session with SSU and UVa successful collaboration occurred.

Student Research Teams

Student teams in each state were required to develop two documents. One was a short paper on the selected issue and the ways in which that issue was addressed in their state. The second document was a summary paper developed by the cross-state teams on the same issue topic. All papers were intended for posting on the TEACH web site. Instructors established a series of due dates for each stage of the project. During the initial semester, variations in due dates were unavoidable because of differences in school schedules and in

class duration. The Wisconsin class did not meet for the last third of the semester, the Virginia class met sporadically during the mid-point of the project due to prior arrangements with a social studies colleague, and the Maryland institution held spring break during the most intense document-sharing flurry of the project. These differences in institution and class schedules added to the potential for difficulties and frustration of the students as they were trying to collaborate on their cross-state summary papers. Many of the problems associated with different calendars were eliminated during the second semester. Dates were more closely synchronized as delineated in Table 3.

During the first semester, the student cross-state teams communicated primarily via email, listserv, and chat rooms. The listserv was created and set up by the faculty coordinators to initiate student communication and to allow the coordinators to monitor communication. During the second semester a class site was established on Blackboard.com. to facilitate further communication. This site hosted a discussion board as well as other features that enhanced communication between instructors and students at all three sites. Many of the students decided to communicate on their own directly via email and also by setting up chat room communication. Students at all three locations experienced email difficulties such as problems with sending attachments, and with sending messages to the whole group when a more narrow audience was intended. This worked itself out as faculty and students coached other students using a "just-in-time training" model.

Conclusion

The TEACH project effected change in the faculty involved in the project. Faculty involved in the project, Drs. Matkins, Klein, and Weaver, developed more sophisticated problem-solving skills as the collaboration progressed. They worked with three variations of technology, and guided their students through the team collaborations. PowerPoint presentations lent themselves to NetMeeting sharing, so faculty developed PowerPoint presentations. A common site for references and class notes was needed, so a faculty member accessed her university's class web site and established a class web page for student and faculty access. This type of sharing was further enhanced during the second semester via the Blackboard.com site.

The three faculty members became more confident and fluent in ways to use technology for instruction and collaboration. They learned to move smoothly from a question and answer portion of the class to a PowerPoint presentation and then on to use of a Netscape-accessed web site – all focusing upon the topic of the day. An aspect of the problem-solving strategies developed was the development of multiple "fall-back" technologies as the semester progressed. Faculty guided the students through a succession of telecommunication strategies, from listserv to email, then fax to phone. When one option failed, another was found. Frustration due to technology glitches and the unfulfilled assurances of technology support staff was often coupled with the TEACH team's exhortations to each other for patience.

Even though the audio connection during the live sessions could have been better, the audio, such as it was, proved essential to the live collaboration. The speakerphones at Maryland and New York and the full-duplex phone at Virginia could be depended upon if everything else failed. Faculty would maintain the class discussions through the use of the speakerphone until the connection was re-established. While other systems were being rebooted and brought back on screen, the class could continue to talk and listen to each other.

In taking on this project, faculty accepted a myriad of challenges with management of the project. Initially, each of the faculty members was on a different semester schedule, and only one of the three faculty members had a three-credit full semester course. One faculty member taught science methods in an integrated course with mathematics, and the another taught science methods in an integrated course with social studies. It was necessary to negotiate not only with each other, but also with other faculty at the university. Table 2 illustrates the variations in start time, spring break, and last day of class. For the collaboration to occur, school must be in session at each collaborative site. Also to facilitate synchronous collaboration, classes must meet at the same time. The changes that occurred during the second semester allowed for these necessary components. Time zone changes must be accounted for, as these faculty discovered in their first (abortive) attempt at a conference call. One reality of video and audio collaboration

is the need for real-time coordination; and variations in class schedules and class meeting times must be accounted for in planning for the semester's collaboration.

Though student collaboration was the intent of the project, purposeful faculty collaboration served to diminish the sense of isolation of the faculty involved. Each was either the only science educator or the only elementary science educator at their institution, and each had the responsibility of delivering a quality course that had the potential to effect change in a mostly traditional audience of mainly young, white females.

An important aspect of faculty outcomes must be seen in terms of its potential effect upon students; that is, the modeling throughout this project by female faculty of relevant problem-solving with technology. A recent AAUW study (Online) cited the differences between girls and boys in choice of computer classes. Girls are more likely to choose clerical-type classes (e.g., word processing), and boys are more likely to choose advanced classes (e.g., graphics design). By participating in TEACH, the females in the class not only developed technology strategies to meet their collaboration assignments, but they also observed their professors working through challenges with advanced technology. Students even helped faculty with the use and adaptation of the technologies employed.

The TEACH project served as an initial step in preparing teachers to access and use technology for collaboration with colleagues across geographical and philosophical boundaries. Both elementary science education faculty and elementary education students reported a diminution of a sense of isolation from other educators. Faculty and student interactions revolved around science reform topics: diversity issues, standards-based education, assessment, teaching methods, integration of subjects, and curriculum resources. Authentic, purposeful assignments were the motivation and the vehicle for collaborative examination of science education reform topics. It is through such projects that teachers have the possibility of developing professional attitudes, practices, and habits that will enable them to be leaders in science education reform.

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SciLinks: Linking Technology and Scientific Inquiry

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Abstract: Because of the ever-expanding emphasis on technology integration in today's schools, and because of technology standards established by NCATE, it has become more important than ever that preservice teachers graduate their programs with a high level of technological literacy. Currently however, technology training for preservice teachers is generally inadequate. This paper will establish a rationale for technology integration in teacher preparation courses, and describe a new technology-rich science textbook that enables preservice teachers to access the Internet more easily via a program called SciLinks.

Introduction

In his classic treatise on education, *Schoolteacher: A Sociological Study*, Dan C. Lortie (1975) described teaching as an occupation with limited mediated entry. Beginning teachers are immediately responsible for all classroom interactions and are socialized into the profession in a "learn by doing" approach. Novice teachers rely heavily on their apprenticeship of observation experience; that is, they look at teaching through their experience of having been a student (Lortie 1975). In his seminal study, Lortie (1975) found that teachers viewed teaching as characterized by anxiety and isolation, and as a private rather than a shared experience. Thus, socialization into teaching is largely a self-socialization process and teachers tend not to adopt a practice unless it fits with their established way of doing things. Since most preservice teachers lack any significant apprenticeship of observation in the area of technology, they are ill-prepared to think about technology as a tool in their own teacher preparation and later practice.

The above view of teaching is closely juxtaposed with many classrooms of today if one considers issues of technology integration across K-16 curricula. Despite an almost fanatic enthusiasm about technology in popular culture, many American classrooms still lack an adequate approach to technology integration. Thus, one current view of technology integration in preservice teacher training is characterized as follows: despite the abundance of technology in schools across the country, we seem to "live in the best of times, and in the worst of times" (Rogers 1996). The best of times viewpoint is widely represented by those who purport children of today as net-savvy, techno-kids who devour a cornucopia of emerging technologies in their schooling and entertainment worlds. Tapscott (1998) describes these youth as the *Net Generation*. The "worst of times" scenario is described by the literature on actual teacher practice, which indicates the inadequacies of teacher preparation for technology integration (NCATE 1997; Rosenthal 1999).

Clearly, the literature describes a digital divide in today's schools. Because many practicing teachers are ill-equipped to narrow this divide (Cuban 1993; 1997; Rogers 1996; Viadero 1997; and Stoll, 1995) technology training has become paramount in teacher preparation programs. How well are today's preservice teachers being prepared to integrate and utilize information technology? Some education schools are on the "vanguard" (NCATE 1997 in Rosenthal 1999, p. 22) of preparing teachers for technology integration across their curricula. However, most colleges of education are currently inadequate in their technology training programs. Thus, most preservice teachers enter their professional semester with limited views of technology use. This is not surprising since only two states, Vermont and North Carolina, require any evidence of student proficiencies in integrating technology into their teaching experience (Rosenthal 1999).

Those tech-savvy preservice teachers who do integrate information technology into their teaching via a variety of emerging technologies, are able to diminish Lortie's notion of teachers working in isolation because their curricula and colleagues become global in scope.

This paper will first explore the rationale for integrating instructional technology in teacher preparation programs. Next, the paper will describe a new type of technology-rich textbook that helps science teachers enrich and extend their curricula through utilizing embedded Internet links called SciLinks. Finally, the paper will examine specific examples of SciLinks that preservice teachers used in response to an environmental education scenario presented in their coursework.

Rationale

The National Council for Accreditation of Teacher Education (NCATE) has developed strong recommendations for strengthening technology integration in teacher education programs. NCATE's (1997) report, *Technology and the New Professional Teacher: Preparing for the 21st Century Classroom*, establishes a strong rationale for increased technology use in teacher preparation programs. This rationale is based on two assertions: (1) that technology is not just 'a tool,' but that it has significantly changed the nature of academic work; and (2) that teachers need to gain technological expertise in order to utilize emerging technologies to promote better learning (NCATE 1997).

The International Society for Technology in Education (ISTE) continues to develop and refine its National Educational Technology Standards for students which when fully implemented, will facilitate school improvement vis-à-vis technology integration (ISTE 1998). Similar to the national *Benchmarks for Science Literacy* (AAAS 1993), the ISTE standards outline what students in grades preK-12 need to know and be able to do in order to demonstrate technological literacy.

The National Science Teachers Association (NSTA), in conjunction with Holt, Rinehart and Winston Publishers, is developing an innovative, practical approach to assist students and teachers in meeting goals and standards established by NCATE, and ISTE. Holt, Rinehart and Winston has produced a series of science textbooks that blend two of the major paradigms in today's classrooms; textbooks and telecommunications (Editor, 1999). These new textbooks promote technology integration by embedding URLs called SciLinks into the textbooks. SciLinks are found in the textbook margins and enable students and teachers to enrich text material and major scientific concepts by linking directly to extensive and "instructionally rich" (Editor 1999, p.5) Internet resources. "SciLinks represents an opportunity to create new pathways to learners, new opportunities for professional growth among teachers, and new modes of engagement for parents (Editor 1999, p.5). The specifics of SciLinks will be described later in this paper.

In addition to technology Standards established by academe, the need for greater technological literacy in America's populace is outlined in detail by several scholars in the business world (Davenport 1997; Tapscott 1998; Dertouzos 1997; Lewis 2000; Gates 1999; Judson and Kelly 1999; and Bronson 1999). The following quote illustrates the central position of information technology to the business world, and by inference, to the education world:

> I don't see information technology as a stand-alone system. I see it as a great facilitator. And maybe most important, it's a reason to keep asking yourself the question-why, why,why (Paul O'Neill, Chairman & CEO of Alcoa, in Gates 1999, p. 295).

What does information technology facilitate? Simply put, its integration across K-16 curricula promotes a new, inquiry-based, collaborative way of learning (NCATE 1997; Author 1999; Bruce and Levin 1999; and Molebash and Milman 1999). In facilitating this integration, SciLinks may provide the necessary assistance to teachers that is missing in many approaches to technology integration. Many K-16 educators find technology difficult to use and too time consuming. SciLinks is a new curriculum tool that may provide educators the boost they need in order to use technology in new, creative ways.

> ...What teachers actually need is in-depth, sustained assistance as they work to integrate computer use into the curriculum and confront the tension between traditional methods of instruction and new pedagogic methods that make extensive use of technology (Panel on Education Technology 1997 in Schmidt, et al. 1999, p. 1469).

Course Participants and Program

In the Fall 1999 semester, 49 preservice teachers at Penn State University at Harrisburg utilized Holt, Rinehart and Winston's text *Environmental Science* (Arms 2000) in their science methods course. This text includes SciLinks Internet resources and was used primarily as a reference tool to support an inquiry-based examination of environment and ecology issues. These issues were organized around Pennsylvania's soon-to-be-adopted Environment and Ecology Standards. Students worked in collaborative research groups and utilized SciLinks to respond to scenarios such as the following:

Camp Catherine and 1,000 surrounding acres are being cleared to make way for a new, single-family housing development. The development will require new roads and infrastructure, sewage and water lines, and communication infrastructure. The acreage to be developed currently includes agricultural fields and pastures, mixed forest, the Swatara Creek corridor, and extensive wetlands. Use SciLinks and other references to explore the impact that development will have on this natural area (Coverdale 1999).

Students utilized SciLinks, other Internet sources, and conventional written reports to research this scenario. Their findings were compiled into poster projects, PowerPoint presentations, and oral presentations. The students' findings were presented to teachers and students in two inner-city elementary schools. The issues raised by students' research were then the focus of Penn State Harrisburg's first Environmental Town Meeting, an interactive forum with a panel composed of experts from several Pennsylvania agencies and governmental departments.

SciLinks – A Description

To use SciLinks, students accessed the SciLinks web site at www.sciLinks.org. They registered as either "Student" or "Teacher," and entered the SciLinks access code found in the textbook margins. This linked students to science content and links to other topics related to specific topics. The list of related URLs has been screened by science educators for accuracy and age-appropriate content and pedagogy (Editor 1999). This screening process by NSTA ensures the URLs represent sound science and the database is continually updated to ensure sites are still active and appropriate. Below, I describe two specific SciLinks that students used to examine the scenario above.

Example 1

TOPIC: ecosystem factors
GO TO: www.scilinks.org
KEYWORD: HE035

Most students chose to research the ecosystems and wildlife habitats found at the Camp Catherine study site. Since the class had attended three field trips to this site throughout the semester, they had collected on-site data on habitats, water quality indicators in the Swatara Creek, and conducted a brief wetland study. Students used the SciLinks feature in their text to research various aspects of the scenario. Below is a brief description of SciLinks KEYWORD HE035 - ecosystem factors.

Entering HE035 into the SciLinks database links students to five URLs that provide background information on ecosystems. One specific URL is titled: *The Chesapeake Bay: Abiotic and Biotic Factors*. This site was particularly helpful to students' research because Camp Catherine and the Swatara Creek lie within the Susquehanna River watershed, all of which drains into the Chesapeake Bay.

Students reported the most useful menu for researching factors affecting the Chesapeake Bay watershed was found from within SciLinks HW035 at: clab.cecil.cc.md.us/faculty/Biology/Chesapeake/cb.html. The following links were provided in table form:

Introduction	The Chesapeake Bay Ecosystem
Submerged Aquatic Vegetation	Trophic Levels
Abiotic Components	Problems With The Chesapeake
Chesapeake Bay Geography	History of Chesapeake Bay
The Watershed	Excessive Sediment In The Bay
Food and Consumption	Common Life & Endangered Species

From these links, students focused their research on *The Watershed, Abiotic Factors, Excessive Sediment in the Bay*, and *Problems With The Chesapeake*. Because students had conducted field study at Camp Catherine, they utilized SciLinks to provide background information and specific science content about factors affecting the Susquehanna River watershed and hence the ecological health of the Bay. Much of the information found

at SciLinks HE035 related directly to the Camp Catherine research scenario. For example, as students pondered the fate of the Camp Catherine wetlands, they discovered in SciLinks HE035 that even though wetlands comprise a small percentage of total land area, they provide habitat to a large percentage of unique and even endangered species. Students also discovered the major threat to wetland habitats: drainage for farmland and construction of housing developments.

The *Sediments* link confirmed student hypotheses about the effects of development at Camp Catherine: the Susquehanna tributaries would become more clogged with sediments that ultimately degrade the Bay, and increased runoff from development would contribute to Bay degradation due to heavy increases of fertilizers, oil runoff, pesticides, and possibly sewage runoff.

Finally, students learned through SciLinks HE035 that by destroying the Swatara Creek buffer zones to develop a housing community, a large portion of the Susquehanna watershed and the Bay would be degraded. However, students also learned that if the development *weren't* built, maintaining the status quo of Camp Catherine would not be enough to improve or *restore* the Bay.

Thus, students were able to triangulate their research data by comparing information from their field study at Camp Catherine, the textbook and other printed sources, and SciLinks sites provided within their Environmental Science textbook.

Example 2

TOPIC: population problems
GO TO: www.sciLinks.org
KEYWORD: HE342

Several student groups felt that issues related to population growth fueled development and urban sprawl and thus examined SciLinks related to population issues. Below is a brief description of SciLinks HE342, population problems.

When students entered HE342 into the SciLinks database, they found four URLs dealing with population issues. Two sites contained information about U.S. and world population statistics. Important global environmental and development trends were depicted in maps, graphs, and diagrams. One URL was a link to the U.S. Census Bureau and was interactive in that it allowed students to analyze census data and predict the rate of the U.S. population growth.

Another Census Bureau site found at www.census.gov/www/index.html contained extensive information under the major headings of People, Housing, Business, Geography, and News. The Geography link directed students to dozens of related links including Geographic Information System data, geographic statistics, maps, charts, and even employment opportunities. Students used this site to research population statistics, land area, and the population density of Dauphin County, Pennsylvania where Camp Catherine is located. Several student groups also used this link to locate a list *of State Data Centers*, which provided a wealth of population and land use information about Pennsylvania.

Conclusion

Unless preservice students are better prepared to integrate technology across their curricula, the paradigm of under-utilized modern computers collecting dust in teachers' classrooms will continue. In order to improve teacher education for preservice students vis-a-via technology, teacher educators must do a better job of modeling technology integration. NCATE has provided a strong mandate to teacher education programs and will continue to be an influential force in forging more technology integration into teacher preparation.

Formal data on the utilization of the SciLinks program were not collected, as this was a pilot experience with this textbook. However, several informal interviews with students indicated that they enjoyed using this textbook, primarily because of the SciLinks feature. Many students stated that they realized the importance of technology integration but that when they prepared for class or wrote their own lessons, they were often inhibited by the time-consuming nature of searching the Internet for relevant material. SciLinks, because it was embedded in the text, was easier to use and saved students time as they researched several environmental issues. Students highly recommended that I adopt the text again.

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TEACHING EARTH AND SPACE SCIENCE: A DISTANCE LEARNING COURSE FOR DADE COUNTY FLORIDA TEACHERS

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Abstract: This paper describes a new program of study for inservice teachers in Miami/Dade County Florida, for the purpose of developing more teachers interested in teaching middle school science. At the end of this interactive/distance learning program, teachers will have gone from an elementary/early childhood specialty to middle school science certification, helping to meet a critical shortage of teachers in this area. The community of teachers is dominated by females and the students they teach consist of the most heterogeneous population in the state, with many minority groups represented. This ongoing course is still evolving and the teachers are responding very favorably to this approach of combining instruction in pedagogy with scientific methods and ideas.

Introduction

In 1999, The Florida State University (FSU) established a Distance Learning Master's in Science Education Program, for teachers in Dade County Public Schools. Students enrolled in this program take a minimum of 33 semester hours, which include 21 hours of science education courses and 12 hours of science content (Florida State University Department of Curriculum and Instruction 1999). All courses of this program adhere to the following goals:

- Improve the science content knowledge of science teachers
- Improve the science pedagogical knowledge of science teachers
- Improve the learning of science in elementary and middle schools; and
- Assist science teachers in understanding issues underlying reform efforts in science education

The program is rich in the use of educational technology, requiring teachers to be active Internet learners, constantly upgrading their level of sophistication to include processing of scientific data, preparation of reseearch reports, and publishing reports on the World Wide Web (WWW). Field trips and occasional lectures are used to reinforce the department's desire to instill value to the implementation of constructivist thinking as teachers reinvent the way they teach, in addition to developing further competencies in new subject areas.

All courses are geared to the Miami-Dade Competency Based Curriculum as closely as possible. In August of 1999, a new course was established at FSU for this program, Teaching Earth and Space Science, for the inservice teachers. The complete list of courses is shown in Appendix A.

A New Course: Teaching Earth and Space Science

Teaching Earth and Space Science is a 3-credit course currently available only to the 120 students in the Miami/Dade County Public Schools Master's Degree in Science Education Program. The focus of the course is on how to teach earth and space science in middle school and in all courses in which earth and space science content is taught (e.g., general science, social studies, physical science, and physics), including elementary-level classes. Science teachers who enroll in this course will know how to teach earth and space science such that their students are able to:

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- Use scientific principles and processes appropriately in making personal decisions
- Experience the richness and excitement of knowing about and understanding the natural world
- Engage intelligently in public discourse and debate about matters of scientific and technological concern; and
- Understand complex scientific issues that relate to environment and environmental policy

Earth and Space Science includes the traditional discipline categories of astronomy, geology, meteorology and oceanography. The fundamental concepts underlying the content standards of the National Science Education Standards (National Research Council 1996) are utilized to organize the course subject matter that is the focus of this pedagogical content course. Coursework organization which crosses traditional discipline boundaries assists teachers in developing interdisciplinary perspectives as well as helps students recognize the relevance of earth and space science in their daily lives.

This course examines earth and space science subject matter in a historical context and employs the variety of activities that can be used to promote learning of students in elementary and middle school grade levels. Students explore the subject matter knowledge of given topics and the historical development of those ideas while also investigating the alternative frameworks and misunderstandings usually brought with them to the process of learning. Such an approach has been utilized in the outreach programs in meteorology at FSU throughout the decade, beginning with the direct readout weather satellite program known as EXPLORES! (Ruscher et al. 1993).

Course Design

As with much of the Dade County Public Schools Masters' Program, Teaching Earth and Space Science is an on-line course. The course website is used by students, teaching assistants and instructors in all aspects of course presentation. Students can:

- Read announcements from teaching assistants and instructors
- View the syllabus
- Obtain course documents, such as handouts
- Submit assignments through a "Digital DropBox;"
- Take quizzes and surveys
- Communicate with other students through email, virtual chats and threaded discussion boards
- Access on-line learning materials such as text, audio and video files
- Dialog with dialog journal partners and develop personal almanacs of real-time earth and space science datasets

For the first semester (Fall 1999), students used an earth science textbook (Press and Siever 1998), an on-line meteorology text (University of Illinois 1999), a set of readings on ocean ecosystems (Cherrier 1999), astronomy resources such as *Cosmos* (Sagan 1983), as well as articles from scientific journals (Scientific American 1998) in their learning. In addition to these activities, students met with instructors face-to-face five times. At the onset of the semester, an instructor orients the students to the course format and online software. During the course of the semester, the students meet with instructors once during the teaching of each content area. During these meetings, students discuss homework assignments, participate in field activities and attend lectures.

Numerous field experiences are also incorporated into the course as part of the face-to-face meetings in Miami. The purpose of these experiences is to encourage teachers to gain some familiarity with their natural environment as well as extracurricular resources which can allow them to believe in their ability to use these resources in their own teaching. With the cooperation of numerous agencies and individuals, we have been able to participate in field experiences that provide teachers with realistic examples of how complex scientific issues are dealt with in the real world. Field experiences carried out for Fall 1999, the first semester of the course, included:

- National Weather Service Forecast Office, Miami
- National Hurricane Center, Miami
- Federal Aviation Administration Air Traffic Control Center and Center Weather Service Unit, Miami International Airport
- Atlantic Oceanographic and Meteorological Laboratory, Virginia Key
- Marjory Stoneman Douglas Biscayne Nature Center
- Broward Community College Planetarium
- Night Sky Watch in the Everglades

Among the locations, the new Marjory Stoneman Douglas center provided opportunities to integrate the various aspects of earth sciences rather well. Although originally picked as a site to carry out a beach walk (Figure 1), the site also afforded an exposed fossil coral reef (Figure 2), which facilitated discussions of climate change, geological processes, and meteorological processes (we were forced to evacuate the reef during a heavy rain squall, on a day in which only a 10% chance of precipitation was forecast).

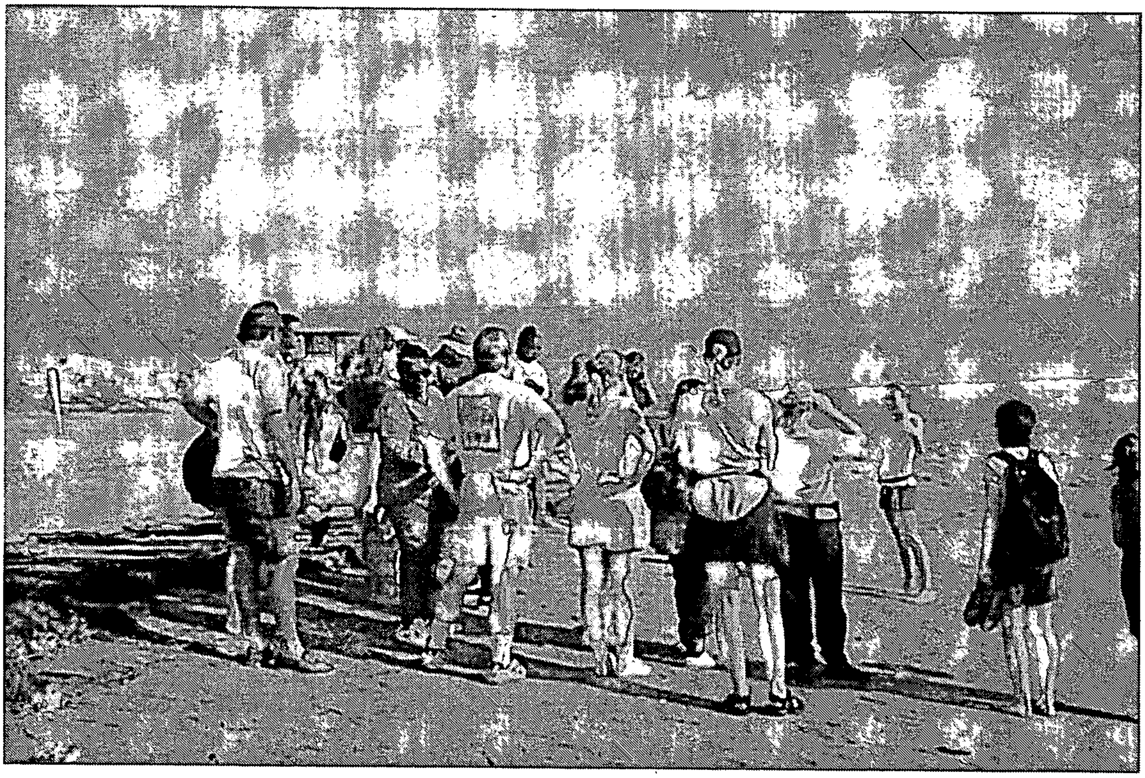

Figure 1. Teachers are guided on a beach walk of Marjory Stoneman Douglas Biscayne Nature Center in Dade County. In addition to being exposed to marine ecosystems and habitats, a variety of species were collected and studied, and meteorological and geological processes were discussed. Several of our teachers indicated they had brought their students out to this location previously, but had never realized the richness that the center offered for a wide array of earth science topics.

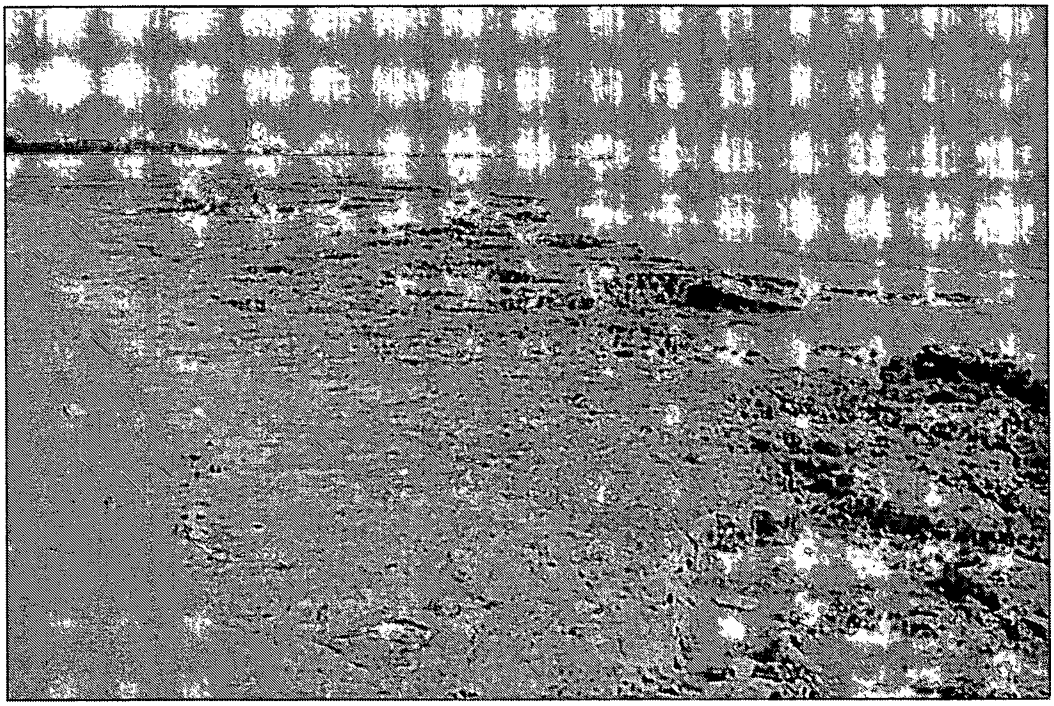

Figure 2. At the end of the beach walk discussed previously, an exposed fossilized coral reef is present. In addition to tide pools, discussions of coral bleaching, limestone formations in other parts of the county, and climate change were facilitated before heavy precipitation occurred.

Course Assignments

Students complete three major assignments in one semester. The first is a term paper, based on one of the four core subject areas. This project is done individually, and reviewed by an instructor and at least two peers. The next assignment is the creation of a WWW site, which is a follow-up to the term paper. Students create their web sites in groups, and are required to include graphics, text and links. These web sites are meant to be meaningful to educators seeking information on earth and space science teaching. The next activity is also conducted with a partner; students create lesson plans for a week of earth science classroom activities. These plans are on a topic different from the web and paper topics. The plans do reflect the content covered in the course.

There are other assignments, done on a smaller scale in the course. Each student is assigned a dialogue journal partner. These journal pairs are required to communicate weekly in their journals. Also, students create almanacs of astronomical, geological, hydrological, oceanographic and atmospheric data. These data are obtained via on-line and newspaper resources. Also, students submit homework problems via the course web site and also while visiting with teachers. Formative and summartive assessments are used to collect data on the effectiveness of communication and learning. Most of the teachers are practicing elementary school teachers and have had little formal training in science classes, so we try to incorporate active investigations of scientific topics of interest. Some of the primary integrating topics used in the Fall were Hurricanes and the El Niño/Southern Oscillation phenomena (University of Illinois 1999). A recent report providing evidence for the success of this type of approach is given in Kielborn and Gilmer (1999).

Future Plans

This course will be taught throughout the year 2000 for Dade County teachers, and beginning in the Fall of 2000, it will be taught on campus in Tallahassee for preservice as well as inservice teachers. This course will be offered annually thereafter on campus for both inservice and preservice teachers in FSU's Colleges of Education and Arts & Sciences. One of the challenges facing instructors will be the recreation of field experiences that are done in an organized manner at a level consistent with the Dade County teachers, but would be difficult to reproduce for the benefit of teachers in other physical locations. To replace the intensive field experiences that are only available in Miami, Tallahassee teachers will visit the State of Florida Emergency Operations Center, the National Weather Service office in Tallahassee, and the Florida Geological Survey, as well as local science and natural history museums and field sites (sink hole, sandy beach, estuary). In addition, extensive use of the GLOBE program's teacher's guide

(GLOBE 1997) and suggested activities will be made, and all preservice teachers will become certified GLOBE teachers, enabling them to bring substantial field experience in taking valid scientific observations with them. Since 1994, the GLOBE program (http://www.globe.gov/) has been providing teachers at all levels in primary and secondary schools worldwide opportunities to train students in the collection of data that scientists can use. It is hoped that this type of training can augment or replace field experiences for those teachers who take such a class, in a locale where intensive field experiences at government facilities are not possible.

For the 2000 offerings, we will also incorporate more video clips and utilize more point-to-point video conferencing. One of the significant shortcomings for the first course offering was the limitation on interactivity. Only during the visits by faculty to Miami did the teachers feel like they were as actively engaged as they would have liked. To some extent, some of the web-based development and labs they used also engaged them actively. These traditional students still felt a lack of direct teacher-student interaction; the interactions through electronic mail were insufficient to capture the spirit of a traditional teacher-student exchange. Further evaluations will be shared at the conference, once data from Fall 1999 has been collected and analyzed.

Although the course web site is restricted to registered teachers and students, a mirror of it will be online in January 2000 at http://www.met.fsu.edu/Classes/SCE5635/, and it will be demonstrated during the presentation (Figure 3).

Acknowledgements

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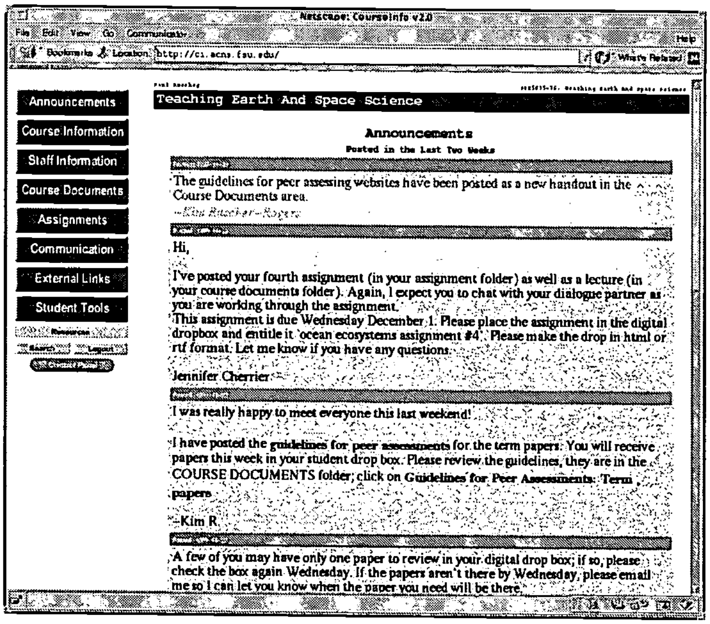

Figure 3. Course web site as seen by registered students and faculty.

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Appendix A: The FSU/Dade County Graduate Science Education Program

First Summer 1999 – direct instruction in Miami for 4 weeks, strong online component

- SCE 5635r Florida Ecosystems (3 semester hours)
- SCE 5920r Colloquium (1) Technology, use of the web.
- SCE 5340 Teaching and Learning Science (3)

Fall 1999, Spring 2000, Fall 2000 – students rotate through these 3 courses in groups of 20 (2 sections per term) – completely online with some faculty-directed field experiences and lessons

- SCE 5740 Research Methods in Science Education (3)
- PHY 5940 Physics Teaching (3)
- SCE 5635r Teaching Earth and Space Science (3)

Second Summer 2000 – direct instruction

- SCE 5140 Curriculum in Science Education (3)
- SCE 5920r Colloquium (1) Current trends in science teaching.
- SCE 5635r Marine Biology (3)

Spring 2001

- SCE 5623 Conceptual Learning in Middle School Science (3)

Third Summer 2001 – direct instruction

- SCE 5695 Science Education in Developing Countries (3)
- SCE 5715 Conceptual Learning in Elementary School Science (3)
- SCE 8966 Master's Comprehensive Examination (1) *or*
- SCE 8968 Specialist Comprehensive Examination (1)

Exploring With Computers in Chem Class

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Abstract: Since 1997 the RITTI program has provided 25% of all public school teachers in the state of Rhode Island with a laptop computer and two weeks of training in its use in the classroom. This paper is an attempt to chart the impact of this program on the classroom practices of four science teachers with particular attention being paid to teachers of chemistry. The author will also document his experiences in incorporating this technology into his own chemistry classes.

Introduction

The Rhode Island Teacher Training Initiative (RITTI) began back in the summer of 1997 as a privately funded program to train public school teachers in the use of computers and software in the classroom. Over the course of three summers, 25% of all public school teachers (approximately 3000) were trained over a two week period. This training consisted of lessons in the basic care of computers; the use of various pieces of software including Office '97, Netscape, and Eudora; and skills such as basic web page design, the use of mailing lists as sources of information, presentation software in class, the use of image and audio processing, the use of search engines, and projection techniques. As a climax to the two week period, each teacher was to have generated a standards based classroom unit that would be used in the next year in his/her classes. These projects can be found and downloaded from www.ed.uri.edu/rif99/. As a part of this program, each teacher was issued a new Toshiba or Macintosh laptop (participants' choice). These participants went back to their classrooms with experience, enthusiasm, and equipment that would enable them to infuse in their students a spirit of excitement and inquiry. The hope was that the teachers would generate an enthusiasm for the use of computers in the classroom that would be contagious and would help the level of technology to achieve a "critical mass", making this new technology a self-sustaining and perhaps ever expanding component of the educational scenery.

During the summer of 1998, I was a trainer at the Woonsocket, Rhode Island training site. I saw first hand the enthusiasm generated among the participants of this program. Last summer I was chosen to be one of 12 RITTI Fellows statewide who were charged with studying the impact of this program and the influence of technology on the learning experience of our students. For my study I chose to research the field of high school chemistry and physics education. This included a search on the Internet of the results of studies on the effectiveness of Instructional Technology in the classroom, a study of the projects written by previous RITTI participants, and interviews of those participants. This research led to some interesting findings. In a study from Washington State (The Gates Foundation Teacher Leadership Project Evaluation Report – July 1, 1999), only 27% of high school science teachers indicated that student learning had moderately or substantially increased because of (computer) technology. In searching high school science classroom web pages, I found examples of sites that ranged in utility from "How can I teach without this?" to "Not much of an improvement over a textbook and bulletin board". For various reasons RITTI participants responding to my questionnaire gave mixed results in their success at integrating computer technology into their classes. One teacher in particular impressed me with the extraordinary changes he has made in his methods and with the subsequent increase in interest on the part of his students.

Explorations

Can education take place without the use of Instructional Technology? Absolutely. Can education improve with the use of Instructional Technology? Once again, the answer is a definite yes. The essential question becomes "How can education improve through the use of Instructional Technology?"

One of the frustrations encountered in exploring the ways in which instructional technology can be used to improve education is the polarization of opinions and of research outcomes relating to the effectiveness of classroom use of Instructional Technology. The following is a list of changes in the relationship between teacher and student that accompany the introduction of Instructional Technology in the classroom as reported in a 1998 T.H.E. report:

1. Technology increases student motivation, and motivated students are more receptive, more engaged, and more likely to learn.

2. Technology promotes cooperation and collaboration among students, and good teachers can capitalize on these opportunities. Cooperative learning approaches with technology give students with different talents a chance to excel.

3. In classrooms with computers, conversations between teachers and students and among students themselves become deeper and more probing.

4. Technology use encourages teacher-as-facilitator approaches.

5. Technology promotes a "balance of power" between the teacher and his or her students.

6. With technological tools, students show more persistence in solving problems.

7. Technology encourages varied methods of assessment.

8. Despite all the challenges of a one-computer/one Internet-connection classroom, even this classroom environment enables good teachers to work effectively with diverse students.

9. Technology fosters increased and improved oral and written communication.

10. Technology enables opportunities for more depth of understanding, but the breadth of the curriculum is still problematic.

11. Technology provides increased opportunities for thematic, interdisciplinary explorations; teachers can use these interdisciplinary connections to further engage and excite students.

12. Technology makes classroom activities "feel" more real-world and relevant, and students often take these activities more seriously.

(McGrath 1998)

As a counterpoint, the following teachers find Instructional Technology lacking when it comes to helping students to understand the function of mechanical devices:

> -"Listen to Tom Henning, a physics teacher at Thurgood Marshall, the San Francisco technology high school. Henning has a graduate degree in engineering, and helped to found a Silicon Valley company that manufactures electronic navigation equipment. 'My bias is the physical reality,' Henning told me, as we sat outside a shop where he was helping students to rebuild an old motorcycle. 'I'm no technophobe. I can program computers.' What worries Henning is that computers at best engage only two senses, hearing and sight -- and only two-dimensional sight at that. 'Even if they're doing three-dimensional computer modeling, that's still a two-D replica of a three-D world. If you took a kid who grew up on Nintendo, he's not going to have the necessary skills. He

needs to have done it first with Tinkertoys or clay, or carved it out of balsa wood.' As David Elkind, a professor of child development at Tufts University, puts it, 'A dean of the University of Iowa's school of engineering used to say the best engineers were the farm boys, because they knew how machinery really worked.'" (Oppenheimer 1997)

In addition, some evidence exists to show that the incorporation of technology in the classroom actually lowers some assessment scores:

> "Increasingly, schools are encouraging students to use computers in their writing. As a result, it is likely that increasing numbers of students are growing accustomed to writing on computers. Nevertheless, large scale assessments of writing, at state, national and even international levels, are attempting to estimate students' writing skills by having them use paper-and-pencil. Our results, if generalizable, suggest that for students accustomed to writing on computer for only a year or two, such estimates of student writing abilities based on responses written by hand may be substantial underestimates of their abilities to write when using a computer." (Russell & Haney 1997)

Some of my colleagues feel a bit negative about the prospects of fostering the use of Instructional Technology in the classroom. Implementing projects involving the use of Instructional Technology involves a great deal of effort on the part of teachers and there is a constant struggle to avoid slipping on those comfortable old sneakers of worksheets and quizzes that are so convenient from a preparation perspective. This struggle also involves working to overcome the institutional inertia mentioned by Vin Doyle in a recent monograph by Roland Barth - "It seems that when the status quo is threatened by anything new, an immediate systemic defense mechanism comes to life. Even when people appear willing to try something new, they eventually revert to the status quo." (Barth 1999).

Despite the caveats expressed above, Instructional Technology has been growing over the years. Part of the reason is the way communication has changed among the stakeholders in children's education. More and more schools are replacing the repository of paper called the teacher's mailbox with e-mail. This has the advantage of minimizing both the handling of physical paperwork and the mountain of "important documents" on the teacher's desk. It also saves much time that would otherwise be spent by an increasingly frazzled clerk on "stuffing duty." In addition, some of the matters that we consider to be crucial to discuss in departmental meetings are conducted via e-mail. This has the effect of reducing the amount of time spent in group meetings that could be spent more fruitfully on topics such as using new software, generating meaningful inquiry topics, incorporating research projects into the curriculum (or the content of the curriculum itself), etc.

Communication among colleagues within a building is also facilitated in this manner. It is much easier to send an e-mail note to a fellow teacher regarding the usage and placement of stage lights for a particular production for example than to try to track down which corridor that teacher is assigned to on that period during that day in order to get the same information. We can all think of dozens of instances where interruptions occur in our daily routine just to deal with minor points that could be dispatched more efficiently through the use of the technology that we have available to us.

Communication with students is enhanced with the current technology. Students are using computers to e-mail their teachers for clarifications on assignments. They are also using web pages to gather materials (as enrichment activities or as missed assignments when they are out because of illness or field trips). Teachers are noticing a trend among students to keep in touch over vacations and after graduation via e-mail. We know that as teachers we often establish relationships with students that reach far beyond the school year. I treasure the short notes I get from graduates from years ago just saying hello and asking how things are. This trend has accelerated since the beginning of e-mail

Communication with parents has shown a marked increase in the past few years. In order to inquire about a student's performance in class a parent had to call the school, leave a message for a call-back, and wait. The teacher would do his/her best to call back, usually speaking with at best an answering machine but usually getting no answer. This might be followed with an evening call (making the teacher about as

popular as a telemarketer) or worse, a morning call involving the attempt to communicate with a barely conscious newly-awakened parent or one who is hurriedly trying to get ready for a new day. Contrast this with a teacher getting a short e-mail inquiring about a student's performance. This is answered at leisure and with all material available. The prompt response is usually followed by an equally prompt thank-you on the part of the parent. Feedback is maximized, response time is minimized, overall stress is minimized. Again, this does not replace personal conferences or face-to-face contact, but it does ensure that developing situations can be defused quickly and perhaps with less need for interruption in the parents' daily routine.

Distance learning is a concept that has developed over the years to include much more than the early "You too can learn to be an artist at Matchbook Cover University – just draw the pirate shown…
to televideo courses whose daily presence on PBS is a source of no cost audits for those of us who want to learn a bit more about physics, chemistry, finance, statistics, or a smorgasbord of other offerings. Some of the RITTI Fellows participated in a distance learning course on the use of the web in the classroom. Granted the structure of the course and its content left a bit to be desired, but the idea is one which will surely catch on. Providence College offers 6 distance learning courses on topics ranging from creative writing to world religions.

Connection to the world wide web has enabled students to do original research in ways never before possible. My original view of this was limited to seeing the Internet as a library accessible to each student in every classroom. The students can at a moment's notice look up historical figures, such as Johannes Kepler, or report on famous controversies in the history of science (the Newton/Liebnitz controversy, the Darwin/Wallace issue, the discovery of oxygen by Priestley/Lavoisier/Scheele, etc.). My vision has expanded to include projects done by students across the country, across the world, and across cultural boundaries. Many students participated in the Monarch butterfly watch, which traced the migration of the Monarchs across the continent. Many students participated in a study of the development of tulips. This helped them to see the differences in climate and weather patterns over broad areas of the country. A rural North Carolina second grade class is developing a set of pen pals in a second grade class on a Navajo reservation in northern New Mexico. These sorts of projects and many, many others are being conducted world wide.

The nature of professional development is changing as well through the introduction of technology in education. A case in point is the RITTI Fellowship. The research for material in this paper was done largely over the Internet. This effort was made much easier by my membership in mailing lists such as the RA-CIA list (RA Curriculum, Instruction, and Assessment). The RITTI participants were expected to create a lesson that would involve the use of technology and would improve learning on the part of their students. The following paragraphs explore the work that some RITTI science teachers have developed. All the projects mentioned can be accessed via the RITTI site mentioned in the introduction of this paper.

Gerry Aissis created a learning environment in which students learned the mathematics and mechanism behind inheritance by studying the characteristics of superheroes that were listed online and by assigning genetic properties to those characteristics. The students then had to predict the characteristics of the offspring of various combinations of superheroes. This is a creative application of information technology in gathering information for a dramatization of an important biological topic. Gerry has found that his use of Instructional Technology has increased dramatically since the RITTI program. He reports that he wants to expand his project next year to include Pokemon characters.

Bob Springer created a great graphic representation on the reason chemical equations must be balanced by presenting animated graphics. The atomic-molecular model for chemical reaction seems to come alive in a way that would be impossible using textbook images. Bob says "I felt it (this project) enhanced the lesson and the visuals help the students connect better with the concepts."

Howard Lancaster is using the Internet to have his students gather information about the elements and the trends for certain properties in rows and columns. This is done as one activity out of four in a "round robin" fashion. He says he has a frustration with a shortage of equipment (hence the round robin format) but he feels that he is doing what he can with what he has. This unit has been improved and upgraded since 1998. Mr. Lancaster says that he has "… tried to use technology to encourage more peer instruction by

forming small work groups to complete computer tutorial programs, internet searches for specific chemical information, and worksheet activities."

Gerald Lafontaine was a participant of RITTI-97 (the pilot year). He began his work by incorporating a computer station as a part of his Forensics class. This worked out well since at the time there was only one connection to the Internet possible in his classroom. The computer station was the place where students went to access the Forensics Web Page to access links to sites with forensic information about ongoing cases in the real world. This use has expanded (along with increased access to the Internet) to include his chemistry classes as well as Forensics. The depth of use on the part of his students has increased as well. These students can visit links that are topic specific. They can take practice tests, find review notes, and more. He has documented a marked increase in numbers of users at his site in the day or two before a test is given. Mr. Lafontaine remarks on the impact of Instructional Technology on his classroom experience:

> "My teaching has become more varied and interesting. For example, at first PowerPoint presentations were used simply as slide shows for note taking. Now I use them for reinforcement and enhancement of topics. The Internet links that I researched serve as a source of additional information that is not covered in the textbook. It added a more practical side to the topics covered. Using the testing program (Harris Test) gave students the opportunity to better prepare for tests. The pretests I wrote were great for preparing students for a test situation. I use Excel for grades. Students are now aware on a weekly basis of how well they are doing in class. By using a CD-reWriter, I was able to organize all my coursework on one CD. By adding to this every year, one can build a tremendous library of lessons and ideas to be used in the classroom. Using Web Whacker and a CD-reWriter, I captured some web sites in General Science and placed them on CD's."

Mr. Lafontaine's web page - http://hometown.aol.com/risa3025/FirstContact/firstcontact2.html - is a continually evolving source of information for his students. He uses his interests and his humor to introduce students to this site and to keep them coming back.

My own experiences are similar to those above. I started using a station or two in the classroom for Internet use. PowerPoint became the method of choice for presenting lecture notes. Word processors made the task of generating worksheets and quizzes a bit easier. As the facilities at the school have improved, so has the variety of uses of this technology.

When I began to introduce Instructional Technology on a larger scale and to a greater depth to my classes I felt that somehow the curriculum would be too restrictive to allow me the flexibility I needed to experiment with new techniques. The Performance Standards were something I would use to rate pre-existing activities or worksheets. (Let's see, that old periodic table worksheet addresses standards S1a and S1b). As I studied the triad of course curriculum, Instructional Technology, and New Standards, I came to see that properly applied they complement one another. As an example I recently tried working in a way that made much more sense from a planning standpoint. I began with the section in my curriculum that called for addressing chemical change. I went online and found an activity which (with modification) would introduce science standards S1b, S1c, S5b, S5d, S5f, and S7b. In this activity the students heated a sample of $Cu(NO_3)_2$ which released a reddish brown gas and formed a black ash as a residue. Heating the black ash in the presence of HNO_3 caused a reappearance of the original $Cu(NO_3)_2$ in solution. I had the students develop a rational explanation of the composition of the black ash and reddish brown gas. The students were allowed to use the Internet to find the properties of different substances, as well as other references (such as the CRC Handbook of Chemistry and Physics). As small groups they had to write down their conclusions and the reasoning they used to reach those conclusions. The students used a rubric to self assess their reports. After discussion of their findings, I used the same rubric to assess their work. I could tell from their reports that they were learning to think like chemists. This activity was the type of educational experience that I want my students to have more frequently.

I have been assigning more research topics for the students, and I have created a web page to help my students and their parents understand what is happening in our chemistry class (http://come.to/Poirier).

This web page contains a practice test on the current topic, links to other chemistry sites and a "Parents Corner," an open letter to parents describing the activities in class for the next two weeks and inviting them to e-mail me concerning their children. To introduce the students to this site I included pages on social activities (dances, concerts, etc.) and schedules for athletic events which are in season. Like Mr. Lafontaine, I have seen an increase in traffic at the web site on the days before tests. I have been using Rasmole (a program which allows students to view a variety of molecular models in various formats and in three dimensions) to show the students similarities in shapes of molecules. We will explore the relationship between structure and function in molecules in the not too distant future. Students use the Internet to do research. One valuable lesson my students learned this year was that the Internet was not the panacea that they might have thought. I created an assignment that was based on six products or processes that were used over 2000 years ago. The students were first to gather information on how these were related to chemistry and then to create a report for the class. The topics included manufacture of jewelry, dyes, ceramics, metals from ores, perfumes, and paints, as well as research on the process of mummification. The students seemed to enjoy not only the research, but also reporting their findings to the class. The one group that did not succeed was the group that was researching the production of ceramics. They could get no information via search engines on how the process originated or on the chemistry of ceramic manufacture. They did get an answer, but from a chance conversation over dinner with an artist and ceramics teacher from Pennsylvania. This is reminiscent of the "Old Way/Net Way" feature in Yahoo! Magazine. I encourage students to find and evaluate chemistry web sites that would help us in learning chemistry. With the growth in the number of students with Internet access at home (around 80% for my students), this is one approach for a teacher to have a multitude of eyes searching for more and better sources of information and ideas on the use of Instructional Technology in the chemistry classroom.

Conclusions

Instructional Technology has been with us for a while now. We can see that it can become a useful educational tool. With it learning can become more interesting and more challenging. It is important to realize that there are educational experiences that are best learned through the use of "tinkertoys and farm equipment". It is also important to realize that Instructional Technology (especially computers and the Internet) provides the students with opportunities that simply cannot be duplicated in any other way. Properly used it will lead to more and better learning on the part of the students. We, as professional educators, have to be willing to put in the extra effort which is required to produce an educational experience which is much more rewarding for our students.

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Field-Based Technology in Idaho Middle School Science Classes: An Evaluation of Performance and Attitude Data from Students

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Abstract: This project collected student performance data on the use of portable computers and probeware in a pair of eighth grade earth science classrooms. Data addressing the subject-matter performance and attitudes of the students was collected before and after the technology integration. A unique opportunity was available to investigate the change in student performance due to a technology integration effort, and independent of the teacher's influence, was possible. Statistical comparisons were made between a treatment group and a similar control group class working with the same subject matter, and with the same teacher. Four earth science classes from two teachers were examined. This investigation suggests that the addition of certain technologies to an existing earth science curriculum will increase the performance of students on a subject-matter assessment. While much of the literature is limited to the speculation of an educational improvement due to certain technologies, this study offers significant findings based on research.

Introduction

The results of this investigation suggest that the addition of certain technologies to an existing earth science curriculum will increase the performance on a subject-matter assessment. With much of the current literature focused upon the speculation of an educational improvement due to certain technologies this study sought out research-based findings on the issue.

The most likely reason for a small body of statistical research in the area of technology integration efforts may be due to the inability of school districts to allow unequal distribution of technology resources within the same curriculum, grade, and teacher, however, the unique opportunity to investigate student performance and attitude change independent of the teacher's influence on the class was available for this study. Since each teacher had one experimental group class and one control group class, the influences of the teacher on that same teacher's control group and experimental group are the same.

A study by Campoy (1992) suggests a possible explanation for the lack of experimental research in educational technology, even in the face of the persistent view that technology can improve learning. Campoy states that teachers and administrators often have little understanding of the role of technology in the teaching/learning process. Furthermore, he states, teachers and administrators do not identify reasonable expectations for the use of the technology.

Tarwater (1992) continues this line of thought with the observation that the lack of reasonable expectations from teachers may be related to the teacher's own ineffective use of technology. The ineffective application of the technology may also be the reason that Paolucci (1998) found that a majority of the articles addressed technology applications, development, and implementation, but did not report findings on the use of technology that included student achievement data. Many articles in education journals offer advice and

suggestions of how to integrate technology into the science classroom. However, very few research studies focused upon the measurable effects of the integration efforts.

In order to increase student learning in a predictable and efficient manner, research is needed. The successful integration and effective application of technology into the science curriculum requires more than good intentions. Formal research that tests a theoretical framework is imperative if technology integration efforts are to provide achievement gains that are reproducible and consistent. This study proposes to explore the relationship between a specific classroom technology integration effort and its direct impact upon student performance and attitude. Specifically, the study will attempt to ascertain if the use of probeware technology will impact student achievement and attitudes in science. Using a set of additional technologies applied in middle school earth science classes, performance data on subject matter performance and attitudes were collected and analyzed. The additional technologies include portable computers, probeware, digital cameras, Internet, and multimedia development software. These technologies are referred to as additional technologies because they go beyond the standard technology setup (personal computer, printer, and utility software packages) found in many school classrooms.

Data collection regarding technology use is important to the educator for many reasons. If further technology integration is anticipated, the foundation for the future integration should be based upon research. Ferdig and Weiland (1998) stress this point with, "There is a plain, one might say urgent need for a more complete approach to research on technology integration" (p. 1334).

Lowery (1997) describes upper elementary science students as good observers who are now ready to learn about cause and effect, and how to record data describing their relationships. Unfortunately, as reported by Bybee (1993) there are many reports offering reasons why the American public has lost confidence in our current science and technology education programs.

Treatment

The training of the teachers and students took place throughout the year as more technologies were incorporated into the science classes. In all cases, the teachers were trained in the use of the specific technology prior to the training of the students. Additionally, the students were trained exclusively by their teacher. While this researcher did observe some of the student training and student use of the technologies, the teachers were responsible for all the student training, and classroom management of the technologies.

The teachers participating in the project were given several hours of training on the use and troubleshooting of the probeware. Previous technology training unrelated to this project gave the teachers the necessary skills to operate the other pieces of additional technology implementation of the project required. Once the teachers participating in the project received training and the additional technologies, they began training the students in the experimental group how to use the equipment. The anticipated progress of the project is outlined the timeline. The timeline offered the teachers a sequence in which to introduce the additional technologies to the students in addition to the steps taken to evaluate the progress of the project.

The teachers began the project with the use of eight portable computers. The portable computers operated in a similar manner to the desktop models the students already had access to in the classroom, but the probeware was new to the students.

One particular probe was used by the students to learn the operation of the computer/probe interface. The probe was called an exercise heartrate. The exercise heartrate monitor allowed the student to measure and graph their own heartrate over time while doing various activities. While this probe was used extensively at first, it was not the focus of data collection for the project. Instead, it was just used for training purposes.

When each teacher believed the students understood the operation of the portable computer, and the exercise heartrate probe, each introduced the other probes available to the students for scientific data collection. At that point, the students practiced using the probes both inside the classroom, and outside the school. The teachers even had some of the students practice using the portable computers inside a dark closet to simulate using the equipment in a cave like what they might find at the Craters of the Moon area.

While most of the activities applied the additional technologies in the classroom, outdoor activities did supplement the indoor work. The most ambitious of the outdoor activities involved two fieldtrips to Craters of the Moon National Monument in south central Idaho. The first trip took place in late September, shortly after the teachers and student received the additional technologies. Since the additional technology was new to the students, taking digital images with the cameras dominated the outdoor activities. The captured images provided a large amount of material to work with once back in the classroom.

The second fieldtrip to the Craters of the Moon area occurred near the end of May. A late snowfall kept much of the Craters of the Moon area closed to the public until the middle of May. During the second trip to the area, students used the portable computers and probes to take temperature and light measurements in several caves; including lowering a 100-foot temperature probe into a volcanic cone to measure the drop in temperature per meter of depth. Hundreds of digital pictures were taken using the digital cameras. The students wrote detailed notes about all the pictures they took, as well as their methods of data collection using the probes.

Data Collection Method

The data collected during the first year of the implementation of the project included the geology pretest and posttest raw scores of the students in the experimental groups. A survey addressing technology attitudes was administered to the students in the experimental group both prior to the treatment and following the treatment. A geology posttest was also given to one additional class under the two teachers who are participating in the project. The additional student performance on the geology posttest served as the control group in the posttest-only control group experimental design.

Two different multiple choice tests were given to the treatment groups. The two measures each consisted of a 45-item multiple-choice test covering two constructs: Construct 1 addressed igneous geology and, Construct 2 addressed general earth science and biology. Woven into the constructs were questions addressing the interpretation of data, and the reasons for observed change. To insure a similar representation of constructs, each test had approximately half the questions representing each construct. The reliability of the geology test instruments was established through a Guttman Split-half analysis. The reliability coefficient of 0.73 was generated using the general geology pretest and posttest scores from the experimental groups of both teachers 1 and 2.

Results

A question of primary focus of this project was to see if a change in student performance on a geology knowledge assessment could be attributed to the inclusion of additional technologies into the existing curriculum. One set came from the groups of students who received the treatment of the additional technologies (the experimental group), and the other set of scores are from students of the same teacher in the same subject, except they did not receive the additional technologies (the control group).

The results of the ANOVA comparing pre-treatment and post-treatment change in attitude about technology indicates that no significant change took place due to the treatment. An F value of 0.1415 was found which is in excess of our alpha of .05. Therefore, the researcher failed to reject our null hypothesis that the introduction of additional technologies into the earth science curriculum will not significantly affect the student's attitudes about technology.

The survey data provided by the students offers some interesting results. In one case, a treatment group reported a lower desire for more technology even though prior to the treatment, they reported the highest desire to have more technology in the classroom. This result could be an indication of a point of saturation where the students prefer to use the existing technology instead of gaining more technology. The finding may also show that the continued introduction of new technology into the classroom may not continue to improve student performance, thus indicating a point of diminishing returns. If further research supports this line of reasoning, it may provide scientific data on which to pattern a timeline for technology integration.

Summary

The purpose of this study was twofold. First, the potential influence of additional technologies on the student performance on general science measures was examined using a posttest-only control group experimental design. Secondly, the influence of additional technologies on the attitude of students toward the use of technology in school was explored. Following a statistical analysis of the data collected by the project, the following results were found. Finding 1: The comparison of posttest data from the experimental group and

the control group on the multiple choice geology instrument did yield a significant increase in performance of the experimental group following the use of the additional technologies by the experimental group. Due to this result, the researcher rejected the null hypothesis and concluded that the additional technologies significantly improved student performance on a subject-matter test. Finding 2: The attitudes of students about the role of technology in education did not significantly change following the inclusion of additional technologies into the existing curriculum. Due to this result, the researcher failed to reject the null hypothesis that the additional technologies will not significantly affect the student's attitude about the role of technology in education.

Conclusion

Based upon the results of this study, it is clear that, in certain applications of technology, student performance will be higher than if the technology was absent. As was mentioned above, most of the literature regarding technology integration does not address the effects of the technology, but rather the application or types of technology used.

The research base addressing technology in the classroom needs to encompass both the commonly found technologies and the more advanced classroom and field-based technologies. It is imperative that more research be done to explore the impact of educational technology. Without data collection during technology integration efforts, each effort becomes an isolated experiment with no contribution to the body of educational research. It is hoped that this study will be joined by others to continue building the body of research necessary to successfully and effectively integrate the powerful tools of technology into the classroom.

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Technology in the Service of Information Literacy and Writing Across the Curriculum: Our Experience

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Abstract: To ensure that future generations are information literate, we must help future educators develop a clear understanding of how to do research, how to write a sound research paper, and how to translate it into quality hypertext. Our goal was to help the students see this as an authentic, long-term process, where their development was of considerable interest to us. We implemented a phased approach, based on the Information Search Process Model, to help them. We employed joint intervention from faculty and librarians, with milestones embedded in the assessment process. This allowed us to view, encourage, and guide their development.

Duckworth (1987) asks the thoughtful question, "what is the role of teaching, if knowledge is constructed by each individual?" (p. 112). Her answer is that the teacher should seek to put the students in contact with the *real* phenomena to be studied, and should ask the students to explain the sense they are making of it rather than telling them what it should be. As reflective practitioners with a constructivist approach to teaching and learning (Brooks & Brooks, 1996), this question and the family of answers that result are always in our minds as we shape and reshape our individual teacher preparation curricula. Recently, a group of us – faculty in the teacher preparation program and reference and information librarians – began considering how to address our unique but shared academic concerns about our students:

> Have you ever desired to teach your students how to craft a thoughtful research paper, one which is not just thrown together a day or two before it's due and never given another thought after having been graded and returned?
>
> Do you believe that the web can be a useful tool in doing research, but that most of the references your students provide from web sources are junk?
>
> How can we help our students construct good hypertext?

What follows is the short tale of our experience in addressing these concerns in the arena of an elementary education course for second-year students. We see both success and room for growth in our experiences, but more importantly

we hope to encourage all who allow Duckworth's questions and answers to pervade their teaching to strive for a better way of utilizing technology in the service of information literacy and writing across the curriculum.

Multiple Imperatives

One of the major and growing concerns of academic librarians has to do with the issue of information literacy. The extraordinary growth of Internet (Web) based information resources over the last several years brought this clearly into focus for librarians. Faculty and students frequently lack the needed skills in evaluating the quality of information found on the Web. The situation for the typical student today is one in which the range of information resources available is so rich that even the simplest search of the Web will produce results that appear, on the surface at least, adequate to the students' needs of the moment. They often assume that all information is of equal value whether it is on the web or in print, but if it is on the web, it must be the latest and best information. By contrast, faculty often assume that if the information source is on the web, it is of no value and students should avoid using it for any assignment.

We are troubled to consider the outcome of a stereotypical research paper assignment. It takes the form of a teacher or professor revealing the assignment early in the semester, making it due late in the semester, and leaving the students to their own devices to figure out how to complete it. Even students with a well developed notion of how to approach the task will be sorely tempted to begin the project in earnest only a day or two before the due date, racing through normally time-intensive processes such as topic selection and research. The lack of true ownership of the assignment is indicated by the lack of attention given to it after it has been graded and returned. This stands in stark contrast to the thoughtfulness and iteration embedded in successful writing process models used in elementary teaching, such as that described by Graves (1983). There, one finds student topic selection mediated by the teacher, multiple drafts of papers, conferences between students and teachers while the work is in progress, and publication of student work. If this is considered ideal practice for training young writers, it is no less ideal for college students in a teacher preparation program, students who will one day attempt to guide young writers.

Hull (1989) describes heuristics that an instructor can keep in mind when structuring an assignment, principles that undergird effective writing instruction. They assume a constructivist approach to learning, and are similar in flavor to the ideas of Duckworth. Writing should be seen as a process, suggesting that students should view the writing task as authentic within a particular context. A writing assignment for pre-service teachers would mirror a professional writing task by allowing the students to make a contribution to a body of knowledge. Writing should also be treated as a process rather than an art – accessible and understandable, but the result of guided practice. Any teacher who creates a writing assignment should be prepared to help the students learn to write, and should not assume that they "should learn it somewhere else." Finally, the writing process is a connectionist process that is complex and social. Since writing emanates from the history and experiences of the writer, some latitude for this diversity must be incorporated into the task.

Given their historical placement, both Graves and Hull probably envisioned a traditional, linear artifact as the outcome of the writing processes they describe. However, near the forefront of the revolution of academic technology is the routine employment of non-linear writing such as hypertext. More alarmingly, this routine employment is being encouraged in the absence of scholarly study and debate. Popular books such as "HTML for Dummies" may address the mechanics of writing hypertext, but bypass the reflective process that is needed to make it *good*. Murray (1997) notes that some genres of non-linear writing predate and coincide with the ascent of hypertext and hypermedia into the educational consciousness, but suggests that hypertext and hypermedia are in their infancy as studied forms, with far greater potential than actualized value. More importantly, she asks that the study begin in earnest, which brings us to this work.

The Information Search Process Model

The ISPM is a "six-stage model of the information search process developed from the thoughts, actions and feelings most commonly encountered in the experience" (Kulthau, 1988, p.232). The model is summarized in Table I. It incorporates concepts from theories by Taylor, Belkin, McFayden and Paisley. It was developed, tested, and refined with information from interviews, questionnaires, time lines, and journals gathered from high school students.

There are very few models that discuss information seeking behavior, and this is the only one that offers a holistic approach combining affective, cognitive, and behavioral elements (Kuhlthau, 1985).

Stages	**Actions**	**Analytical Strategies**	**Feelings**
Research Assignment	Considering possibilities	Brainstorming; Discussing	Uncertainty; Apprehension
Topic Selection	Finding Background Sources	Evaluating & predicting outcomes	Confusion: Optimism after topic selected
Prefocus Exploration	Skimming & taking notes	Identifying possible foci	Confusion; Frustration; Doubt
Focus Formulation	Reading notes	Choosing or combining ideas	Confidence' optimism
Information Collection	Comprehensive library searching; Taking notes	Summarizing; Possibly redefining	Confidence or Intimidation
Feelings	Filling gaps in information	Organizing sources; Analyzing adequacy	Relief; Satisfaction or Disappointment

Table I: A summary of the Information Source Process Model

Most information seeking guidelines tend to be very product-driven – how to take notes, compile a bibliography, etc. The ISPM breaks new ground because it identifies and legitimizes the researcher's feelings throughout the research process. For example, students learn that it is *normal* to feel stressed-out, confused and overwhelmed in Stage 3, *Prefocus Exploration*, and Stage 4, Focus *Formulation* (Kuhlthau, 1985). When students are introduced to the model, they are relieved to discover that their feelings of anxiety, fear, indecisiveness and apprehension are part of the information search process.

Once they realize the business of conducting research is somewhat predictable and not random and haphazard, they are more responsive to developing information skills and strategies. They can see the long-term value in acquiring skills that will help them locate information and help them cope with the tumultuous emotions associated with the research process. For example, they may learn how to realistically budget their time and not procrastinate or they may learn how to use reference sources to explore and formulate a topic focus.

The African American Scientists Website (http://educate.albion.edu/art/aframsci)

The description of this project from the course syllabus reads as follows:

> The class will develop a self-contained web site that will elaborate upon the personal stories and scientific research of specific Black Americans or Africans. "Science" may encompass the traditional disciplines of biology, chemistry, mathematics, physics, and geology, as well as second-tier subjects such as engineering, medicine, architecture, computer science, and astronomy/cosmology. We do not want to create the compilation of still shots and short biographical sketches that are prevalent on "Black History Month" posters. Instead, we want an integrated sketch of the person – the story of their life and how they ended up doing what they did, the context of their times, a description of their research contribution in science and the ramifications of that research, and what happened to the person since then. The person chosen can be contemporary or historical. An event or issue that is of interest can influence your choice of a person.

Linear

Early in the semester, we provided the students with an introduction to the ISPM. We asked the students to comment on it, and to talk about their previous experiences with research papers. We then spent some time in class allowing the students to brainstorm or sample possible choices of scientists to research, and receive feedback from each other on their thinking. Next, we introduced reference sources that provide background information on African

Americans and scientists such as encyclopedias and biographical sources, along with some basic topic-refining techniques. Shortly after this session, the students turned in a research proposal with an annotated bibliography. They were asked to include sources that turned up a "blind alley" as well, so they would understand by way of a grade that all of their exploration at this point was of value. This sequence of sessions and assignments moved us through the first four stages of the model.

The next session involved the presentation of in-depth reference sources such as online databases and specialized reference sources, along with other information sources like listservs, interviews, etc. We also discussed guidelines for evaluating sources. It was here that we spoke with the class about the pros and cons of using commercial web search engines for research. On one hand, there is apparent ease and a wealth of ready information from searching the web, especially when one sees hundred or thousands of hits from a search. Web sources also can provide up-to-the-minute information on a topic, and increase the likelihood of first person contact or sources. However, web search engines have uniformly weak filters and do not always turn up information from reputable sources. We told the students that web sites are at best self-indexed with ad hoc keywords, and at worse may show up as a "hit" because an errant word on the page happened to match one of the keys. Together we discussed some strategies for Boolean searches, and we noted the relative strengths and weaknesses of specific search engines. We spoke about how to decipher URLs in order to determine the origins of the page creator. We also talked about how to assess the quality of information on a web site by looking for modification dates, author names and contact information, bibliographies or reference lists, or reviews about the information from other sites.

This was followed by a fourth session in the library, where the students used class time to perform research under the supervision of the two faculty and the librarian. This allowed us the chance to model information research and problem-solve with them. We held conferences with the students to assess their progress, and gave them hints about locations for other sources. Through these efforts, the students made use of "alternative" ways of accessing material that they had generally not used before – interlibrary loan, searching the collections of large, state universities nearby, and personal email and telephone contact with the scientists.

The efforts we made to scaffold students' research not only helped them as writers of informational text, but it helped the faculty facilitate and be responsive to students' needs, questions, and suggestions. For instance, we planned to provide students with thorough feedback and suggestions for improvement on their rough drafts. We did this to help the students achieve the highest quality final linear paper and subsequent web version. Our intentions were to be as supportive as possible. In the syllabus the components were weighted as BLAND POINTS for the rough draft and BLANK POINTS for the final draft. Several students voiced concern about the point distribution. Upon consideration of this the faculty realized that such a distribution undermined one of the key motivations behind responding to the rough drafts so thoroughly ˆ to help students work toward improvement. So the faculty responded to the students' concern, and made the change in weighting. And the efforts to provide extensive feedback and return the drafts within a week proved to be of considerable help in improving the final written work of students.

Non-linear

Now that the students had a thoughtfully written linear text, we began the process of creating a non-linear piece. The process of constructing hypertext or hypermedia begins with an assessment of three simple questions: 1) What do I want my reader to know right now?, 2) What do I want my reader to know next?, and 3) How can I use the tools of pictures, sound, video, animations, and time-dependence to convey my message more effectively? The first question defines the *lexia* (Murray, 1997), the amount of information that is appropriate for viewing on a single screen. While no studied rules exist for the upper limit of the lexia, our experience is that roughly 600 words of straight text can reside on 1.5 "screens." This was used as the upper bound. We suggested that the students start by breaking up their linear texts into lexias, and that they respect the upper bound by a wide margin throughout the translation process. In fact, this starting point was identified as another project milestone for the students, providing a window through which we could view the translation process. We guided them through the mechanics of conversion to Hypertext Markup Language (HTML) using the "save as HTML" option. Most students then used a basic HTML editor to further refine their pages.

The second question defines the selection of links to further information that are delineated in each lexia. We proposed two navigation schemes for each student to consider. The first is a *subway* model that gives the reader a

well-defined path through the document. This is the easiest transition form between linear and non-linear text because it presents information in a time-dependent order that is determined and controlled by the author. The second is a *web* model, with multiple entry points to different lexias. This provides a true non-linear experience for the reader, who determines what to read and when. It was the responsibility of the students to construct screens that were vigilant in reminding the reader where they had been and where they could proceed next.

The richness of links across each student texts presented itself early in the process. While reading the rough drafts, we noted that different places or themes were common to several of the stories about the scientists. Some of these were facile, such as career choices or institutions of employment. However, some were profound; for example, one student wrote a brief description of the south side of Chicago, the home of one of the scientists. Others wrote about hospitals where the medical doctors they wrote about had practiced or pioneered innovative practices. We alerted the students to these commonalities, and provided class time for them to speak to each other about their subjects. The result was that some students created lexias from their papers that were linked in appropriate places from lexias created by other students. This epiphany is what turned a collection of texts into a communal, unified web site with far more communicative power than the sum of its parts.

Each student was asked to include at least two pertinent media items in their set of pages. The term "pertinent" was meant to focus them on the last of the three questions. The term was presented to the students to mean that the media should directly support or advance the story, conveying a meaning that words by themselves could not do. A majority of the students asked for guidance about the pertinence of items they had selected, and for the most part their instincts were reliable. We also showed them how to copy graphics from other web sites or scan them. Finally, but not insignificantly, we asked that they scrupulously abide by copyright laws, citing the source of each graphic that they obtained elsewhere.

It was anticipated that the students would pass through three phases in their use of media such as colors, graphics, audio, video, and animations. The first phase, from which everyone would probably graduate, shows a bare-bones screen with color absent or quite simple. The second phase, which occurs after one learns a few "tricks," results in all manner of gaudiness with respect to colors, backgrounds, and animations. Not everyone was expected to graduate from this phase, even though we made the usual suggestions about a high contrast of color and focus between background and foreground, minimizing the number of different text colors, and the distraction value of blinking.

A Student's Voice

As a student who had absolutely no experience with webpage design before this class, I was certainly a bit anxious when I heard that our final project was going to be to create an entire website. However, as I went through the step-by-step process, the project turned out to be an incredibly valuable learning experience.

In doing my initial research I explored the lives of many African American scientists. I chose Mae Jemison, a female astronaut. I now began really focusing my research on the life of Mae Jemison. I tried to extend my research beyond a simple documentation of her personal life as I also examined her role as a minority woman in science, a male dominated field. I finally compiled the results of my research efforts to first compose a preliminary draft of my research paper and later a final draft where I enhanced certain sections of my paper by developing them more thoroughly. I also added a new section in my final research paper upon making personal contact with one of Jemison's co-workers at Dartmouth.

Converting my research paper into a webpage was the most exciting part of the process. I created a short summary of Jemison's life and accomplishments to include on my individual Mae Jemison homepage. I then chose main sections of my research paper to create additional webpages that focused on more specific aspects of Jemison's life and her role in science. These sections became links that could be accessed from my homepage. After each student in the class finished putting together their own pages about the scientists they chose, the class worked together to create our collaborative website. We created committees to work on the homepage, organize the main index, and link related pages together within our site.

The best part about the project was that we were not given step-by-step instructions on how to organize our information and create our webpages. I spent many hours exploring on my own and making many changes to my own pages before I considered them "ready" to be a part of the final website. I am now using the skills that I acquired in this class to help maintain the website

at the elementary school where I am student teaching. This experience was definitely a valuable experience as I also intend to maintain a class website in my own classroom next year.

Reflection

In the end all participants – faculty, librarians, students – were surprisingly pleased with what they had learned and produced. There were moments, particularly before the rough draft was due and during the first days of HTML conversion, in which students were vocally resistant to the relevance of the project and the amount of effort it required. However, it was clear at the end of the term (and has since become increasingly so), that students feel great pride in what they accomplished as writers, as thoughtful and creative users of technology, as young professionals trying to find ways to integrate substantive multiculturalism into the teaching of science, social studies, and language arts.

The Dialectic of Science and Culture (http://educate.albion.edu/art/dialectic)

One year later, we decided to implement the same basic project for the course, but with a different focus and some changes in the methodology. In response to feedback from the students that we had underestimated their overall understanding of the research process, we scaled back the number of class sessions with the librarian. We had been pleased with the sense of community and committee work that the previous class had developed, so we also decided to be proactive in fostering a sense of community. Our hope was that this class would be able to work even more cooperatively, and produce an even more cohesive project.

We also changed the focus of the project, as follows:

> The class will develop a self-contained web site that will explore the dialectic (discourse; interaction) between science and culture. You will define and elaborate upon a particular topic/issue/question concerning this dialectic for any context which is outside the contemporary mainstream Western tradition of science in the United States. Through this project we are asking you to thoughtfully consider what multiculturalism has to do with teaching science; we are asking you to consider how people around the world, both historical and current, have employed "the sciences" to make sense of and better their world. We ask that you not narrowly define "science" with respect to method and tradition that characterizes science in our own society in the present.

Though we accomplished our goal of cultivating a stronger learning community, the faculty discovered upon reflection that the topic choice was too great a challenge for students to conceptualize questions or topics that they were truly invested in and few were successful in making the "dialectical" links between culture and science. As a result, students felt less ownership of the topics and their efforts on the website were more going through the motions than the investment we saw the first time.

Future Directions

Our colleague Sean Pollack of the Great Lakes Colleges Association has suggested that an important future direction for this project is the incorporation of an image analysis component. Graphical images, as well as audio and video, communicate a message more precisely than text because of minimal signal degradation and less individual interpretation on the part of the recipient (Rosmiszoski, 1986; Salomon, 1984). However, precision does not imply effectiveness. A message that is not accurate about what the author means to say can be sent through a medium, and if the medium can precisely transmit that message, the result is that this inaccurate meaning becomes fixed in the mind of the recipient. Thus, an important ability for future educators in an age where hypertext and hypermedia are routinely employed is a more complete understanding of how to interpret the messages conveyed in images and other media, and to teach others to do the same.

These pilot classes provided our opportunity to test this approach to acquiring information literacy in a collaborative environment, and provide evidence of the learning with a web-based artifact. Such an approach may be of great

value to teacher preparation programs and academic libraries in that it provides an opportunity for librarians and classroom teachers to work together to understand the best possible use of information technologies.

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Physical Science in the Early Grades: Technology in Action

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Abstract: The Colorado School of Mines presented an intensive two week program that delivered physical science content to upgrade teachers' science skills at the elementary level. The objectives of the workshop were to: (a) upgrade physical science material understanding, (b) provide teachers experience in a technology-driven delivery of instruction, (c) promote collaboration of teachers between schools and grade levels, (d) provide teachers with a repertoire of teaching strategies, activities and lesson plans for teaching physical science, (e) provide laboratory and demonstration equipment, (f) provide teachers with hands-on experiences in problem solving, and (g) provide teachers with a sustained experience for continuous improvement. The topics of motion, heat, light, electricity, magnetism, and sound were investigated. Technological skills including probeware, the internet, compressed video, and computer usage were employed to augment these content areas. Thirty teachers successfully completed this program with significant gains in knowledge of physical science principles.

Often science learning in elementary schools is limited to very basic observations and concepts. This is often due to limited expectations for what young children can understand and to a lack of teacher understanding of scientific concepts. Science texts are generally written two reading levels below grade level in order to ensure that the students will be able to understand what they read. This does not mean that students are incapable of understanding more complex ideas, it just means that teachers need to be careful about how the information is presented. As long as it is presented in a way that students can understand, complex concepts are not out of their reach.

Technology has the potential for increasing the concepts that children can understand by allowing them to collect and process data more easily, safely, and accurately (Rudolph & Preston 1995). Tools like probes, calculator-based labs (CBLs), calculators, databases and spreadsheets allow children to collect and analyze data that would be beyond their capabilities if they had to do it by hand. Teachers can also benefit from technology by using it to communicate with others who are teaching similar concepts.

In order to address the problem of a lack of teacher understanding of scientific concepts and explore the ways in which technology can be used to aid in developing scientific concepts in elementary school children, a two-week workshop was designed. The objectives of the workshop were to: (a) upgrade physical science material understanding, (b) provide teachers experience in a technology-driven delivery of instruction, (c) promote collaboration of teachers between schools and grade levels, (d) provide teachers with a repertoire of teaching strategies, activities and lesson plans for teaching physical science, (e) provide laboratory and

demonstration equipment, (f) provide teachers with hands-on experiences in problem solving, and (g) provide teachers with a sustained experience for continuous improvement.

The workshop was developed and delivered by university and K-12 teachers in two distant sites on opposite sides of the state. At each site, fifteen teachers and one or two instructors explored concepts in physical science, using hands-on activities to understand the concepts, gaining knowledge through these activities, reference texts and web sites. The teachers spent time each day exploring web sites relating to the concepts they were studying and interacting with those at the other class site through a course web site. Up to two hours each day were spent online with the other site using a video link. This time was used for sharing what those at each site had learned that day, making plans for the next day, and sharing group presentations that exemplified the concepts being studied. This time was also used for a guest speaker on assessment.

An Example Unit: Heat

One concept which was discussed was "heat". The preliminary reading assignment covered two chapters from the course text (Hewitt 1998): Temperature, Heat and Expansion, and Heat Transfer. The day opened with a discussion of terminology. For example, we clarified the difference between heat and temperature. Then the teachers were divided into teams of three. Each team received a 3 x 5 card which presented a question about heat. On one card was the question: Will hot water cool faster in a black container or a silver container? The question came directly from the pre-test and had been incorrectly answered by many teachers. The team investigated the cooling of hot water in two tin cans. One can was painted black while the other remained silver in color. Temperatures were taken at regular time intervals using the CBL system's temperature probe. Temperatures were also taken with a laboratory thermometer and numerical values were compared. The results were then plotted using a spreadsheet. The information gained included: accuracy in measurements (both time and temperature), repeatability and reliability (by taking parallel measurements with thermometers), use of spreadsheets and graphics, as well as the concept of emission and absorption of radiant heat. Next, web sites related to heat, such as the Utah Link (http://www.uen.org/utahlink/lp_res/TRB004.html), were investigated.

After lunch, results of the morning experiments and computer connections were shared with the other campus via the video connection. Finally, we returned to the classroom for a discussion of how the information learned about heat could be useful. In reviewing the results of the experiment with the silver and black cans, some questions were raised: Would one want to build a white house or a dark house in Colorado? What color of car might you want to own in Arizona? At the end of the day, teachers concluded with journal entries on the day's experiences.

Method

Students

The workshop was intended for elementary school teachers, mainly 3rd grade and below. The actual participants ranged from kindergarten through eighth grade. Most were classroom teachers, but a few others were resource teachers, retired teachers, or on leave. The came from districts across the state, including urban, suburban, and rural. Test scores on a pretest of the science concepts to be covered averaged 54%, indicating a lack of understanding of basic physical science concepts.

Instruments

An attitude survey questionnaire was developed to evaluate the last six objectives (b-g). A fifteen-item, seven-point Likert-type scale was used to assess the participants' perceptions of how much they learned about science, technology, problem solving, teaching science, and working cooperatively. It also asked for their overall feelings about the course and the instructors. The questionnaire included seven open-ended questions covering the same topics.

A pretest/posttest was developed by the course instructors to assess the first objective, physical science subject matter understandings. It contains 59 items, including 10 true/false, 48 multiple choice, and one short

answer, dealing with the six concepts covered in the workshop (motion, heat, sound, electricity, magnetism, and light).

Procedure

The workshop was held for two weeks in June. The class met for six and a half hours a day (including an hour for lunch). The mornings were divided between lecture, demonstrations, hands-on activities, and time in the computer lab. The afternoon included two hours for the online video connection between the two sites and closing activities. The pretest was given on the morning of the first day and the posttest was given on the morning of the last day. The attitude questionnaire was given to the participants on the afternoon of the last day. In addition, the evaluator spent 18 hours at CSM observing a variety of activities during six days over the course of the workshop. This included observations of each type of activity, the guest speaker on assessment, and a full day of activities. The evaluator also reviewed the workshop web site and other course materials.

Results and Discussion

The data were collected as planned. The pretest and posttest scores were compared using a t-test. The attitude questionnaire responses were tabulated and the frequency of scores determined. The open-ended question responses were analyzed by content. Notes taken during the observations and web site postings were also analyzed by content.

Science Understandings

The mean score on the pretest of physical science subject matter understandings was 32 out of 59 or 54% (SD = 6.6). The posttest results averaged 49 or 83% (SD = 4.3), indicating a significant increase in understanding of physical science concepts ($p < .001$). The first two items of the questionnaire dealt with how much the participants felt they had learned about physics and about conducting classroom physics activities. Item 1 asked, "How much information about the subject matter of physics did you learn during the course?", with 1 indicating "nothing" and 7 indicating "a lot." All of the participants responded 5 or higher, with 70% selecting 7. Item 2 asked, "How much did you learn about conducting physics demonstrations, and designing and conducting physics labs, during the course?" All of the participants responded 4 or above with 53% selecting 7. This objective to increase understanding of physical science understanding seems to have been met, both in the test score gains and the students' perceptions.

Promote Collaboration and Technology Use

The participants actively used the course web site during the course. The intention of this site was that the teachers would continue to use it during the school year to seek assistance with projects they were working on and to share successes. So far, this has not happened. The teachers are communicating via email instead, even to respond to messages posted on the web site. It is still early in the school year, so that may change as the teachers begin to use the lessons in their classrooms.

Teachers from twelve districts participated in the workshop. They interacted daily via the course web site and over the video link. The majority of the web site interactions were of a personal nature, such as introductions and sharing interests. All of the teachers explored the Internet for related science web sites. Those they found that were appropriate for elementary students and related to the state content standards were shared with the others in the course via the course web site.

The video connection between the sites proved to be a challenge. The connection remained stable most of the time, but there were several instances where the signal was cut off. The participants found that the two second delay made it difficult to have true real time interactions. This was particularly noticeable with the guest speaker. The participants at the site with the speaker were able to ask questions right away, while those at the other site had to wait until the participants at the first site had finished before they could get a word in.

Presentations from one site to the other worked particularly well. The teachers at one site were already familiar with their fellow teachers' presentations, so those from the other site were able to ask questions without being interrupted as often. The interactions between the instructors followed a similar pattern. They were able to establish a dialog that made their conversation feel fairly natural, even with the delays.

Probably the most important aspect to the video connection was the way it allowed the participants to quickly get to know each other. Personalities surfaced on the first day as they introduced themselves to each other. Many commented during the first week of the course that they felt they knew the teachers at the other site. If the only connection they had had was through the course web site, it is unlikely that they would have gotten to know each other as well. Seven teachers mentioned that the time spent on the video link was worthwhile. For example: "I also enjoyed the interchange with the class in Golden." "It is good to see more experiments from Grand Junction to expand on our concepts." "Distance learning was excellent!" Six teachers suggested having less time for the video link and five suggested moving the video link time to the morning "while we're all alert. After lunch, the hands on activities and demonstrations will help keep us engaged."

All of the teachers had direct experience with several forms of technology, but there is room for improvement. While the comments in the second part of the questionnaire indicated that the teachers enjoyed using the technology that was part of the course, one teacher questioned the degree to which the experience was technology-driven, calling the use "sparse." Technology was being used throughout the workshop, but many of the experiments and activities used non-electronic technologies, such as cans with wind-up motors and thermometers. A balance between electronic and non-electronic technologies seems appropriate, due to the nature of hands-on experience with real objects needed at the elementary level and given the concerns of some teachers as to the expense and lack of availability of the electronic technologies in their schools.

Several of the teachers requested more of a particular tool. Three requested more time to use the experiments they found on the Internet. Two wanted to do more with CBLs. One teacher wanted to learn to use graphing calculators and one wanted to see more on using the computer in ways other than the Internet. One wanted to see more applications that were appropriate for younger children.

Problem Solving

Items 6, 7 and 8 in the first part of the questionnaire dealt with problem solving. Item 6 asked, "How much did the course teach you personally about problem solving skills and techniques?" The responses were mostly rated 4 and above, with the mode at 6 (30%), indicating that all but 10% felt that they had learned some to a lot about problem solving skills and techniques. Item 7 asked, "How much did the course teach you about teaching problem solving skills and techniques to students?" Seventy-seven percent of the teachers rated this item a 5 or 6, with 93% rating it at a 4 or above. Most of the teachers felt that they had learned some to a lot about teaching problem solving to their students. Item 8 asked, "How useful do you think the material covered on problem solving techniques will be for you in your teaching?" Of the three, this item received the strongest positive response. Sixty percent of the teachers rated this item a 6, with 97% rating it 4 and above. This indicates that the teachers felt that the materials will be somewhat to very useful in the classroom.

Based on observation and a review of the course materials, problem solving was embedded in all of the course activities. The demonstrations and experiments required the teachers to pose questions, search for solutions, and discuss their findings. Unfortunately, this was not made as clear as it could have been, as the following data show.

Item 5 in the second part of the questionnaire asked, "Did you find the problem solving material helpful? Why or why not? Could it have been changed in any way that would have made it more helpful?" In response to this item, seven teachers said that no problem solving instruction had occurred, even though several of them mentioned problems solving activities in their responses. For example:

- We talked together and solved problems with demonstrations. Problem solving techniques were not covered in this course.
- No instruction on problem solving – We were in problem solving mode…

  I don't think we did a lot of the problem solving – We did solve problems on experiments and shared ideas on using in the classroom.

Eighteen teachers recognized that the problem solving instruction had occurred. Their comments included: "The problem solving activities helped us develop an understanding of concepts and helped us think about what we were observing." "Problem solving material was very helpful. It helped me to see better ways to approach problem solving with my students." and "So many ideas and techniques in problem solving – gives me a lot of

confidence in my ability to present material that I never have used before." More specific connections need to be made for some of the teachers to become aware that problem solving is taking place.

Conclusions

Overall, the teachers were satisfied with the workshop. They felt they were more able to teach science and that they better understood science concepts. The knowledge test indicated that their knowledge of science has increased. Though there is room for improvement, the workshop objectives were met. When planning for future workshops, the following changes are recommended:

- Require the participants to work in different groups and make the groups consist of at least three members. This will provide the participants with opportunities to get to know each other better and facilitate future interactions.
- Be more overt in the use of instructional and problem solving strategies. Debrief after each activity, not just about the science learned, but about the strategies used.
- Embed assessment within the activities, as was done with problem solving. A short review of assessment with opportunities to develop and use authentic assessments would be more effective than a guest speaker.
- Extend the workshop to meet the same number of hours, but spaced out over three or four weeks. This will allow more time for independent work and reflection between sessions.
- Two topics were not covered in sufficient depth: Circular motion and electromagnetism. We recommend that a one-week advanced physical science class be given to cover these topics.
- On the technology side, we recommend that the one-week advanced class cover the technology of creating a web page for each participant. This would enable both students and other teachers to see experiments in physical science and add a further connection to discuss physical science issues.

Finally, although the class was advertised for elementary school teachers, there were four participants who taught at the 7^{th} and 8^{th} grade levels. There appears to be a need for a similar class for the middle school teacher as well as for elementary school teachers. In future planning, this will be discussed.

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Comprehensive Professional Development Reform Efforts: Changing Attitudes and Practices about Pedagogy and Technology for Science Teachers with Diverse Needs.

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Abstract: This paper examines a professional development program within a large urban school system, along with a framework of the pedagogical concerns to be addressed by the program. As a part of the Center for Learning Technologies in Urban Schools (LeTUS), the University of Michigan and Detroit Public Schools have partnered to develop and implement a systemic educational reform program geared toward changing the practices of middle school science educators to include the integration of technology into the enactment of the curriculum and a transition to student-centered inquiry and investigation. To do so, the professional development program focuses on changing teachers' knowledge, beliefs, and attitudes regarding pedagogy, learning, and science. Initial findings of the impact of the program suggest a significant positive impact in changing said beliefs. This paper discusses elements of the program, and suggests recommendations for future study.

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Introduction

The past several decades of research and development in science education reform have yielded many innovative curricula, tools, and ideas. One area, however, that has seen less overall progress is the

development of new frameworks for professional development of science teachers (Marx, Freeman, Krajcik & Blumenfeld, 1997b). The staff development literature rarely addresses science education directly, and in turn the science education literature has not until recently addressed issues of professional development at any length. Tobin, Tippins, and Gallard (1994) devote considerable attention to teacher development in science, pointing to two practices as successful: connecting to teachers' existing knowledge and providing a supportive environment for change over time. In addition, Richardson (1996) states that a chief objective of professional development should be to foster changes in teachers' knowledge, beliefs, and attitudes (K/B/A), which show a strong correlation to changes in their classroom practices.

We have been working in collaboration with an urban school district to reform science education to be inquiry-oriented and make use of pervasive educational technology by creating professional development opportunities that will address the needs of a diverse population of teachers. There are challenges unique to urban environments, including high teacher mobility rates, erratic content-area and technology specific preparation for teachers (with many teachers teaching out of their specialization), a lack of a substantial and "teacher friendly" technology base in many schools and classrooms, and high poverty among students. These challenges (and others) must be addressed by professional development if reform efforts are to become successful for individual teachers and students, scaleable to the needs of the whole school and district, and sustainable in both individual classrooms and the system as a whole.

Theoretical Underpinnings

The professional development framework described in this paper is rooted in a larger theoretical frame called CERA (Marx, Blumenfeld, Krajcik & Soloway, 1997a; Marx et al., 1997b), which stands for Collaborative construction of understanding; Enactment of new practices in classrooms; Reflection on practice; and Adaptation of materials and practices. CERA provides the general backdrop for our collaboration with the school district and with teachers in all activities, including professional development.

Collaboration

Collaboration involves teachers, principals. and university researchers working together to inform, critique, and support each other (Lieberman 1992), with group members sharing both work and thinking. Support may come from other teachers who provide useful feedback about changes being implemented (Fountain & Evans, 1994; Nelson, 1986) and suggestions about enactment of the technology-centered curriculum. Support may also emanate from a research partnership with a university, allowing teachers and researchers to develop models of change together (Goodlad, 1993; Knight, Wiseman, & Smith, 1992; Stoddart, 1993) as well as provide feedback on use of experimental technologies. Support may take place through dialogue with administrators, particularly school principals (Greene, 1992; Leithwood, 1992) in matters involving administrative concerns regarding technology access and curriculum enactment.

Enactment

Collaborative conversations serve as a stimulus for change, but, by themselves, are not enough to promote teachers' learning. Experience and accompanying reflection are also essential. Teachers must try complex innovations such as those suggested by research (Krajcik et al. 1994; Roupp, Gal, Drayton & Pfister, 1993) and policy (Project 2061, 1993) before they understand the innovations' full implications. Enactment involves planning for innovation and conducting new practices in classrooms. We use the term enactment to emphasize that the process is generative and constructive. Rather than merely applying a set of predefined prescriptions, teachers attempt to establish practices which take into account their own, individual classroom situation, based upon reflection and practice.

Reflection

The element of reflection and its role in professional practice is the subject of Schön's (1983) seminal work. We share Schön's view that teachers must reflect on teaching to extract the knowledge that leads to improved student learning. Experience educates via reflection. Reflection involves both private acts, such as the reviewing of videotapes of classroom implementations, the use of new multimedia tools (Krajcik, Soloway, Marx, Blumenfeld, Bos & Ladewski 1995), and the use of reflective journals and other artifacts

of classroom practice, and public acts, such as the opportunity to discuss their work with peers and university researchers.

Adaptation

Finally, and perhaps most importantly, new approaches to education often require an explicit tailoring of instruction to the local contexts in which it takes place. Thus, enactments will look different in various classrooms. In particular, adaptations often occur after teachers have been given the opportunity to reflect on their enactments. Adaptation with respect to the use of technologies in the classroom is of particular interest, as individual teachers must respond to administrative and technological differences which are not likely to be addressed for individual circumstances within a professional development program.

The implicit goal for the design of our professional development activities is to provide opportunities for teachers to enhance their knowledge, beliefs, and attitudes (K/B/A) about science content, science teaching, and technology use. Changes in teachers' K/B/A result from a variety of conceptual change mechanisms that are mediated by cognitive, social, and contextual components. Cognitive mechanisms include the intelligibility and feasibility of the innovation. For instance, an innovative software program may not become intelligible to a teacher until he/she gets to see how another teacher uses it. Teachers may not feel that using technology is feasible for a variety of reasons, including their attitudes toward technology, their self-efficacy for using technology, and combinations of underdeveloped content knowledge or pedagogical knowledge with respect to the technology or science content. Social mechanisms include support for risk taking among teachers, or simple exchanges of information among colleagues, such as a teacher being more inclined to try to use a new technology in the classroom if they see that people they trust have tried it with success. This may lead both to increased feelings of self-efficacy ("If he can do it, I can do
in attitudes toward the technology. Contextual mechanisms are factors related to the settings in which the innovation is to be carried out, such as availability of resources and understanding by administrators of the teachers' goals and practices and the bureaucratic barriers limiting these practices.

Context

This professional development program was one of the programs developed by the University of Michigan and Detroit Public Schools as members of the Center for Learning Technologies in Urban Schools. The Center is an NSF funded partnership between those institutions, Northwestern University, and the Chicago Public Schools with a mission of developing educational programs using pervasive technologies. This particular effort was aimed at changing practices of middle school science educators throughout the large district. Programs were piloted in two schools at first, reaching ten schools in the second year. In this third year, more than 45 teachers and administrators from 18 schools participated in the program.

At the outset of the program, a series of goals were established and communicated to all individuals involved in the program, which would become the benchmark for success in the program. Our implicit goals for professional development are complemented by a set of five explicit goals, which are communicated to all teachers as part of regular professional development activities. These goals are: (a) to become active participants in a science teaching community; (b) to learn how to enact and adapt inquiry-oriented, standards-based science curricula that employ new forms of pedagogy, learning technologies, content, and assessments; (c) to understand how constructivism forms the basis for inquiry-based science; (d) to develop strategies for managing change in the broader context of your school and district; and (e) to actively participate in the evaluation and adaptation of curriculum and technology.

Implementation and Findings

Professional development for systemic educational reform (focusing on understanding and enactment of inquiry-based science curricula with embedded technology use) within a massive urban school district requires a variety of elements in order to accommodate the diverse needs of the teachers within the system. These elements include more traditional development activities such as summer and weekend workshops

(with non-traditional, model based activities during the workshops) with other, less-traditional events such as in-class support by curricular, pedagogical and technological experts. All of these elements of professional development are centered around the use of educative curricula, which are intended to provide opportunities for student learning through inquiry and technology use while providing teachers with activities and other constructs to enhance their understanding of content, pedagogy, and technology through active reflection. This allows for individual teachers to center on their own goals and strategies within the classroom, while being a part of a massive development program.

Initial findings regarding the impact of the professional development programs center on information gathered from the summer workshop element of the program. The summer workshop functioned as the kickoff activity for teachers involved in the program, in that it provided the orientation to the program and the underlying pedagogical concepts promoted by the Center. Teachers were introduced to inquiry-based, technology centered curricula by enacting their own investigation of the concepts inherent in the curricula they would be teaching in the following academic year. While participating in the inquiry projects, teachers were constantly encouraged to reflect upon their activities from a learner's perspective, and develop and share strategies for the teaching of these concepts during the school year. Teachers also participated in other work sessions, focusing on understanding the underlying content and pedagogy of the educative curricula, forming a community with other colleagues in the program, and developing a strategic plan for local enactment of the curricula. All of these sessions were videotaped for subsequent analysis to document both the actual activities of the workshop as well as teacher actions and responses during the sessions.

Daily reflection surveys asked summer workshop participants to reflect on the day's activities and the impact which that might have on their teaching practice, as well as the explicit goals of the professional development program. Our analysis thus far gives credence to the professional development framework we are using to support the systemic reform of science teachers in the Detroit Public Schools. Teacher commentary in workshop reflections showed evidence that all of the major change mechanisms we posited were necessary to foster their development. Furthermore, the quantitative feedback from teachers on the workshop indicated that the goals we explicitly stated for the work session were important to them. The lowest rating was 4.62 (on a 5-point scale), assigned to the goal of becoming active participants in the evaluation and adaptation of curriculum and technology. The highest rating was 4.85, on the goal of understanding how constructivism forms the basis for inquiry-based science. Teachers also felt that the work sessions as designed were useful in helping them achieve the five goals. The lowest rating was 4.66, for helping teachers develop strategies to manage change in their local school contexts. The highest rating was 4.79, for helping teachers to become active participants in a science teaching community.

Saturday workshops held throughout the school year provide another element of the professional development program, similar in nature to the summer workshop, but held periodically through the school year to provide a construct for teachers to reflect on practice during the enactment of the educative curricula. These workshops group teachers and administrators working with four distinct curricula together in the mornings to discuss general concepts and strategies of constructivist pedagogy focusing on technology integration and inquiry based science. In the afternoons, teachers collect in smaller groups to discuss issues relevant to the implementation of their particular curricula, which are divided by grade level and district standards. These events have yet to be fully enacted as of this writing, and, as a result, have not been thoroughly analyzed regarding the impact upon teacher attitudes, knowledge, or practice.

We do not claim that these in-service workshops, by themselves, can create lasting change in support of systemic reform. They are two of the pieces of a comprehensive approach to professional development represented by the CERA model. Another very important aspect of this program is the use of in-class support personnel who assist the teachers with the enactment of the curriculum, and encourage reflection on practice. These individuals are prepared by training and immersion in the curricula and with the technological tools. All support personnel are experienced teachers with an understanding of the underlying pedagogical concepts of the program.

Initial findings of the practices and observations of the support personnel based upon field notes indicate that these individuals participate in four basic activities; cognitive/pedagogical understanding support, in-

class teaching assistance, technology related assistance, and logistical or documentation activities. Based upon these findings, a survey instrument has been developed and piloted to examine the teacher's perceived need for elements of these areas, though collection of this data has not been completed at the time of this writing.

As mentioned earlier, all of these activities are centered upon the use of an "educative" curriculum unit, designed to provide opportunities for enactment of the desired practices within a content-focused framework. These curriculum units provide a guided set of activities to engage students in the learning of science content focusing on a contextualized driving question. They are designed to remove the teacher from the role of "keeper and communicator of knowledge" to a facilitator of student learning through an inquiry and investigation process, which utilizes a variety of technological tools to help students understand relationships of the content concepts. They provide a number of opportunities for teachers to personally reflect upon the enactment of the curriculum, and engaging questions to help redirect the personal pedagogy of the teacher. They also provide the context for the professional development program to help teachers examine different practices and their impact on student learning.

While findings of these curriculum units are not discussed here, informal observation reveals the impact, both positive and negative upon teacher practice. Successful enactment of the curricula allows the teachers to become familiar with the content, pedagogy, and technological tools encouraged in the program. Teachers use the materials to provide learning opportunities for students which also allow the teachers to gain experience in the enactment of an inquiry based pedagogy, and in the infusion of technological tools designed to aid in student cognition regarding the concepts and relationships of the content. The reflective questions and commentary within the written curriculum documents, when teamed with other forms of support, help the teacher understand the educational impacts of their practices on students, and focus on the changes in student learning, motivation, and content focus encouraged by the curricula.

Difficulties in the enactment come, for the most part, from challenges regarding organization, time management, and a diverse and dynamic student population. These challenges have forced some teachers to cut short elements of the curricula, as administrative and personal pressure encourages teachers to move on to more familiar practices. Such enactment seems to encourage the use of the pedagogy and technologies as interspersed "activities" and "techniques" rather than an underlying change in philosophy of teaching and learning to a more constructivist approach. Such challenges highlight the need for more comprehensive integration of all of the forms of support for teachers, as well as additional needs for addressing administrative buy-in and professional development for individuals in decision-making positions.

But, the challenges for enactment do not stop there. A number of other issues face educators in a variety of ways regarding the use of the curricula and adoption of these goals and practices. Some of the teachers struggle with content knowledge and its accompanying pedagogy. Over one third of the science teachers involved in the program have no strong science background, and so part of the professional development must address basic scientific concepts for these individuals. Many teachers who feel less proficient with the content often find themselves so tied to the activities listed in the curricula that they limit the adaptation necessary to gear the curricula to their students' specific needs and abilities. Others let their insecurities get the better of them, straying away from the design and focus of the curricula.

Perhaps the greatest barrier to enactment does not exist within the teacher, but rather within the school. Implementation of a curricula with pervasive technology use requires knowledge of and access to the technological tools utilized within the curricula. Problems with these technologies abound within the program. Some teachers have little or no access to facilities with appropriate technology within their school, either because the school as a whole is limited in these tools (though the Center made this an inherent element in the selection of schools to be involved in the program), or because these tools are used for other educational programs. The software for these curricula are specialized and require a variety of specialized hardware and software requirements, which are often limited within some schools. And, while the software has been tested in a variety of circumstances, the tools created for this program are specialized tools for these curricula, and are continuously under development. Analysis of all of these barriers will take place in a variety of stages, including analysis of videotaped class sessions, field note forms from

teachers and support personnel alike, notes from administrative meetings, and interviews and surveys of teachers and students involved in the project.

Conclusions

As a result of the dynamic interplay of collaboration, enactment, reflection, and adaptation, teachers' visions of innovative instruction are enriched. To provide this interplay for a large group of individual teachers within the context of a large urban school district is a challenge of the professional development program which supports these teachers. Yet, the interplay is necessary for real change, both in teachers' beliefs and practices, to occur.

To enact such a professional development program for such a diverse group of teachers requires far more than traditional in-service style approaches. A diverse population of teachers has diverse needs from a professional develop program, ranging from support to understand base philosophies and practices to assistance in understanding content concepts to knowing that there are other educators facing similar issues and that ideas and strategies can be garnered from a community of teachers. The professional development program described within this paper is an attempt at such a program, and initial findings show examples of the successes and challenges of such a program in changing teachers' knowledge, beliefs, and attitudes regarding their students' learning and their own practice as educators.

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Technology And Field-Based Learning: Efforts To Bring About Change In Schools

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Abstract: Authentic learning is often considered to be hands-on and experiential in nature. This paper describes research that was conducted with an educational methodology designed to provide students with an authentic learning experience in a field-based setting with the help of computer technology. Furthermore it presents efforts to expand the use of the methodology in an elementary school through efforts to provide faculty in the school and undergraduates who will be engaged in their student teaching practicum in the school with the same access to the methodology through engaging them in field-based learning. Plans for exploring the effects of the professional development are also discussed.

Introduction

Around the country, numerous efforts are underway to learning opportunities for students through authentic and meaningful inquiry. Such endeavors provide contexts for students to 1) think critically, explore phenomena, and solve relevant problems; 2) plan and conduct investigations in relevant settings; 3) gather and collect information to construct reasonable explanations and solutions; 4) engage in discourse about their ideas, explorations, and conclusions; and 5) use technological tools to assist in their investigation and communication efforts (International Society of Technology in Education, 1991). In order to continue this reform movement, inservice teachers, and ultimately preservice teachers also need to be exposed to such contexts and also have the opportunity to learn through inquiry. The projects reported here focused on the use of tools of science, mathematics, and technology by preservice and inservice teachers to engage in scientific inquiry through the investigation and communication of phenomena in field-based settings.

Computer technology is a tool that supports authentic learning experiences in field-based settings as well as in the classroom. It allows students to collect and record information in the form of numerical data, written field notes, drawings, and digital images while in the field. Technology helps to connect the field-based experiences to the classroom learning by providing ways for students to easily and professionally display and analyze the data that they collect in the field and to communicate their findings so that peers can share in their newfound understandings. As students work in relevant field-based settings, they use and develop skills necessary for scientific work such as formatting significant questions; developing methods of exploration; carrying out studies; and engaging in discussion with others about their discoveries.

Technology supports the processes of wondering, exploring, and discovering which are central to the scientific process. Through these authentic learning opportunities students construct their own understandings about the world around them.

In addition, teacher education programs are doing an inadequate job of preparing preservice teachers to teach with technology. Too often preservice teachers' exposure to computer technology in their preparation program is limited to a single required survey course (Strudler, Heflich, & Anderson, 2000). Efforts to integrate technology into methods of teaching and applying that to student learning are sorely lacking. The projects described herein are one attempt to more fully integrate the use of computer-based technology in methods of teaching mathematics and science.

Integrating Technology, Science, and Mathematics in Field-based Learning

The project reported here falls in two phases. The first was a Dwight D. Eisenhower Professional Development Program supported effort to integrate field-based inquiry into a preservice science methods class and with inservice professional development offered to faculty at two elementary schools in an urban, southwestern school district (Heflich, Dixon, & Davis, 1999). Our goal in working with both preservice and inservice teachers was to influence the way technology was used in elementary education. An additional goal was to explore the integration of mathematics, science, and computer technology through the use of field-based teachning methodolgies. The project utilized field trips to a variety of natural areas within the community, using traditional data collection tools, as well as temperature probes connected to Apple Computer Corporations eMate computers. Each of the interventions followed the same model:

- A discussion of the inquiry process as a means of looking at natural phenomena in the world;
- An introduction to the data collection tools, including the computers, and opportunities to practice with them;
- Trips to a site in the field in which they were introduced to field-based inquiry methods throught games, engaged in observational exercises, delineated a study site, and, working in groups, collected data;
- Space to organize the data collected in terms of the inquiry driven questions they had asked;
- An introduction to story boarding techniques as a way of planning ways of presenting their questions, data, and conclusions to the larger group;
- Working with slide show software to create presentations;
- And, presenting their results to the group as a whole (Heflich, Dixon, & Davis, 1999).

The project successfully exposed both preservice and inservice teachers to field-based methods of scientific and mathematical inquiry through the use of computer technology. Teachers in the participating elementary schools expanded on their use of the methodology and introduced it to others in their schools, but preservice teachers had less success in influencing the practice of their colleagues once hired by schoolsin the district. By this last measure the project was less than fully successful.

On-Campus Professional Development School

Some of the teachers involved in the Eisenhower-funded professional development grant work at a school that was in the process of becoming a collaborative program of the College of Education (COE) and the Local School District (LSD) to create a Professional Development School (PDS) on the university campus. The goal of the PDS is to improve the clinical preparation of educators (Robinson & Darling-Hammond, 1994). Central to the planning for the PDS was relocating the school to the university campus, adjacent to a privately funded professional development center containing a computer laboratory, offices, two classrooms, and a large activity room, all amply provided with computers, projection systems, and smart whiteboards. In addition, the COE developed a teacher education cohort of twenty-two students who work intimately with teachers at the school and with program faculty in an integrated approach to teacher

education which offers them the opportunity to learn both in the university and elementary classroom. (Myerson, Gallavan, Girogis, Heflich, Putney, Ramirez, & Regin, 1999).

In fall, 1999, the PDS cohort was engaged in their last semester of coursework prior to entering their semester-long student teaching internship at the school. Their coursework during fall semester included advanced literacy methods, mathematics methods, science methods, and a field-based practicum at the school that was supported by a seminar in which students were expected to reflect on their experiences as teachers. One of the authors was responsible for teaching science methods; another was responsible for running the seminar. The latter proposed to use the seminar to expand cohort students' concept of the use of computer-based technology in teaching and learning, building upon the experiences of some of the PDS teachers All of the students had previously taken a required survey of computers in education. Within that course students learned to design and develop slide show presentations. Therefore cohort members possessed some of the ability that had been stressed within the professional development provided to PDS teachers. Working with the cohort in the seminar, exposing cohort members to the same field-based, technology- infused methodology to which teachers working at the PDS had been exposed provides the opportunity to explore the possiblity of changes in teaching methodologies that may result.

Working in the field with the PDS cohort

The cohort convened on an autumn morning at the Desert Demonstration Garden, the same local used for providing professional development to the PDS teachers and a site within walking distance of the PDS. They were joined by two of the authors, their teachers in Science Methods and in Seminar. Cohort members were divided into four working groups. Each group had with them:

- Apple eMate computers with temperature probes;
- Measuring tapes;
- Ph kits;
- 10m of rope;
- And, digital cameras

Groups decided on a site which they bounded with the rope. They spent time observing the site and reflecting upon and discussing what it was within the site that interested them and why. Group members then began utilizing their tools to record the data needed to answer their question. Temperature data of all sorts (water, air, sunlight, shade, reflections, body, etc.) were recorded with probes and the eMates. The eMates also served as a vehicle for recording questions, making sketches of objects in the area, and serving as a repository for the data collected from the probes, measuring tapes, and ph kits. Digital cameras were used to take pictures of the site, objects within the site, and the activities in which group members were engaged.

These data were taken back to a computer laboratory and uploaded onto desktop computer systems. Group members met with one another, revisited their questions, catalogued the resources they had gathered for a presentation, and began the process of developing storyboards that recounted their experience. Students were given the freedom to develop their slide show in the program of their choice. Among those chosen were ClarisWorks, PowerPoint, and KidPix Studio. Groups received technical support from faculty when they encountered problems, but otherwise worked on the slide shows independently for five hours over two weeks, before presenting them to the group as a whole. Examples from student presentations are included in the attachements.

Where do we go from here: changing educational practice.

Changing educational practice in schools is not simply a matter of having a good idea, sharing it with others, and waiting for it to develop. An investment needs to be made in the process. It needs to be pushed and shaped by those who are willing to commit the time to try to realize it. Fullan (1993) points out that institutional change is inherently personal. Therefore any consideration of change must be broadly based, a group of individuals who share a common vision of how to change their practice as educators.

The plan for change in the PDS involves integrating technology into methods of teaching science and mathematics through field-based experiences. The actors involved include the two teachers at each grade level, who have previously been exposed to the methodology during the Eisenhower-funded professional development project described by Heflich, Dixon, & Davis, 1999, PDS interns in the school, now student teachers who have been exposed to the same methodology, a technology coordinator who serves the role of a change agent (Fullan, 1993) committed to seeing the methodology succeed, and a coordinating group containing members equally invested in changing the way technology and teaching occur in the school. Efforts are underway to match teachers with experience in the methodology and interns who have had the same experience. In addition, a series of workshops, supported by Project THREAD (Technology helping to restructure educational access and delivery) ,a federally funded imitative described in Strudler, Heflich, & Anderson (2000), will work with teachers in the school to more fully integrate technology into teaching and learning. Follow-up support will be provided to the teachers by the technology coordinator, Project THREAD, and university faculty.

Five classes, one at each grade level, will take a trip to the Desert Demonstration Garden on the university campus, about one quarter of a mile away. Support will be given to the teacher and the intern helping students ask questions about what they see in the environment, and teaching them how to measure things and keep records of their measurements. The older children will use eMates to collect data. Once the data is collected, we will introduce children to slideshow software, and work with them as they prepare presentations. Other classes at the various grade levels will be invited to student presentations of their experience.

The plans descripted here are part of the larger agenda of Project THREAD which is designed to better prepare preservice teachers to work with technology in teaching and learning. Teachers working in the PDS have a clearly defined role serving as professional examples and mentors to cohort interns (Myerson, Gallavan, Girogis, Heflich, Putney, Ramirez, & Regin, 1999). Professional development with technology in the PDS is a goal of Project THREAD (Strudler, Heflich, & Anderson, 2000). The professional development is targeted towards grade level interventions and will support the use of technology-infused, field-based instruction of students.

Technology support for PDS teachers will be ongoing, supported by Project THREAD and the PDS coordinating committee. Teachers' use of field-based methodologies will be monitored to evaluate the extent to which it is used in school, and the effect that its use has on students attending the school. These results will be reported as they become available.

Discussion

Field-based methods of teaching science and mathematics with technology have been positively described (Heflich, Dixon, & Davis, 1999). The use of environmental probes connected to laptop computers provides students with tools that will allow them to collect and record data that can easily be transferred to desktop systems for more detailed analysis and presentations. The use of technology in field-based methodologies to teach science and mathematics supports the process of wondering, exploring, and discovering that are significant elements of elementary education (Heflich, Dixon, & Davis, 1999). It further allows students to engage in the scientific method, allowing them to engage in the process of forming hypotheses, searching for data to address the hypotheses, analyzing data to address the hypotheses, and reporting their results. All of these steps are aided and supported with the use of computer-based technologies.

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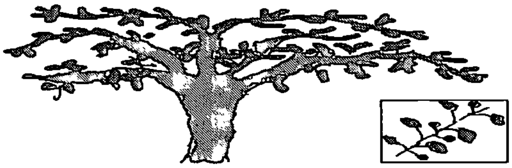
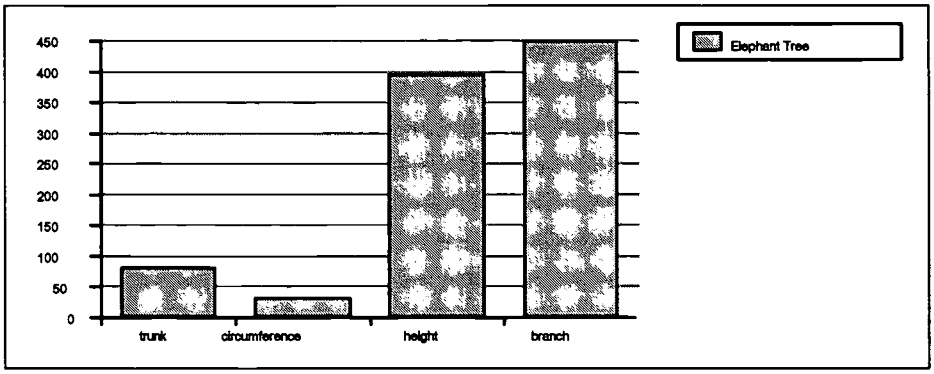
Attatchments

Attachment 1
EMate generated picture and description from PDS field trip.



Elephant Tree...smooth bark, many small leaves, small green berries, thin, long reaching branches, dagger shaped leaves, provides lots of shade, most small branches have 6-8 leaves on a branch, evenly spaced small branches for leaves

Attachment 2
Data collected during PDS field trip regarding the tree, stored in a spreadsheet on an eMate, uploaded and converted to a graph using spreadsheet software.



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Site-based Inservice that Works: Using the Internet to Integrate Science and Mathematics Instruction

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Abstract: Project SCOUT provided inservice and preservice teachers opportunities to experience inquiry-based learning, which combined hands-on and Internet investigations in science and mathematics. The goals of the project were: (a) to provide staff development in standards-based strategies for teaching science and mathematics for teams of inservice and preservice teachers at a single elementary school that hosts a site-based university teacher preparation program; (b) to enable mentor and student teachers to learn knowledge navigation strategies using the Internet and develop teacher and elementary student web sites to accompany their curricular units; and (c) to conduct a summer camp for local school-age children, which would allow participants opportunities to practice the strategies they learned during the institute. The results suggest that appropriate training, which allows significant time to explore and adapt instruction; immediate practice opportunities with children; and significant follow-up opportunities will engender confidence and foster use of the Internet as a part of K-8 classroom instruction.

Introduction

Rationale/Need

Surveys of K-12 teachers (Sowell, et. al., 1995) revealed that elementary teachers felt unprepared to teach mathematics and science and to use technology effectively in math and science instruction. Needs assessment surveys of the SCOUT project teachers indicated similar needs. With the increased nation-wide emphasis on standards-based education, the need for assisting teachers in developing both the competence and the confidence to teach these three discipline areas has intensified.

Hands-on Learning

Evidence clearly indicates that hands-on activities increase skill proficiency in processes of science (Mattheis & Nakayama, 1988; Tobin, 1990). Inherent in the constructivist approach is its meaningfulness to children. Additionally, although it has long been understood that the power of inquiry learning is its focus on applicability in authentic contexts (Bruner, 1961), teachers face the challenge of keeping current. In a rapidly changing world, on-going staff development is vital if instruction is to remain relevant. Thus, we elected to utilize an inquiry style of delivery for the institute as a model of the kind of teaching we hope participants will employ in their own classrooms.

Self-efficacy

Bandura (1997) cogently argues that teachers are responsible for creating instructional environments that foster effective learning. He asserts that their doing so is dependent upon their confidence that they have sufficient knowledge and an adequate understanding of strategies for effective teaching. It is therefore incumbent upon staff developers and teacher educators to offer current techniques that will engender this competence and confidence.

Simultaneous Inservice-Preservice Staff Development at a Single School Site

Research on implementing innovations shows that successful programs provide training and support for the entire faculty of a given school (Fullan, 1991). Moreover, at a single site where the principal supports the program, colleagues tend to work together knowing that there is an expectation of implementation (Marcinkiewicz & Regstad, 1996). This contrasts with the trainer-of-trainer models where one or two teachers from each of many schools receive the training and take it back to disseminate at their schools. In such a design, there is neither immediate support when teachers experience difficulties, nor a sense of common commitment and vision for implementation. Sadly, these isolated teachers often abandon an innovation before it is fully implemented (Fullan, 1991). Thus, we have chosen to focus on all of the teachers in one elementary school. The impact of the project will not be limited to this local school, however, since the university students, upon leaving this supportive environment, will carry their learning into a variety of school districts where they are employed.

Description of the Project
Two-week Summer Institute

In a summer institute format, 28 participants began these experiences in the role of students, exploring the behaviors of butterflies and weather-related phenomena under the guidance of subject-expert leaders and College of Education mathematics, science, and language arts, and technology faculty. Hands-on experiments led them to seek additional information and real-time connections through the Internet. The intent was to have practicing teachers and future teachers learn in the manner they would later use with their own elementary students. During the second portion of the institute, inservice teachers and the education majors, whom they would be mentoring through internships in the fall, collaborated to develop their own web pages to be used with elementary school children. As a result, technology staff development was designed to have direct applicability as participants learned to search the Internet; bookmark appropriate sites; complete a template with both teacher lesson planning pages and student activity pages; create links; and save their work appropriately for posting on a web site.

Two One-week Summer Camp Sessions

Using the activities and web pages they had developed during the institute, the inservice-preservice teams could field-test their ideas with small classes in an informal climate. One of the institute participants, a teacher from the school site, served as director of two camp sessions attended by 114 children from the community.

Follow-up Sessions

During fall of the school year, the project team conducted monthly follow-up meetings. There were three purposes: (a) to sustain the motivation for implementing and extending the units place on the web pages during the institute; (b) to provide assistance in resolving any technological or curricular problems experienced during implementation; and (c) to maintain the sense of community built during the concentrated summer experiences. Additionally, participants and leaders continued to communicate and shared ideas using e-mail.

Data Sources and Data Analysis

Participants completed several survey instruments at various points including prior to the summer training, after completion of the summer training institute, and during the fall implementation phase. One survey instrument measured participants' confidence in using the Internet to enhance their instruction. This instrument was an adaptation of the Microcomputer Utilization in Teaching Efficacy Beliefs Instrument (Enochs, Riggs, & Ellis, 1993). This valid and reliable instrument was modified to focus on the use of the Internet rather than on microcomputers. The instrument uses a Likert-type, five-point scale from strongly disagree (1) to strongly agree (5). Additionally, two dimensions of efficacy are measured on the instrument—personal efficacy and outcome expectancy. Personal efficacy measured feelings of teacher's confidence for using the Internet including for example, "I know the steps necessary to use the Internet in an instructional setting." Outcome expectancy assessed the teacher's feelings of how it will affect learning, "Students' Internet ability is directly related to their teacher's effectiveness in classroom use of the Internet." At the same three times participants completed the efficacy instrument, they also completed a survey instrument, which assessed their understanding of and their perspectives on the usefulness of Arizona academic standards for mathematics, science, and technology. These measures of understanding and usefulness were measured on a Likert-type, four-point scale from strongly disagree (1) to strongly agree (4). In a third instrument administered at the completion of the summer institute, participants responded to items that assessed their confidence for publishing on the web. Specifically, they responded to items assessing how they felt about publishing on the web prior to and after the summer training. K-8 students and parents completed questionnaires related to evaluation of the summer camps.
The efficacy measures and the understanding and use of Arizona academic standards was analyzed using repeated measures ANOVA. Confidence for publishing on the web was analyzed using a dependent t-test. Student and parent responses are descriptive data.

Results

Results from the repeated measures ANOVA showed a significant effect on personal efficacy for use of the Internet in instruction, $F(2, 42) = 8.82, p <.001$. Means showed a substantial increase from before the summer institute training to after the training, which was maintained during the fall follow-up. Means for the personal efficacy measure were: 3.51, 3.81, and 3.81, respectively for these three time periods. Similarly, results from the repeated measures ANOVA for outcome expectancy were significant, $F(2, 42) = 6.95, p < .002$. These means showed the same substantial increases from pre- to post-training, but the follow-up mean fell back. The means for outcome expectancy were: 3.50, 3.81, and 3.63, respectively for the three time periods.
With respect to the understanding of the academic standards, results showed that participants increased their understanding of the technology standards, $F(2, 42) = 4.22, p < .021$ and of the science standards, $F(2, 40) = 4.60, p < .016$, but not of the mathematics standards. Means for understanding the technology standards were: 2.79, 3.11, and 2.95, respectively for the three time periods. Means for understanding the science standards were: 2.59, 2.97, and 2.84. For the measures of usefulness of the mathematics, technology, and science standards there were no significant differences across the three time periods. Ratings for the usefulness of the standards for instruction were initially quite high, 3.5 on a 4-point scale, and remained stable over time.
The analysis for the measure of confidence for publishing on the web was significant, $t(26) = 3.72, p < .001$. Teachers demonstrated more confidence in web publishing following the summer training institute. Students and parents felt the summer camps were valuable and indicated they were pleased with the camp, happy with what they learned and would participate again if given the opportunity.

Discussion

The hands-on, inquiry-based approach to professional development utilized in the current project was quite successful. Significantly, Internet utilization in classroom teaching easily lends itself to the use of an inquiry-based approach, the kind of instructional approach for classrooms that maximizes understanding and motivation among students. For example, by using the Internet, students quickly can gather information related to their own questions that are based on their needs, interests, and goals. The Internet offers powerful opportunities to teachers and their students to conduct their own research about issues, which concern them.

The success of the project also was reflected when teachers demonstrated greater feelings of efficacy for using the Internet as a result of their participation. With regard to using the Internet for instruction, both personal efficacy and outcome expectancy for use of the Internet increased for the participants. In addition to increasing efficacy for Internet use in instruction, participants also demonstrated increased understanding of the academic standards for technology and science. These outcomes are consistent with Bandura's (1997) work in which he suggests that efficacy, confidence about teaching, is dependent on sufficient knowledge and adequate understanding of strategies for effective teaching. Thus, in the current project, the training engendered feelings of confidence among inservice and preservice teachers about their ability to augment their mathematics and science instruction using the Internet.

For this project, one final issue warrants some consideration. Comprehensive, effective professional development provides sufficient and appropriate opportunities to learn, adapt, and field test newly learned content and pedagogical knowledge. Importantly, in the current project, teachers had sufficient time to carry out these three critical activities. The summer institute provided sufficient depth of material and time for participants to *learn* material appropriate for augmenting their instruction on the Internet, *adapt* the materials and methods to their particular needs, and *field test*, i.e., try out their new understandings during the summer camps. Such opportunities, which provide for depth and time, are critical to the success of any professional development activity.

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A Net-Course for Physics Teachers Supporting Collaborative Learning and Inquiry

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Abstract: This paper is a report on an experimental model of Net-Seminar tailored to train teachers in transforming their teaching by promoting a constructivistic teaching practice and an instructional approaches computer-enhanced that enables pupils to learn about the process of modeling physical phenomena. A relevant point of the instructional approach is the development of metacognitive knowledge and skills: teachers are engaged in a reflective process in which they evaluate their own and each other's activities and reasoning. The Net-Seminar supports the learning by scaffolding apprenticeship model: teachers experience a first-hand virtual education that includes downloading of electronic documents, participating to group discussions, creating shared knowledge spaces and other activities which they can carry out with assistance and then use by themselves in their own classrooms. Results concerning the characteristics of the network are discussed and conclusions are drawn about the ways of improving the network and the interactivity of the Net-Seminar.

Introduction

The introduction of (IT) Information Technology (Microcomputer Based Laboratory, multimedia, simulation software and hypertext) in teaching/learning environments produces relevant modifications that are the objective of many research studies. A Project is in progress in Italy concerning the physics teaching at high school level: it involves 8 universities and is supported by CNR (the National Council of Research). Its main objective is the implementation of teaching/learning environments using computational tools in order to support student activities concerning exploration and experimentation. Computational tools does not simply offer the same content in new clothing: areas of content have to be recast and new ways of teaching concepts are possible, allowing learners to explore concepts that were previously inaccessible. Moreover, computational tools involve a substantial modification of teacher role and teaching methods.

The research results reported in literature (Riel, 1994, Swan and Miltrani, 1993) as well as some preliminary results of our project show that teachers need an appropriate training in implementing IT innovations: very soon, they act as modifiers since they try to adapt the innovations to their old teaching/learning models. After a training course, the isolation in which teachers work, in most of cases, lead them to limit objectives of their work in corresponding to the met difficulties. Innovative teachers should feel part of a wider community that, while operating locally, helps them to overcome isolation by linking them up in an on-going manner even though they work in separate geographic locations.

The use of Information and Communication Technologies (ICT) in education is currently the focus of much attention: many projects now in progress study the design and the development of telematic learning environments by stimulating learning through communication and peer collaboration (Kaye, 1991, Veen et al., 1998). Some findings concern the new instructional formats that make ICT effective and applicable in different contexts: technology-enhanced distance education environment facilitates collaborative learning, active learning, and independent learning and exceeds the traditional classroom in its ability to connect people and course materials on a round-the clock basis (Selinger, 1998).

This paper reports a currently under-way research in Italy aimed to experiment ICT for teacher training in introducing new physics contents and teaching methods at high school level. Objectives of the project are:

- the understanding of teachers' need in the area of ICT;
- the preparation of new pedagogical environments for teacher education;
- the analysis of new competencies that teachers, using ICT, will need.

A relevant point of the instructional approach is the development of metacognitive knowledge and skills: teachers are engaged in a reflective process in which they evaluate their own and each other's activities and reasoning. The course model is based on the hypothesis that the focusing on the process of metacognition is helpful to teachers to learn how to be engaged in and to reflect on modeling teaching practices. The teachers attending the Net-Seminar are exposed to a broad repertoire of educational strategies, virtual teaching techniques and supporting material for thinking about the discipline.

The paper describes the structure of I.MO.PHY.(Introduction to Modeling in PHYsics education), a Course delivered through digital Network (Net-Course) and some preliminary results of its pilot test involving 50 experienced teachers attending the Net-Course on optional base. They have been engaged by the research groups that supplied their local assistance (hardware, software, etc...).

The Innovations

Our approach to physics teaching is based on the frameworks derived from constructivistic epistemology (Von Glasersfeld, 1993) and focused on the process of constructing predictive conceptual models of the physical world (Hestenes,1987, Gilbert et al., 1998). Model building is considered as a superordinate process skill and the introduction of modeling activities contributes to various content areas, enabling students to see similarities and differences among a wide range of phenomena. Scientific models are usually very different from pupils' personal views of the world, the spontaneous models (Gentner. and Stevens, 1983), and some transformations of scientific models are necessary in order to fill this gap: these will be able to perform the "fitting", that is to gradually adapt pupils' conceptions to scientific models.

This approach involves a construction of the physics content structure that has to be taught not mainly, or even solely, oriented to physics issues but also including educational issues and pupils' conceptions. These two issues, students spontaneous models and statements of the scientific knowledge, are therefore accepted to be of the same relevance and treated as resources for physics education. In this way the physics content to be taught is reconstructed in order to realize the main goal: to allow students to gain a fruitful knowledge of the outer world (in our case physical world). This involves substantial modifications in learning sequences as well as in teacher's role and teaching methods.

The teacher has to transform himself or herself from being a 'dispenser' of knowledge to being a 'coach' managing the evolution of student skills and a 'modeler' shaping and molding learners' knowledge (Watts and Jofili, 1998). Teaching strategies to be implemented have to build new knowledge on pupil spontaneous models and to provide learning environments explicitly promoting an appropriate epistemology of science that has to become the content of instruction and has to be embedded in instructional methods. Consequently, teachers need to have a deep knowledge of the nature of physics models and their functioning in the development of the discipline as well as an awareness of the pupils' spontaneous models in the different content areas.

Usually physics courses, at high school as well as at university level, use a teaching approach based on a lecture format of the classes and few laboratory activities restricted to a mere verification of some physical laws. It has been shown that the direct learning experience as university students functions as the best training in teaching methodology: in fact, very soon they transfer perceived methods and learned contents in their classrooms, simplifying the approaches usually through the teaching models reported in textbooks (Sprinthall, 1995).

Teacher training usually consists in scientific courses and courses about education based on a lecture format of the classes. Moreover, the courses in education are totally separated from the instruction in physics content and teachers have to necessarily synthesize by themselves in order to solve their specific teaching and learning problems.

To modify the high school physics teaching approach by a procedure of transmission of consolidated knowledge to the implementation of teaching/learning environments, where teachers manage and support the pupil processes of knowledge construction, involves a deep modification of the structure of the teacher training courses: substantial modifications of teaching methodology and approaches cannot be transferred to teachers only by using theoretical courses outlining the methodological underpinnings but by making experience to teachers the same teaching/learning environments we think they have to provide to their pupils. In order to communicate new knowledge and new behaviors, we need teachers' training strategies that build the new knowledge on the previous one: there is a close parallelism between how the change occurs in pupils' scientific conceptions and how a change in the conception of teaching can occur (Sprinthall, 1995). A well founded change in teachers' didactic activity involves also a conceptual change (Posner et al., 1982).

As a consequence, the basic principles of the Net-Course are the following:

- teachers themselves have to be learners and to experience the kind of learning they can provide to students;
- they have to be engaged in using the pedagogical tools designed to help learners in conceptualizing physics models and in gaining the abilities connected with modeling procedures;
- they have to be involved in activities aimed at stimulating hands-on learning and metareflection;
- teacher education has to be connected with classroom experimentation of the involved innovations.

For metareflection we intend the activation of those procedures (sometime named metacognitive skills) that direct and steer the information processing-flow of learning, in order to make them explicit, recognizable and reproducible (Simons 1995). In particular, we intend the metalearning development of Shön's (1988) reflective practice that already has been successfully applied in various contexts of science teaching and tutoring (McKinnon and Erikson 1988, Linder et al. 1997). Shön argues that all aspects of teaching-practice supervision should be characterized by fundamentals of "coaching" where:

> through advice, criticism, description, demonstration, and questioning, one person helps another to learn practice reflective teaching in the context of doing. And one does so through a Hall-of-Mirrors: demonstrating reflective teaching in the very process of trying to help the other learn to do it.

Shön (1988) defines the learning activity as the process of "making sense of complexity" and introduces a second reflective domain relevant for the objective of learning to teach: the 'reflection-on-action', i. e. the thought used to review sense-making of complexity. We have applied Shön's hall-of mirror approach in the context of the Net-Course. Electronic conversations, facilitated by moderators, are aimed to perform this kind of reflective coaching.

The IMOPHY-Net-Course

A telematic learning environment, used for teacher training, demands a thorough rethinking of the content and the teaching/learning activities of the involved learners (in our case the Teachers (Ts)) and trainers (in our case the Researchers (Rs) of the projects). Interactions and teaching learning activities are delivered in a setting that it is very different from a classroom and/or a laboratory. Our Net-Course takes into account the results and the experiences rising from previous Projects evidencing that three main categories of functionality seem to be critical for the design and the development of telematic learning environments. These are related to: - information such as documents and other material including images and sound; -interactivity defined as human-machine interaction; and communication taking place among learners and teachers, peers and others.

These functions have been supplied, in an integrated way, in the three phases of our Net-Course:

1. Face-to face Workshops where Ts were trained by the Rs of their local university group to get acquainted with Internet, e-mail facilities and software involved in the project (Excel and Interactive Physics).
2. Net-Seminars where Ts were supposed to analyze the educational materials supplied by Internet, discuss them using e-mail and/or forum facilities and, at the end, to program a classroom experimentation of one Learning Unit (one activity concerning the modeling of a choice category of phenomena).
3. Experimentation in classroom of the chosen Learning Unit and collection of evaluation elements (Ts' logbooks and students' reports).

The physics content of IMOPHY involves modeling activities in different fields of mechanics and thermodynamics. The materials and the pedagogical tools used in the Net-Course had been experimented in real high school classrooms by the researchers and/or experienced teachers. The learning material is structured in modules aimed to support (through Teacher Guides(TGs) and Student Sheets (SSs)) teachers in implementing the modeling activities in their classrooms. The organization of each Teacher Guide intends to engage teachers in their own investigations in order to gain the prerequisite skills and knowledge, concerning the physics content as well as the pedagogical tools. For each module a Net-Seminar has been organized: its term was from 10 to 15 days depending on the materials to be analyzed and/or on the software and experiments to be performed.

The Net-Seminar Structure

The relevant points of our teacher preparation process are the following:

- deep analysis of the physics content structure;
- evaluation of the pupil involved spontaneous models;

- construction of pilot classroom instructional sequences through metareflection on the involved learning requirements.

The starting point of each modeling procedure is the analysis of some easily observable phenomena and the TGs conduct from observations to models through 4 different sections:

- in the first section some examples of questionnaires, used by researchers in order to investigate pupils' common conceptions (the spontaneous models), are supplied and the research results analyzed;
- in the second section , observations about common phenomena that can constitute the ground of pupils' spontaneous models are pointed out;
- in the third section, some experiments, that can be easily performed, are described;
- in the fourth section, different aspects of the modeling procedure and the gradual enlargement of the experimental field, for the further presentation of more powerful conceptual models, are analyzed.

All sections include suggestions about the ways in which to perform the different activities in the classrooms. Moreover, the TGs supply examples aimed to stimulate teachers and students in reflecting on the relationships between real-world observations and results of experiments with modeling activities, in order to foster a common interpretation.

The Net-Seminar audience was constituted by 12 project researchers (6 were the local coordinators supporting locally the teachers) and the involved teachers. Two or three moderators (the project coordinator and the authors of the educational materials) stimulated discussion and reflection concerning the materials as well as their transfer in a classroom setting. They tried to stimulate a reflective domain, relevant for the object of learning to teach. Fundamentals of coaching for reflective teaching were questions and statements stimulating opinion on a question of action, criticism, descriptions of learning situations, demonstrations of cause/effect relationships, etc...This activity was aimed to help Ts to become aware of learning strategies and self-regulation skills applied in the various phases of their work and how these strategies and skills were related to learning goals.

As a starting point, Ts were requested to prepare a report describing a possible implementation of the educational materials in their classrooms. The requirements were to prepare a conceptual map connecting the involved concepts, detailed questions for pupils, activities to be performed and evaluation materials. The need to evidence their role as teachers, in each moment of the programmed classrooms activities, was outlined. Following Schön's hall-of-mirror approach (1988), Ts and moderators continually interchanged prospective: moderators never had to figure out how to solve a peculiar problem, instead they introduced new problematic elements in order to put into evidence the real complexity of situations. The moderator main role was, in simulating pupils meeting learning difficulties and in analyzing these to stimulate Ts in surfacing their own difficulties and in reflecting on their own learning, putting in action some possible ways of searching for appropriate solutions. In few words, the hall-of mirror experience gave Ts the opportunity to share with each other how they dealt with difficulties, questions and problematic situations of their future teaching/learning environments. The researcher experience, during the experimentation of the pedagogical tools in real high school classrooms, has been the main point for the implementation of this phase: to observe the knotty problems of the physical content and the crux of the used pedagogical tools have given useful indications in outlining possible teaching/learning settings for the analyzed context.

Research Design and Preliminary Outcomes

The scope of the pilot test was limited: a case study approach has been employed using a qualitative method of data gathering and analysis. This method involves constant reflection through the observation and data in order to identify key analytical themes grounded in the data (Strauss, 1987). Various data collection sets have been used:

- the analysis of the communication, including frequencies and structure of messages, their peculiarities and so on;
- the analysis of the forum' discussion;
- a questionnaire concerning individual timings;
- a anonymous structured questionnaire;
- the Ts' logbooks and the students' reports of the classroom work.

The analysis is in progress, yet some preliminary results can be drawn:

- Teachers of our sample ranged 35 - 55 years old; their experience with IT had been on optional individual basis and their classroom use of IT had been short and fragmentary. The majority was not accustomed to work with the physics colleagues in studying teaching approaches and classworks.

- Only 70% of teachers who had signed up to the Net-Course completed the work. Those who have given up met two kinds of problems: technical problems and lack of time. The second problem is a consequence of the first since they declared to have under-estimated the required technical competencies. Two kinds of technical problems have been met: access to web and problems in managing software and hardware. Teachers actively attending to all the Net-Seminars had home access to web; access from schools usually was not easy for time problems as well as for computer availability. Many teachers revealed that the face-to-face meetings have been not enough to gain the necessary familiarity with software and hardware in order to actively use them and, then, to actively participate to discussion.
- 153 e-mail messages have been exchanged using the listserver, during all the phase of the Net-Seminars, but 30% of people sent no more than one message. More structured and complete messages were sent to the forum; it registered 35 messages. It is interesting to note that the project coordinator received to its private e-mail address 48 messages: some from teachers that usually did not participated to the group discussion and others from teachers asking a private evaluation of the results of their modeling activities and/or experimental data. Most of the teachers who have been absent from the on-line discussion were graduated in mathematics: they declared to their local coordinator to be not enough competent in the physics content to participate to discussions. This involves the need to reflect about the composition of the groups of discussion: homogeneous or heterogeneous groups? Both the choices present advantages and disadvantages.
- The analysis of e-mails shows that the computer mediated communication, that is communication in writing and in deferred time, presents many advantages in-service teacher training. It involves a much greater degree of synthesis and clarification than in face-to-face oral communication. Moreover, on-line education benefits professional teacher preparation: the possibility of sharing personal experience related to the subjects and to the class management plays a key role in the collective growth of the group.

Some basic principles of metacognitive instruction have shown their validity for teacher education, and among these:

- to emphasize learning activities and processes, rather than learning outcomes;
- to spend sufficient time in reflecting on learning strategies and self-regulation skills.

The application of some aspect of Schön's reflective practitioner in teacher's education helped Ts to think about teaching, planning and classroom management in ways that they had not before. They, through reflection, gained a framework in order to build metalearning awareness in terms of both the content and process of learning. In our opinion, this framework helped them to generate significant changes in their teaching/learning approach.

A preliminary analysis of the anonymous questionnaire shows that the most of teachers judge the experience very positive and give many suggestions for improvement. However, it must be taken into account that for a more effective using of ICT for teacher training a deep teacher knowledge of the involved technology is a prerequisite.

By a large majority, teachers asked to repeat the Net-Course (also amplifying the physics content). In our opinion, the fruitful sense of belonging to a community has been the main factor to stimulate the active participation of teachers.

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The Web in High School Science Teaching: What Does a Teacher Need to Know

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Abstract: The Internet is becoming omnipresent as a resource for K-12 education. Teachers are a diverse set of users who must incorporate this resource into ongoing practice. Research on using the Internet in classrooms is lagging far behind deployment, and teachers are left to their own devices to figure out what works. Using case studies of three teachers, this study considers the work of teaching with the Internet as a site for understanding what teachers need to know to incorporate the Internet into high school science teaching. Results point to knowledge in three areas - technology, pedagogy, and content. Technological knowledge need not be extensive, but technological support is necessary. Pedagogical knowledge is more problematic, as teachers work out how to fit the Internet into their own practice. An important aspect of content knowledge emerged, knowing the boundaries of one's knowledge.

Introduction

Connecting to Internet is a widespread educational innovation in K-12 schools, and some argue, a resource for major reform. But what teachers and students do with this new resource has been little studied. Work from major research and development projects indicate that, with adequate support, the World Wide Web can be used in productive and exciting projects in high school classrooms, projects which engage students in scientific inquiry in line with recent calls for reform (Edelson, Pea, and Gomez, 1996, Songer, 1996, National Research Council, 1996). But few studies have been conducted of teachers as users of the Internet in "ordinary" situations, i.e., when they do not have the extensive help of researchers and developers. We know little about what teachers need to know to make effective use of the Internet in part because we know little about what effective uses look like in practice. Yet it is commonplace to read that the Internet could be an agent of reform in schools if only teachers were "trained" to use it. While survey research indicates that the Web is being used extensively, it provides little insight into how users – both teachers and students – are making sense of the technology in classrooms (Becker and Anderson, 1999). It is this process of sensemaking, of teachers and students constructing a reasonable use of the technology in practice, that provides a window into issues of teacher preparation for the future.

The major question of this study is: What do high school science teachers need to know to construct and manage the work of teaching with the Internet as an on-line resource? Thinking of technologies as resources for the work of teaching changes the point of view significantly, from considering how students might best learn from features of the technology to studying affordances for interactions between the teacher and students in their use of technologies, and how teachers can help students learn with and from technology. The mediating space between students and technologies becomes the site of opportunities for teaching and learning, as well as becoming a site for understanding the possibilities for future technologies, and for designing learning opportunities for professional development. The larger study, of which this work is a part, explores uses of the Web in practice from the point of view of the teacher, identifying challenges and dilemmas high school science teachers face as they use the Web in their teaching and considering how they resolve or manage those problems. It draws on two major research programs for its rationale and methods: research on teaching as problem solving and dilemma management (Ball, 1993, Ball and Lampert, 1999, Lampert, 1985, Lampert, 1995) and research on social construction of technologies (Nardi & O'Day, 1999, Suchman, 1995).

Methods

Ethnographic methods are the basis for the work of this study. Data includes structured interviews with seven high school science teachers and subsequent case studies of two of the interviewed teachers. Teachers were selected for interviews based on solicitation at a statewide conference for computer-using teachers, and by word of mouth. Since the purpose is to explore, gain understanding, and generate theory about use of the Internet in the practice of teaching, cases were selected as probable sites for "telling tales" (Mitchell, 1983, Rex, 1997) not as either typical or exemplary teachers. These cases are telling because they are likely sites for making the work of teaching with the Internet visible, likely because of the teachers' levels of experience (not novice teachers, but not entirely settled in their uses of the Internet), their attitudes toward and knowledge of the technology (eager and willing to use the Internet, but not overly technical), and their willingness to share their ideas and experiences. The case studies include classroom observations during units in which the Internet was in use by students, and interviews before and after classroom observations. Each teacher was observed during one class period for approximately a week, depending on the design of activities using the Internet. For two of the teachers, data collected during the observation period included video recordings of the teachers along with video captured from computer monitors of students with audio of the students' conversations as they worked on the Internet. The third teacher declined to be recorded, so records of her classes consist of observation notes. Data were analyzed by coding transcripts and video using qualitative analysis software, (Quality Solutions and Research, 1997). Coding schemes have been developed iteratively in multiple passes through the data, with constructs and categories emerging from repeated analysis. Nardi's description of information ecologies (Nardi & O'Day, 1999), Lampert's work on domains of teaching (Lampert, in preparation), and Cohen's categorization of teaching terrains (D. K. Cohen, personal communication) provided starting points for initial coding.

The Cases

The three teachers included in this study – Daniel Owens, Lucy Varner, and Mary Robbins – worked in three very different schools with distinct populations of students.[1] The teachers had different reasons for using the Internet, different expectations for their students, and different approaches to the work of teaching with Internet resources. The teachers needed, and used, knowledge in three areas: technology, science, and pedagogy. One intriguing view of teacher knowledge in these classrooms comes from considering teachers' awareness of their own knowledge. What do they report that they know and do not know, and how does this contrast with observations in the classrooms?

Daniel Owens

Owens is a young teacher, in his third year of teaching science in an urban school district. He comes to teaching from a major in biology. Owens' school was wired for the Internet just before he started teaching there, and the science classrooms were each provided with 17 Internet-connected computers. Owens expresses a desire to make use of the Internet in his teaching, but he has not quite figured out how to use it effectively. He struggles with reconciling what he learned about science teaching – that he should let students explore and discover science for themselves – with the reality of the expectations for his teaching – that he will cover a specified curriculum during the year. He expresses a desire to do less talking, to get students more involved and motivated to learn science, and he thinks that doing projects on the Internet can be helpful in reaching this goal. He wants all of his students to get to use the Internet because, for some of them, school is the only place they will get that opportunity. Most of Owens' students do not go on to college, so he feels acute responsibility for helping them learn as much science as possible in what may be their last science class.

During the two-week observation period for this study, the students in Owens's chemistry class (mostly eleventh graders) worked on a project using the Internet to find information about radiation. Owens decided to assign the textbook chapter on nuclear chemistry because he thought it was important

[1] Pseudonyms are used throughout.

and interesting, even though the other chemistry teacher at the school "would never teach that chapter." After they read the chapter, students spent three class periods browsing the Web to find evidence supporting or opposing some use of nuclear energy in preparation for a debate they would have at the end of the unit. This was new content for Owens as well as for his students, so they were, in a sense, learning together. Owens purpose was to motivate the students to want to know more about radiation so they would more enthusiastically learn nuclear chemistry. Owens reported that he felt he did not know enough about using the Web. He wanted to know more about searching, about constructing queries that got better results. He felt certain there were some tricks of the trade that would make his searching more effective. He also reported that he was dependent on the technology support person, located in the building, but shared by several schools, to straighten out technological problems. Although he said he rarely had problems, during the two weeks of observation, many computers were out of use, and printing was not possible except from the computer on his desk.

In Owens' class, students were ranging free on the Internet, looking for information that interested them about radiation. This led to Web sites with little science and lots of opinions, interesting but controversial and not well substantiated claims about scientific phenomenon. Students offered Web sites as evidence that cellular phones cause brain cancer, that radiation therapy should be banned because it is more dangerous than the cancer it is used to kill, that nuclear power plants routinely emit huge quantities of dangerous radiation, and more. Owens worried that the students "were not learning the science" by using the Web, even though he seemed to be accomplishing his primary goal of getting them interested in "the science." Nevertheless, the strengthening of scientific misconceptions via the Web was troubling: Owens knew he was not familiar with much of this content, but was less aware that he too was vulnerable to accepting non-scientific arguments from the Web. In this case, the issue seemed to be Owens' need for a better awareness of *what he did not know*. He ventured into territory where his scientific knowledge was not strong enough to make judgements about validity. Because of his goals for the activity, rather than taking students into the science they would need to make sense of what they found, he participated with the students in using information from the Web rather than scientific evidence or arguments as support for their beliefs.

Owens used the Web for motivation and worked from the assumption that he did not need to know the content to use the Web this way. This is a familiar argument from reform literature: the teacher should become a guide or facilitator and does not need to know about everything students encounter. However, it was worrisome to see students buying into possibly illegitimate or prejudicial content without intervention by the teacher. Owens was experimenting with pedagogy, figuring out what would work to get the students interested in the topic and still get to the substance of the scientific knowledge he hoped they would learn. On the one hand, his strategy worked: students got quite interested in issues related to radiation. On the other hand, he worried that they had not connected that interest to the science of nuclear chemistry, and he was not sure how to go about making a stronger connection. Owens felt he knew the science well and knew enough technology to get by. He was less certain about the pedagogy of teaching with the Web, and knew he was learning as he taught.

Lucy Varner

Varner has nine years teaching experience. She, too, was a science major in college, and she is teaching in her area of expertise, physical science. Varner's school is a large suburban high school with a very successful Advanced Placement science program. Varner teaches the first class in the AP sequence, Advanced Physical Science. Her students, who are mostly tenth graders, are expected to go on to AP Chemistry in the eleventh grade. She takes her mission to get them prepared for chemistry quite seriously. She uses the Internet to get access to content not available in the books she uses, to keep the students motivated, and to work with up-to-date information. She also thinks that these students should learn to use the Internet as part of their education, and that science class is one place where that should happen. Varner sometimes goes to one of the school's connected computer labs to use the Internet, but once a year, she has a set of laptop computers on-line in her classroom. During the observations for this study, the laptops were in her classroom for a week during which the students worked on weather, on and off line, to learn to interpret weather maps and forecast weather.

In contrast to Owens, Varner became an expert on the Web sites she asked her students to use. She took an extensive course from the American Meteorological Society (AMS) about weather and using their Web site in teaching, then she modified their curriculum to fit her class. Each day they were online, Varner went to the site before her classes started (she taught five sections of the course) and prepared questions specifically dealing with the day's weather. During class, she was able to answer questions from across the room about what students saw on the AMS Web site, so familiar was she with what was on the site. The assignments she gave her students were quite constrained – they used only a couple of pages within the AMS site; but they took advantage of the up-to-date weather data available on the Web in ways that would have been nearly impossible without Internet access. Varner also depended heavily on the technology person in her building. The complex set-up of 15 laptop computers in her classroom would not have been possible without his assistance. Varner had used the laptops many times and she was able to handle the few technological problems that came up during class. The technology person came by her class a couple of times each day to make sure things were working smoothly. He helped her put the computers away at the end of the day (they had to be stored in a locked cabinet) and set them back up in the morning. Printing was not available in her classroom, and it was not part of the activities she planned for her students.

Varner taught with the Web as she taught with other resources: she acted as an expert and planned activities to help students gain the knowledge she thought they needed. Her class was carefully planned, and its execution depended on her expertise. She engaged with students on the scientific substance of their work. Varner became an expert in the content her students used on the Web, and had them use it as the basis of their learning. The focus was on science content and Varner's expertise was an important feature of the students' opportunities to learn. Varner's teaching and her content knowledge were seamless across Web and non-Web activities: she directed student activities with a firm hand, gave them demanding and fast-paced assignments, and expected them to learn the required content. In the context of her class – highly motivated, college-bound students – her strategies worked well and her level of expertise was necessary to make the strategies effective. She knew the science she wanted to teach, she knew how she wanted to go about teaching it, and she knew enough about the technology to make it work. In this case, the teacher created an application that took advantage of an important offering of the Web – the up-to-date data – and fit it into her curriculum and pedagogy.

Mary Robbins

Robbins is a veteran teacher with 16 years experience. She teaches in a suburban district, in a school for students who have had trouble in the district's other high schools. Classes are small – no more than 15 students – and the school itself has only 150 students. Her classroom has 12 on-line computers that are used extensively by students for a variety of purposes, including word processing, running applications programs, and using the Internet. The computers are totally integrated into classroom life, with students going on and off computers just as they use reading materials. Robbins teaches science as a means for teaching students to take responsibility for their lives and education. Her priority is on getting students to complete their work, behave well in school, and be able to work independently, with the goal of getting them back into a regular high school before graduation. If they learn science too, so much the better. In the year of this study, Robbins was teaching biology. The class worked on a set of independent assignments – their first of the year – with a short research paper due each week on a specified contagious disease along with a set of questions about the week's biology topics. They were free to use any resources they chose to do the work – textbooks, CD-ROMs, the Internet, and the library were all available to them. Robbins kept a tight rein on the students' work, with many checkpoints and lots of feedback about their progress. She gave them quite explicit suggestions for using the Web, telling them keywords to use in specific search engines to get results she knew would be there. Students moved on and off the Web quickly, mostly using it to find specific bits of information that Robbins knew would be there. The assignments were carried out almost as they would be done using a textbook, looking for specific answers by matching keywords. For these students, doing this work in a relatively independent way, was an accomplishment.

Robbins knew the science content she was teaching well, and yet that knowledge did not seem to be an important factor in these activities because the focus was so much on responsibility and behavior.

Her pedagogical knowledge was also extensive – she had taught this unit before and knew how to manage the class and what to expect students to do. Robbins was something of a "techie," an expert in using and maintaining computers, but she called on the local technical support person when computers went down in lieu of fixing them herself, reporting that her time was better spent working with students. At the end of the unit, Robbins reported that things had not gone quite as she expected and hoped. Many of the students had not been able to work well in this independent mode, and Robbins felt she had not provided enough structure for the activities.

Discussion

Some clear patterns are apparent in these cases, illustrated in Table 1. First, although their expertise varied, all three of these teachers felt comfortable using the Web themselves. They were confident that help was nearby if something went wrong, and they each went into these activities with contingency plans for what they would do if the on-line activity proved to be impossible. It is important to note, however, that two of the three teachers were not technology experts in any sense. They had not received special training in technology, nor did they surf the Web or use technology for their own pleasure. The third, Mary, was much more of a computer expert, mostly self-trained as a programmer and hardware tinkerer. Those skills did not come into play in the teaching observed here. All three teachers were well aware of the boundaries of their knowledge of technology, but they each had adequate support to make effective use of the Internet in their classrooms. Without this support – in all three cases, on-site and readily available – these teachers probably could not have taught as they did. They all had a strong belief that using the Web was valuable for their students, agreeing that one of the values is that students "need to

Area of knowledge	Challenge
Knowledge of technology	Knowing enough to be able to plan effective lessons and units. Knowing enough to get help when it is needed (and having help available).
Knowledge of science	Knowing the boundaries of one's knowledge. Having a grasp of the discipline itself.
Knowledge of pedagogy	Understanding the fit between technological contexts and activities. Predicting how students will engage in activities – knowing what to expect.

Table 1: Teacher knowledge for Web teaching

Second, while extensive content knowledge is almost inarguably a necessity for science teaching, teaching with the Web brings out another important dimension of content knowledge: knowing the boundaries of one's knowledge. The problem may not be that a teacher does not know something, but rather that he is not aware of his own misconceptions or misunderstandings. The idea of teacher as facilitator or guide for students as they engage in inquiry must presume a level of *disciplinary* knowledge which enables the teacher to navigate content he does not know, using disciplinary structures to model a sense-making process. Two of the three teachers studied here dealt with this problem by constraining what students did on the Web to limit them to content with which the teacher was familiar. The third let students explore the Web more openly and unknowingly found himself in new territory. Without a better understanding of the limits of his knowledge, and perhaps without specifically adopting a goal of modeling inquiry for students, he stumbled into student misconceptions that were never rectified.

Third, knowledge of the pedagogical possibilities for teaching with the Web include knowing the kinds of activities that are fruitful and those that, although they sound good, lead to frustration; knowing how to bound student work on the Web so that their actions and products are manageable; knowing what kinds of technological contexts can work for particular activities (e.g., the number of students per computer, number of days on-line needed to accomplish the work, locations of computers, etc.). These teachers varied in their approaches to using their pedagogical knowledge and to learning new things: Owens experimented with pedagogy, Varner designed the work to fit with known ways of teaching, and Robbins built on prior experience.

As predicted by previous studies of technological innovations in schools, these teachers took two approaches: they adapted the technology to their teaching, working to make it fit into established routines and expectations; or they used it for reasons somewhat peripheral to content knowledge – in these cases, for

motivation and for learning the technology *per se*. The simple technology of the Web makes this adaptation possible, but also means that the Internet-in-use can have many faces, and that "training" teachers to integrate the Internet into their teaching is likely to be a complex and challenging undertaking.

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A Science Equipment Clearinghouse: Linking Industry to Science Education Reform Efforts

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Abstract

The purpose of this paper is to demonstrate how a science equipment clearinghouse may play an important role in science education reform efforts at the 8-12 grade level. Project-STIR's unique program begins with an equipment transfer process which serves many schools in a wide geographical location, bringing them into increasing contact with industry leaders and scientists who view science education reform as a major goal. Begun in 1992 by arranging donations of science equipment from Industry into high schools, the project, now in its seventh year, has led to professional development activities for approximately 800 teachers through year round workshops and intensive summer training institutes.

Introduction

Our mission is to promote reform and creativity in classroom science teaching that results in a better education for all students. Specifically, the Project seeks to intensify student involvement in science by increasing the ability of teachers to employ "hands-on" experimentation and inquiry learning in the classroom. Teachers will become familiar with the ever changing laboratory environment and will be instructed in educational technologies that lead to increasing student skills and understanding of scientific methodology. Improving teacher background and skills in this regard, is vital to stimulating student interest in science, and improving overall student performance. (slide 2)

Although reform in science education receives encouragement from both the public and private sector, urban and inner city schools have become more crowded, poorer, and unable to afford even fundamental laboratory supplies for their science courses. Boards of education and school administrators may recognize the need for such equipment, but budget constraints increasingly prevent their purchase as high-tech apparatus becomes more expensive. As hands-on inquiry-based laboratory science experiences become an increasing part of the standard curriculum, the need for equipment becomes ever more urgent.

Why a Science Equipment Clearinghouse?

Perhaps more than in any other discipline, adequate, up-to-date, well functioning equipment is essential to teach science in today's technological society. As noted, school budgetary constraints can barely outfit their science laboratories with basic equipment, let alone fill the demand for more highly technical instruments and computers.

In many locales, at least a partial solution rests nearby. Chemical, pharmaceutical and even university research labs often update their older equipment, condense lab space or move to new locations, thus freeing up equipment no longer used.

While those organizations may willingly donate unused items to schools, the time and work needed to arrange the donations become obstacles to its happening. The result: older equipment that would be welcomed and used in many school science labs remains on storage shelves for years, eventually becoming no longer useful or functional.

A science equipment clearinghouse can provide the link that brings together potential donors and schools that need their unused items. In addition, the transfer of equipment from the "science rich" community of industry and research institutions to "science poor" schools is a unique way of improving school science programs and bringing about reforms in the training of teachers that result in a better education for students. Stimulated by the transfer process, this linkage of schools and teachers with industry leaders of vision is seen as

a major goal of the project. The train of events and activities resulting from the initial transfer of equipment is an integral part of the project design. (Slide 3)

The advantages to donors include finding recipients, supplying documentation, possibility of a tax credit and opportunity for improving public image. Advantages for schools are the procurement of equipment and facilitation of its transfer from the donor to the school site. (Slides 4,5,6).

Who Should Start a Science Equipment Clearinghouse?

To insure that the science equipment clearinghouse be regarded as a public service, it is important that there be an affiliation with a publicly supported group such as a school district, a university or chamber of commerce.

Project-STIR's experience supports the belief that a university is an ideal choice to start a science equipment clearinghouse, particularly a university that possesses a strong education or science education department. Being non-profit and educationally motivated, the university can lend a public service note to the project while also serving as a disinterested liaison between nearby industry and schools.

Consortia of teachers and educators, collaborating with nearby industries, would also be a highly desirable alternative to a university. Such a group was started recently as a spin off of Project-STIR, and is known as WISTA, Westchester Industry and Science Teacher Alliance.

Where Should a Science Equipment Clearinghouse Be Located?

Ideally, a clearinghouse will be located near both donors and schools. Central to its success is its accessibility to a large number of public and private science, industry and research institutions. Although it is important that it be within reach of many schools and colleges, it should not be in the vicinity of another clearinghouse.

Rather than being limited to a single district, a science equipment clearinghouse should cover a wide geographic radius, service several districts at once, and collaborate with university and other K-12 outreach programs in the vicinity.

How Many Participants Should be Involved?

Project-STIR currently has 450 schools on its recipient and mailing lists, compared to about 250 potential donors. (The actual number of donors to date is 56 and the number of school recipients is 165.)

More important than having a large number of potential donors, therefore, is to have a large number of potential recipients that are available and willing not only to accept appropriate donated equipment, but also to pick up the items quickly and efficiently.

How Do We Identify Potential Donors?

Companies that have been increasingly solicited for equipment are in the chemical, pharmaceutical, and bio-technology industries. Others, such as food and cosmetics, public utilities, environmental protection agencies, universities and medical schools are also a very important source of equipment, laboratory supplies and computers. (slide 7)

About the Project-STIR Science Equipment Clearinghouse

Our equipment clearinghouse has led to increasing relationships with industry, schools, teachers and district administrators. Since its establishment in 1992, 165 schools have been provided with approximately 100,000 items of laboratory supplies, technical apparatus, and computers from 56 companies and private

organizations. More than 70% of this equipment has found its way to the students in New York City's inner city schools. (Slide 8)

Transfer of Equipment (Slide 9)

Summary of Equipment Transfers : 1992 - 1999

Type of Equipment	Market Value*	Number of Items
1. Research	>$1,000	615
2. Basic Laboratory	$500-$1,000	1,365
3. Laboratory Supplies	<$500	100, 883
		102, 863 Total Items

Total Number of School Recipients	165
Total Number of Donors	56

Table 1. Summary of Equipment Transfers, 1992-1999

Explanation:
* Market values are based on present market value as determined by manufacturer or donor
1. Examples of research equipment: spectrophotometers, ultra-centrifuges, chromatography systems, HPLC, microscopes
2. Examples of Basic Laboratory equipment: small centrifuges, analytical balances, small ovens, incubators, student microscopes, pH meters
3. Laboratory Supplies: glassware, small scales, filter paper , laboratory hardware, Bunsen burners, burettes

Items of transferred equipment range from basic laboratory glassware to hi-tech analytical instruments, from capital equipment such as ovens and centrifuges to computers and computer components. A computerized database system has enabled the Project-STIR director to match the science program and needs of the school with appropriate available items. The amount of equipment donated, the number of recipient schools and the availability of potential donors have increased significantly since 1992.

To provide a measure of the equipment market value or money saved to the schools, we have chosen to divide the equipment into three categories.

Category One, represents research grade equipment and would be any item whose market value would be over $1000.
Category Two , includes basic Lab Equipment : any item whose market value would be from $500-1000.
Category Three, consists of consumable laboratory supplies such as glassware, burettes, plastic ware, hardware

Functional Condition and Educational Value of Donated Equipment

In 1997 a survey of the condition, use, and educational value of the equipment that was donated to a sample of recipients was undertaken. We surveyed schools that had received equipment over a prior two year period. Sixty- two out of 117 schools responded to the survey (52% response rate). The number of items in the survey was about 1,816, with cartons of glassware counted as one item.

Results:
1 82% of the equipment transferred was in excellent or good condition
2. 7% was in poor condition but may have been used
3. 11% was not used, probably because of poor condition. However, some excellent hi-tech equipment may not have been used at the time we did the survey. (Slide 10)

The effect of equipment on student attitude toward science is summarized on Slides 11- 13. On a scale of 1-5, over 85% of the teachers rated the equipment as being important in enhancing student technical skills, in understanding current technology, and in using quantitative techniques. In determining its effect on changes in teacher attitudes, the degree of importance of the donated equipment was rated very high with respect to increasing hands-on activities, encouraging student projects, and increasing the numbers of students participating in laboratory experiences.

Need for Teacher Professional Development

Although efforts are made at both the local and national levels to upgrade science education, many classroom teachers, especially those in disadvantaged, minority school districts lack the equipment and the training necessary to implement recent proposed reforms that mandate a hands-on and inquiry-based science curriculum. In New York City there is an urgent need to train not only the large numbers of new teachers coming into the system, but also to acquaint and re-educate older and experienced teachers with modern science technology and its application and use in science teaching.

The need becomes especially pressing as teacher retirement incentives diminish the number of adequately prepared teachers. For this reason, a significant portion of Project-STIR's activities is devoted today to the training of in-service high school science teachers. (Slide 14)

STIR sponsors three professional enhancement programs. A summer technology institute, year-round academic workshops, and summer internships in industry. The last is a training program in which teachers spend seven to eight weeks in nearby chemical and pharmaceutical industrial laboratories. Teachers are paid a stipend which is contributed by the company, and the Project handles all the paper work, documentation and follow-up activities. Companies who have hosted interns for Project-STIR are: Infineum (formerly Exxon Chemical Corporation), Bell Laboratories and Akzo Nobel.

Academic Year Workshops

Project-STIR arranges numerous workshops for teachers given by highly experienced colleagues, industry representatives and members of university faculties. In these workshops and demonstrations, teachers become acquainted with current, hi-tech laboratory instrumentation, chemical analysis, DNA technology, environmental science and integration of computer techniques into all aspects of experiential science inquiry. Since 1993 almost one thousand teachers from districts across the city have attended our year round workshops. Project-STIR, for example, arranges numerous workshops for teachers given by highly experienced colleagues, industry representatives and members of university faculties. In these workshops and demonstrations, teachers become acquainted with current, hi-tech laboratory instrumentation, chemical analysis, DNA technology, environmental science and computer techniques. They learn of new scientific developments and teaching techniques applicable to the classroom. (slide 15)

In meeting with industry representatives and members of university faculties, teachers learn how scientific principles are applied in the world beyond the classroom.

The Laboratory Technology and Classroom Activities Institute

The LTCA is an intensive professional development program that helps to infuse new technology, understanding of scientific methodology, and inquiry-based learning into the classroom. This unique program draws upon, to a large extent, the efforts and expertise of industry, and industry leaders who are very responsive to the need for better science education in our high schools. The Institute trained 103 teachers recruited from 60 high schools in New York City during the 1997-1999 programs.

The Institute begins in early July where the teachers attend one (or two) weeks of workshops and hands-on instruction at the Chemistry Department at Lehman College in the Bronx. It is followed by additional fall workshops at various sites throughout the city, and continues into the spring semester. The teachers, selected by application and principal and supervisor recommendation, receive a stipend, or graduate credit upon completion of the course. (Slide 16)

Workshops Design

The goal of the Institute emphasizes preparing teachers in new instructional techniques, and helping them to follow a model focusing on student inquiry and teaching within a standards- based curriculum. A great deal of emphasis is placed on using computer based science laboratory experiments that require a hands-on application. Other techniques include the use of computerized hand-held graphing calculators, such as the Texas Instruments TI-83, which facilitate the recording and analysis of data obtained during laboratory experimentation. More recently we are devoting considerable time to fostering student research using

interactive web sites, with particular interest in Environmental Science, and finally we shall study the use of distance learning to facilitate teacher participation in all workshops and conferences. (slide 17)

Industry Collaboration

A key component of the Institute is the collaboration with Industry in terms of expertise and workshops. Scientists at Wyeth-Ayerst Laboratories, Bell Laboratories, and Infineum (formerly Exxon) are strongly supportive of the project. Companies, including Brinkmann Instruments, Mobil Chemical Company, the Merck Institute, Novartis and Hewlett Packard, provide equipment that helps teachers carry on more highly sophisticated hands-on activities in the classroom. Many other companies provide workshops for the Institute, and still others have hosted site-visits by Institute teachers. During these visits, teachers spend one day at a local industrial or research facility, where they observe the laboratories and become acquainted with science and industrial personnel. Teachers report this as being one of the high points of the entire training program. Thus, Industry collaboration brings the real world of science and its practical applications to the teachers and leads to more interesting and dynamic science instruction in the classroom. (Slides18-20)

Assessment of the Laboratory Technology and Classroom Activities Institute: 1997-1999

Teachers provided responses to pre and post questionnaires containing three main sections: motivation to acquire training in technology and hands-on science; experience or skill levels of the participants, and perceived ability to apply new techniques and laboratory processes into the classroom. Results of the responses of 90 teachers (87% response rate) to the 1997-1999 surveys agree markedly and are summarized below and in Figure 1 on page 6.

1.Motivation: Teacher attitudes towards hands-on science and its correlated objectives were very positive upon entering the Institute as reflected in an overall mean of 4.4 on a 5.0 point scale.[1] These ratings became slightly lower (4.2) on the post-questionnaire at the end of the Institute. All participants who entered the program were highly motivated to acquire more technical skill and to help their students understand and appreciate science as a current and relevant topic.

2. Experience: A dramatic increase in skill level and experience was reflected in the overall initial mean rating of 2.2, which then jumped dramatically to a mean of 4.3 on the post-questionnaire. Thus, by the end of the Institute, skill levels of teachers were aligned with their levels of aspiration with regard to conducting the hands-on science activities that were a focus of the Institute.

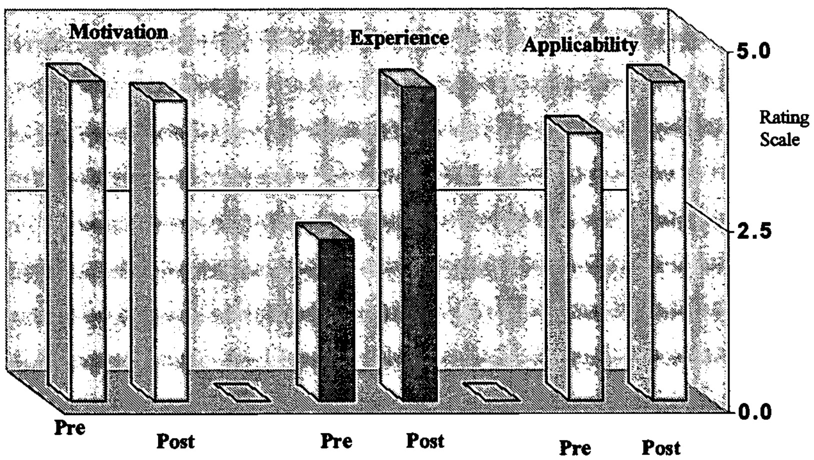
3. Applicability: Positive attitudes were also reflected in teachers' assessments of the applicability of various laboratory processes to classroom activities, as indicated by an initial overall mean rating of 3.7 These ratings became more positive at the end of the Institute as indicated by an overall mean rating of 4.4. Despite positive attitudes and guarded optimism in terms of applicability, teachers recognized that a lack of equipment and limited experience with instruments and systems might prevent their ability to translate aspirations into actions.

This lack of equipment is the most important reason for lack of integration of new activities into the classroom. For this reason, Project-STIR now directs many appropriate donated items to Institute teachers.

The results of the surveys to date demonstrate the success of the Institute in helping teachers to promote hands-on science education and to up-date their use of technology in classroom teaching (Slide 21)

[1] Five point rating scale: 1: lowest ranked response, equivalent to no importance, experience, or applicability; 3: moderate rank for these attributes; 5: highest ranked response

Technology Institute Survey: 1997-99



Average of Teacher Paired Responses to Pre and Post Questionnaires.(n = 66-90 paired responses)

Figure 1. Survey of the Laboratory Technology and Classroom Activities Institute: 1997-1999

Summary

A Science Equipment Clearinghouse is viewed as a design for achieving reform in the teaching of science and technology in high schools. Linking industry and the scientific community with local schools and school districts for the enhancement of science education is seen as a model for this approach. A collaborative effort between science related industry, university leaders and school administrators can help bring about needed change in science education for both teachers and students. (Slide 22)

Acknowledgements

I wish to acknowledge the following foundations for their generous financial assistance in establishing and extending the Project-STIR program: the Charles Hayden Foundation, the Pfizer Foundation, the Greenwall Foundation, the Gilder Foundation, the New York City Board of Education and the Urban Systemic Initiative of the City of New York. I also wish to acknowledge the support and encouragement of Dr. Bert Flugman, Director of the Center for Advanced Study in Education, Graduate Center, City University of New York. I wish to thank Dr. Iraj Ganjian, Professor of Chemistry, Lehman College of the City University of New York, for his assistance in establishing the Laboratory Technology and Classroom Activities Institute. My sincere thanks to all corporate contributors to Project-STIR, to committee members, friends and volunteers who have helped to make this project a success.

The GLOBE Program

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Abstract: K-12 students, teachers, and scientists are meeting on the Internet to collaborate in a worldwide project designed to expand our understanding on the Earth's environment. Having received strong endorsements from educators worldwide, the international Global Learning and Observation to Benefit the Environment (GLOBE) Program is now being implemented in over 7,000 schools in over 80 countries, on all seven continents. Unlike traditional school science programs, in which students perform isolated experiments with no consequences for increasing scientific knowledge of the world, GLOBE students participate in actual science investigations led by scientists. The GLOBE Program is sponsored by NASA, NOAA, and the EPA, and administered through National Science Foundation. The Program was announced on Earth Day 1994, and implemented the following year

Overview

GLOBE students take environmental measurements in the areas of Atmosphere/Climate, Hydrology/Water Chemistry, Soils and Land Cover/Biology at or near their campus. These measurements are then reported via the Internet to the GLOBE Web site (http://www.globe.gov) for use by students and scientists around the world in research projects.

Though GLOBE is not a free standing curriculum it strongly reflects the National Science Education Standards. It is a framework for use by teachers to enhance and enrich their curriculum. Other than requiring careful adherence to the data collection protocols, GLOBE gives schools complete latitude in determining the grade levels and classes in which to implement the program, the educational activities to provide and the way in which the program will fit into the local curriculum. For example, many schools are using GLOBE activities in math, geography, and foreign language classes, in addition to science classes.

GLOBE is an ambitious attempt to put the concepts of authentic learning, student – scientist partnerships, and inquiry-based education into practice on an unprecedented scale. The results are already being seen in an enhanced environmental awareness of individuals around the world through an increased understanding of Earth as a system.

GLOBE students work under the guidance of GLOBE teachers who are certified after participating in teacher enhancement workshops. These professional development workshops enable teachers to guide students in taking measurements according to scientific protocols; in using the Internet to report and analyze scientific data; and in creating partnerships among students at GLOBE schools around the world. In addition to using the Internet for communication and research, GLOBE students use computers to create graphs, charts, maps, 2-D and 3-D visualizations of their data for analysis.

GLOBE students use hand-held Geographic Positioning System (GPS) units to establish the coordinates for their study sites and to lay out a 30 meter square for biometric studies. This 30 meter square corresponds to the size of one pixel (picture element) that is imaged by NASA's Landsat Thematic Mapper (TM) earth observing satellite. NASA provides each school with a Landsat TM image centered on their campus. GLOBE students use the MultiSpec image processing software, developed at Purdue University, to manipulate the image, conduct unsupervised classification of the features, and analyze the land use and

land cover (LULC). In some areas GLOBE training partners are providing schools with historical sequences of satellite images of their school sites for the study of LULC changes over time.

GLOBE students are also being introduced to GIS technology through partnerships with the ESRI and Intergraph Corporations. ESRI (http://www.esri.com), based in Redlands, California, has provided every GLOBE teacher in the United States with a copy of the GIS for Schools and Library CD-ROM. The CD-ROM contains the ArcVoyager software, a four tiered GIS tutorial, and an enormous amount of data to incorporate into learning strategies. Intergraph, of Huntsville, Alabama, (http://www.intergraph.com) has made its GeoMedia software and a CD-ROM called The Power to Learn: GeoData for Schools available to every GLOBE site.

The GLOBE Program is very attractive to educators interested in introducing the technology of Geographic Information Systems (GIS) into the classroom. Through GIS, with its new advances in software technology, geographers, scientists and students are able to import satellite imagery, aerial photography, digital images, topographical maps, vector data, relational databases, and other information to create detailed data maps and models that extract new data more easily than ever before. GIS models and maps can include a wide variety of information, such as GLOBE student data, and be tailored for use in an almost infinite number of scenarios, such as land use planning, transportation, health services, emergency response scenarios, wildlife and resource management, environmental modeling and business development.

High-Performance Computing Technologies, and Pre-Service Teacher Preparation: Is There an Overlap? (Post-Evaluation Thoughts)

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Abstract: In this paper, we share our experience in the development of successful programs focused on promoting high performance computational tools in undergraduate science education, and among high school teachers. The two NSF-supported projects we will describe, are the Education Center on Computational Science and Engineering, established on the campus of SDSU two years ago, and STEP, the Supercomputer Teacher Enhancement Program. Both projects have been evaluated, using a variety of questionnaire surveys and interviews. This gave us the material to assess what worked and what didn't, and share the lessons we learned. Pre-service teachers fall in the gap between the target audiences of these two projects. We believe that some of the tried and proven techniques used in our two projects are applicable to pre-service teacher education, and argue for the need of a project focused on integrating high-performance computing technologies in teacher preparation. A replicable project of this nature would address the widening gap between the rapidly changing computing environment and needs of the marketplace, on the one hand, and the awareness of teachers and their students of such changes, on the other hand.

Background: High Performance Computing Technology in the Curriculum

Developing replicable and scalable examples of successful incorporation of advanced computing technologies in the curricula at various levels has always been one of the main priorities within the national effort of making high performance computing more accessible and more useful to as many people as possible. Since October 1997, NSF has channeled its support of high-performance computing in education through two National Supercomputing Partnerships, led by the San Diego Supercomputer Center (SDSC), University of California, San Diego, and the National Center for Supercomputing Applications (NCSA), University of Illinois at Urbana-Champaign. The two partnerships, namely the National Partnership for Advanced Computational Infrastructure, NPACI (NPACI 1999), and the National Computational Science Alliance (NCSA 1999), unite over a hundred leading research universities and national labs over shared use of high-performance computing resources, advanced compute-intensive research, and a variety of education and outreach efforts. These efforts focus, broadly speaking, on promoting computational science curriculum in K-12, undergraduate and graduate schools, and informal learning communities, on shortening the distance between research labs and classrooms, and developing learning tools that utilize the best modern scientific accomplishments (EOT-PACI 1999). As part of this effort, the NPACI Education Center on Computational Science and Engineering (Ed Center) (EC/CSE 1999) was created on the campus of San Diego State University, with the mission to promote the incorporation of NPACI-developed tools within the California State University system, and design relevant exemplar projects which could be replicated and scaled to the national level. The focused education and outreach efforts in the present NSF program are based, in part, on the experiences and successes of several previous programs, including STEP (Supercomputer Teacher Enhancement Program) (STEP 1997) originated from SDSC and UCSD with direct participation of one of the authors of this paper. Both STEP and Ed Center programs are described in details in subsequent sections. During the 1998/99 academic year the NPACI Ed Center program has been formally evaluated by an external group of experts (Foertsch & Alexander 1999). The STEP program was also evaluated (Stewart & Bowers 1997), its materials are now a part of Smithsonian permanent collection (Smithsonian 1996). While pre-service teachers are only a fraction of the clientele of the Ed Center program, and the STEP program is focused on in-service teachers, the evaluation results and

literature review suggest that the challenges we faced are similar to those experienced in pre-service teacher education. Indeed, finding a meaningful integration of computer technologies in various curricula, convincing faculty that such innovations are effective from the standpoint of student learning, and establishing an environment conducive of change – remain the central challenges, despite the visible progress in technological infrastructure (Campus Computing 1998). At the same time, access to the Internet which quickly becomes ubiquitous, makes many resources of high-performance computing available to both undergraduate and K-12 faculty.

We believe that the strategies we have developed in the STEP and Ed Center programs, may prove useful for the pre-service teacher preparation in high-performance tools, such as advanced simulation, 3D visualization, web-based collaboration, access to large on-line data sources, etc. In the next two sections, we will briefly describe the two programs, and complete the paper by outlining the strategies appropriate in introducing high performance computing technologies to pre-service teachers, and ultimately - to broad populations of students.

The STEP Project, and its Evaluation

The goal of the NSF STEP program was to introduce in-service science teachers from San Diego area to computational science, connecting the high school classroom with the computational world outside, and enhancing the teaching of high school science. In the course of the program, which was funded between 1993 and 1997 (and still continues, through regular meetings), STEP teachers explored various computing platforms, from Macintosh and PC to UNIX mainframes, wrote their first Web pages, engaged in electronic communication, discussions and collaborations. For the advanced computing technologies to work well in the classroom, teachers had to be convinced that their use *significantly* aids students' learning, supporting conceptual understanding of the material and effective engagement. As Noblitt (1997) stressed, and as the STEP program experiences demonstrate, new classroom technologies, to be accepted, must work substantially better than, or provide a different kind of understanding than the traditional form of instruction. This is an additional justification for focusing the curriculum changes on high-performance computing techniques.

As the teachers were getting interested and involved in the advanced computing world, it was clear that this program would need institutional support to be sustainable. Thus, we emphasized the participation of local school administration in the program. Similar approaches proved viable in our subsequent Ed Center project described below. STEP teachers' experience showed that using advanced computing in the secondary classroom requires additional resources, sometimes not readily available at the individual school level. It is important that pre-service teachers willing to present state-of-the-art research tools to their students, are aware of the available support and computational resources. In the survey at the conclusion of the program (Stewart & Bowers 1997), the teachers indicated that involvement in STEP supported their professional and personal growth, and curriculum development, and was a valuable contribution to their schools. STEP teachers presented a series of workshops at their schools and districts. Turning project participants into enthusiastic "ambassadors" of curriculum change with advanced computing tools was perhaps the main accomplishment of the project, and a lesson for projects to come.

The Ed Center Project, and its Evaluation

With over 31,000 student body, SDSU is the largest university within the California State University (CSU) system, which in turn, is the largest and most diverse undergraduate system in the nation. This reflects the diversity of Southern Californian population - the likely future audience for students in SDSU teacher preparation program. In collaboration with the LEAD Center (Foertsch & Alexander 1999), we examined SDSU faculty expectations and practices in teaching with computers, based on a series of questionnaire surveys and interviews. Analysis of faculty use of the Web, use of computers in the classroom by students and instructors, and the use of high performance computing applications in the curricula, helped us develop Ed Center strategies of curriculum change. In (Stewart & Zaslavsky 1998), we described at least ten obstacles to a wider acceptance of computational science in undergraduate education, and came to the conclusion that a comprehensive educational infrastructure - human, technological and administrative - is needed for successful curriculum change. Thus, from Ed Center's inception its focus has been on building a comprehensive

infrastructure to support the incorporation of high-performance computational science tools into undergraduate education. Addressing this problem, we have established an environment encouraging the curriculum enhancement in sciences and engineering with modern simulation and visualization technologies, through the campus-wide Faculty Fellows program, collaboration with NPACI and NCSA researchers, in-house project development, and various outreach efforts.

The rationale for the Faculty Fellows program initiated by the Ed Center is the fact observed by many researchers of educational change: curriculum innovations spread successfully through personal contacts with a respected colleague who has tried the innovation, and hands-on demonstrations (Foertsch et al 1997, Rogers 1995, Noblitt 1997). Therefore, the goal of our Faculty Fellows program is building a synergetic environment supporting such interaction between faculty members from various departments, sharing of ideas and hands-on experimentation. Each semester, the program has provided release time to two-three faculty members who worked on changing their regular undergraduate courses to include computational approaches. This support allowed them to use various compute-intensive approaches ranging from interpretation of satellite imagery and web-based collaborative visualization of large geological datasets, to the exploration of the Network of Workstations (NOW) distributed architecture implemented on a cluster of SUN workstations, to investigating new Web-based 3D visualization strategies for geographic data in an experimental class composed of geographers and computer scientists. Note that these technologies and functionality are almost entirely available on-line, i.e. can be accessed by K-12 teachers and students.

Creating on-line repositories of high performance computational tools, and introducing these tools to CSU faculty through focused presentations and workshops is another Ed Center "mission-critical" activity. However, early in the process we recognized that just presenting the tools is not sufficient. It is important to convincingly demonstrate how these tools can be used, and, possibly, have been used, in the curriculum. Thus, we have been experimenting with various computational techniques in our own teaching. Examples include group-based problem solving environments in our supercomputer classes, real-time distance teaching with Web-based collaborative software (featured as a Microsoft Case Study in Higher Education (Microsoft 1998)), etc. Yet another project, which has significant infrastructure impact, is the development of the Sociology Workbench (SWB 1999), a collection of on-line survey data analysis tools that can be used in various evaluation settings, as well as a teaching tool in classes that deal with sociological analysis. The Ed Center's external evaluation showed that the most successful, though time-consuming channels were through individual collaboration with faculty, and our own in-house curriculum experiments.

An important lesson we learned is that the target audience of curriculum change efforts should be carefully selected. Over ¾ of surveyed faculty have used WWW *often* or *sometimes* in 1997[1], however there is still a big step to being able to effectively use advanced computing techniques in instruction, or even being receptive to technology-induced curricular changes. Many obstacles – including lack of time, tenure and review considerations, lack of awareness about existing tools, etc. may prevent faculty from curriculum innovations even if they believe in their usefulness. A telling graph (Fig. 1) demonstrates how the faculty use of computers in the classroom depended on his/her number of years as a faculty: the difference between those who *never* use computers in the classroom, and those who do this *often*, is the largest for untenured faculty, with the largest gap towards the time of tenure review.

Though advanced computing applications can make a difference in student learning in "any discipline which uses mathematical formulas to examine and understand relationships in complex systems" (Foertsch & Alexander 1999, p.12), only 12% of SDSU faculty respondents[2] saw themselves as having a use for high-performance computing applications in their courses (this number is higher for the colleges of Science: 17.1%, and Engineering: 20.0%). At the same time, 11% of the responding faculty indicated that their students *often* worked with computer models in SDSU courses (16% in the College of Sciences and 22% in the College of Engineering), 23% had students *often* use computers "hands-on" in the classroom (33% and 17% by the two Colleges, respectively), and 18% had students *often* use the Internet in courses (15% and 9% by the two Colleges). As experts in pedagogical reform noted (Hutchinson & Huberman 1993), and our experience confirmed, the best strategy is to focus on most enthusiastic and technically advanced instructors who are

[1] This telephone survey of SDSU faculty was conducted by the Social Science Research Lab at SDSU in the Fall of 1997. The number of faculty who responded to the survey was 402.

[2] The cited survey of SDSU faculty was conducted by the LEAD Center in the course of its evaluation of EC/CSE in the Fall of 1998. Of the 461 faculty surveyed, 175 responded (38% response rate). The sample was representative of the total faculty population in colleges of Arts & Letters, Engineering, and Sciences, in terms of gender, years teaching, and tenure status (Foertsch & Alexander 1999)

already using computing and modeling in their classes, since they are most capable of producing a lasting curricular change (Foertsch & Alexander 1999).

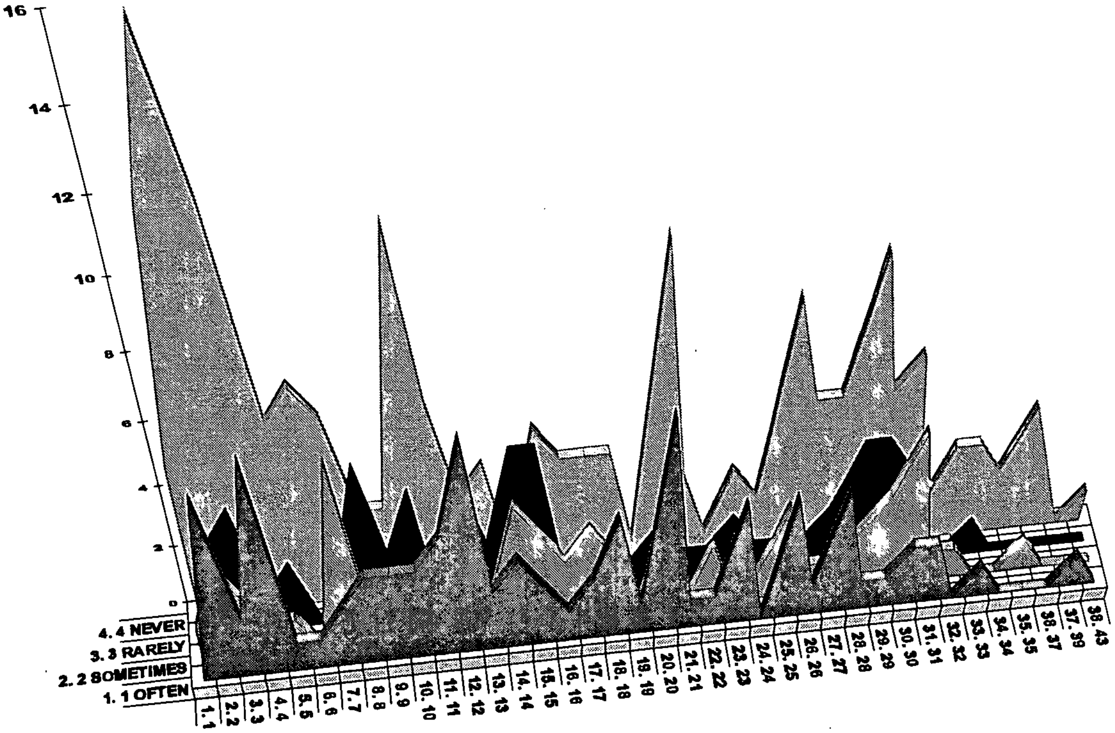

Figure 1. Using computers in the classroom versus number of years as a faculty member. Source: SDSU Faculty Survey, Fall'97.

Channels for influencing pre-service teacher preparation

The pool of undergraduate students at CSU, which is the target audience of the Ed Center, includes large number of future teachers, at various stages of getting their teaching credentials. The following are the major channels for influencing these groups of students, making high performance computing tools accessible and attractive to them:

- The use of advanced computing modules in general education courses. For example, Geol 303 "Natural Hazards" traditionally attracts a number of future teachers. Targeting this student group, the Ed Center sponsored an instructor for this course through the Faculty Fellows program. We hope that this will lead to a wider exposure of future teachers to novel simulation and visualization techniques, specifically new ways of modeling El Nino effects, earthquakes, and pollution.

- Cooperation with College of Education faculty and students, especially those specializing in Education Technology, on various projects which involve experimentation with new technologies and exploration of their use in the curriculum. To promote and support this effort, we organize SDSU Computational Science Olympics (CSO 1999), a competition of student projects focused on various aspects of computational science. Successful student projects are likely to be used again by instructors, eventually becoming a part of curriculum. This "bottom-up" development of computational science modules complements the traditional trajectory of curriculum change.

- Establishing regular meetings with in-service teachers who have been exposed to advanced computing techniques and used them in teaching. STEP teachers are an invaluable source of experiences, willing to share them with future colleagues.

- Providing on-line assessment technologies. Without accessible and relatively simple technologies for classroom assessments and evaluations, it is difficult to demonstrate positive impacts of curriculum changes. *Sociology Workbench* (SWB), a collection of on-line computational tools and resources for social scientists, is one of such technologies developed at the Ed Center. The SWB allows faculty and students to share and analyze social science data (questionnaire surveys, public opinion polls, and similar data) on the Web. In essence, it is a free on-line statistical package implementing a unique data analysis methodology. It emphasizes exploratory social data analysis, integration with other resources available on the Web, convenience of the user interface, and transparency of the analytical approaches. In teacher training, SWB can be used as a convenient instrument for sharing and analyzing student surveys, developing evaluation metrics, comparing results from various surveys, etc. At SDSU, the software has already been used for analysis of faculty surveys and student surveys in several classes. You are welcome to analyze your surveys with SWB, it is accessible from http://edcenter.sdsu.edu.

Conclusion

Within the two programs we described, several successful strategies for the incorporation of advanced computing in classroom teaching have been developed and evaluated. We believe that the tried and proven technologies can be extrapolated to the needs of pre-service teacher education, and outline the steps we are already taking to influence this group of students. As with any curriculum change, a successful integration of advanced computing in the standard curriculum is likely to take years (Green & Gilbert 1995), and result from a focus on most enthusiastic and technically-advanced instructors. We believe that our two programs created the necessary prerequisites for a successful undertaking focused directly on pre-service teacher education.

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Malini Ranganath

Visual Imagery for chemical conceptualization: Picturing knowledge with multimedia

"A soul never thinks without a mental picture." --Aristotle.

1.0. Introduction

A significant aim of education is to enable students to understand and learn in a meaningfully way. Educators around the globe strive to create an environment in the classroom conducive to effective learning. In today's society, greater demands are being placed on education systems at all levels, to produce citizens who can use knowledge in new domains and different situations. Learning to think critically, to analyze and synthesis information, to solve problems in a variety of contexts is important for betterment of life. Studies show that there is little evidence that our educational systems are developing these skills in our children (Bransford, Goldman and Vye, 1991).
Effective learning and teaching science has been the topic of discussion among educators for the last few decades.Learning is the building of new knowledge, skill, or and attitudes. A learner interacts with information and the environment (Jonassen, 1996). Studies have shown that students are unable to understand the basic science concepts. Studies and reports constantly show the difficulties students face in grasping the knowledge imparted in the classroom (Gabel and Samuel, 1987; Gardner, 1991). Learning, in our educational institutions generally emphasizes the output of knowledge.The general tendency among students is to memorise the information and repeat the information transmitted from the teachers to students. In schools all over the globe, certain performances predict the signs of knowledge or understanding. Outcome is stressed more than the understanding of knowledge. The aim of educators is to emphasize an effective and meaningful learning, for a bright future for students. The learning process is often overlooked. The students' cognitive processes remain in the background.This passive cognitive environment is unhealthy for any educational institution. Many theories have evolved, such as the generative theory of learning, and the metacognitive theory of learning, to encourage the active thought processes of the learners (Forrest-Pressley, 1985).

To create such an active cognitive environment in the classroom, we as educators have to incorporate various strategies to create a true learning environment. Piaget (1920) believes that it is not the accuracy of the child's response that is important, but rather the lines of reasoning the child invokesSome studies have shown, that the development of visual imagery can enhance learning in general (Paivio, 1971; Shorr, 1980; Pylyshyn, 1973). However, fewer studies have been conducted to show the importance of visual imagery in chemistry learning. Here the focus is on using visual imagery to enhance chemistry learning. The unit in review is electrochemistry. This paper is divided into four sections: (a) conceptual difficulties in chemistry learning; (b) visual imagery for chemical conceptualisation; (c) theoretical and practical implications of visual imagery and (d) multimedia for visualising chemical knowledge.

2.1 Conceptual Difficulties in Chemistry Learning

Chemistry has been the primary source of description and depiction of chemical changes. Volumes of articles and notes on chemistry depict chemical reactions and equations with little emphasis on the meaning of chemical equations. Students' conception area of research point out the difficulties students have in learning chemistry . Driscoll (1960) was one of the first people to conduct a study on students' "misconceptions" and the difficulties involved in understanding chemistry. Gordon McCalla (1989) points out, "a student's knowledge is more complex than an expert's knowledge because it may be imprecise, contradictory and full of misconceptions". For example, Ben-Zvi, Eylon, and Silberstein (1982, 1987) discovered that students found it difficult to relate the macroscopic phenomena to microscopic level spontaneously and simultaneously. The foregoing studies reveal that students have difficulty in understanding the microscopic nature of a chemical change and perceiving the abstract or invisible agents involved in the total chemical transformation (Hesse and Anderson, 1992).
More specifically in the domain of electrochemistry, Australian researchers Butts and Smith (1987) through surveys examined the difficulty level of students' conception of electrochemistry.Garnett and Treagust (1992) found that students had difficulty understanding electric current, differences in potentials, the charge law, electromotive force, designating

oxidation numbers, utilising oxidation numbers to distinguish redox equations, utilising methods apart from oxidation numbers to specify redox equations, and the dependence of redox reactions with each other. Garnett and Treagust (1992) also found that students overgeneralised the utilisation of the charge law to improper situations:

.......In a cell the anions and cations attract each other and this affects the movement of ions to the electrodes.

Ogude and Bradley (1994) found most students capable of solving electrochemical problems in chemistry tests, but only few students could answer qualitative questionnaire which required a sound conceptual knowledge of electrochemistry. Sanger & Greenbowe (1997) believe that some misconceptions of the student have a strong influence in describing the experiential and observational experiences, relating to the logic of the student, and consistent with his /her understanding of the universe. (Herron, 1990 as cited in Sanger & Greenbowe, 1997). This explains the reason behind the usage of simulation softwares to explain the microscopic nature of electrochemistry concepts and as depicted later the usage of visual imagery in reviving the abstract thinking process and thereby making the learning of electrochemistry concepts meaningful.

2.3 Visual Imagery for Chemical Conceptualisation

Some students are able to grasp conceptual knowledge while others find it more difficult. This is where imagery might be useful. Since the focus of my study is on using images to enhance chemistry learning, I would like to explore the construct of imagery in detail. Alan Richardson (1969), defines mental imagery as "(1) all those quasi-sensory or quasi-perceptual experiences of which (2) we are self-consciously aware, and which (3) exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts, and which (4) may be expected to have different consequences from their sensory or perceptual counterparts" (p.). "Quasi-sensory or quasi-perceptual experiences" refer(s) to the sensory, perceptual ,and experiential states represented in a concrete manner. Paivio (1971) one of the pioneers of conducting studies regarding visual imagery, examined how imagery affected the acquisition, transformation, and retrieval of various types of information. According to Paivio, the theoretical assumptions of learning is that it is linked with two specific coding systems, namely, the use of verbal processes to acquire information; and the use of nonverbal processes (visual imagery) to assimilate knowledge, the cognitive mode. Moreover, both the codes are interconnected to each other, and it is possible to create a bridge between the two for better understanding of the concept. A verbaliser might require to understand better, the meaning of the information by using its visual counterpart and vice versa.

Paivio argued that images need not be specific in their representation but rather it can be schematic, and consciously functional. Paivio also pointed out that "meaning" from a psychological point of view might not be rigid or fixed, but might vary depending on the prior incidents and the present situational contexts. Furthermore, Piovio stated that stimuli accelerates the formation of images. An extension of these ideas to my future study is that imagery is connected to words and that it is an important component to comprehend chemical language. Pylyshyn (1973, 1979) believed that knowledge was represented by a single abstract or propositional code. Piaget incorporated both the representational and operational planes of thought within his theoretical framework.

Paivio (1971) believed that verbal coding is attributed to using "abstract stimulus information"; While imagery is the iconic representation of the concrete situations. Richardson (1969) stated that imagery by its figurative nature, could bridge the communicative gap between

the abstract information and its meaning. The difference between visual imagery and verbal representation is that, visual imagery is stored in the brain as iconic units and the excess of information is stored spatially; while verbal or abstract information synthesises knowledge sequentially.

Psychologists describe "meaning" to be an output of direct and indirect reactions derived from iconic objects, words, and various other symbols. Roger Brown (1958) considered "meaning" to be the end product of "response disposition". Paivio (1971) explains that meaningful reactions are kindled, inferred or are direct expressions of the human arrangement. Titchner and Paivio stressed that regardless of visual or verbal method of thinking, individuals' meaningful reactions are aroused involuntarily in contextual settings. For example, outside a chemistry classroom, a chemistry teacher might refer forest fire as "burning of trees"; while in her chemistry classroom, her chemical jargon will be "oxidation of carbon to carbon dioxide". Thus response variation depends on that particular environment. These responses are due to reflective thinking which might either be a verbal or visual process of thinking. Reflective thinking is accomplished by taking time to think. This is the main difference between an impulsive reaction and meaningful reaction. In a chemistry class, reflective thinking needs to be encouraged to arouse meaning in and outside the scientific environment. How do we encourage such thinking processes? Using the "coding processes" described by Paivio (1971), we can try to understand the various kinds of information coding techniques may be to synthesis an impetus. This will give science educators an insight to help their students to think reflectively and make science classroom an active learning sanctuary. Some of the different levels of encoding the various stimuli can be divided into four distinct categories (Paivio, 1971). The first level of information encoding process, comes into the fleeting category. The information vanishes within seconds and does not leave a lasting impression (Sperling, 1960; Crowder and Morton, 1969 as cited in Piovio, 1971). The next three levels of informational processes facilitate meaningful learning. Piovio classified them as "representational, referential, and associative levels of meaning":

2.4. Multiple intelligence theory:

Howard Gardner (1983) deduced a theory after researching the cognitive abilities of various individuals. He named this theory as the multiple intelligence theory. The theory indicates that there are seven kinds of thinking and each has a specific use:

- Logical-mathematical The thinking skill which involves the use of logic, pattern of numbers, and use reasoning deductively. For example, the thinking skill used by individuals in the field of science, mathematics, and others.
- Linguistic The thinking skill which is sensitive to sounds and understanding of words and linguistic abilities. For example, literary experts, poets, journalist, novelists, and others.
- Musical The thinking skill that is sensitive to melodious tunes, rhythm, pitch, and taste for musical jargon.
- Spatial The thinking ability to perceive spatially, use visual imagery, and manipulate and transform spatial objects. For example, spatial manipulation used by architects, artists and some scientists.
- Kinesthetic The thinking skill to control and articulate body movements. For example, ballerina, athletes, sportsmen and others.

- Interpersonal The thinking skill used to perceive the personalities, behaviors, temperaments, and deal with other people. For example, the skill used by solicitor, counselors, lawyers, priests and others.
- Intrapersonal The thinking ability to understand oneself, strengths and weakness, control, direct one's behavior and feelings.

Driver and Erickson (1983) and Posner (1982) explained the integration of cognitive psychology into the activities of students while learning science. They point out that, "We ought to engage in research endeavors which will uncover student frameworks, investigate the ways they interact with instructional experiences and utilize this knowledge in the development of teaching programs (pp. 39-40).

2.5. Imagery and hemispheric function of the brain

Forisha (1988) defines mental imagery as "the act of schematically representing things internally or the process of transforming these schematic representations" (p. 311). Visual imagery is the visual representation of these processes. As seen earlier, creative thinking skill is associated with imagination or spatial form of intelligence. Creativity is the process of innovating new ideas, events, concepts etc. Efforts have been devoted towards the measurement creative potential (e.g. Guilford, 1989; Torrance, 1979). Attempts have been made to increase creative behaviors (e.g., Osborn, 1953; Parnes, 1967). Taylor & Williams (1966) report a survey of the relationship between creativity and instruction. Let us understand the underlying relation of creativity and cognition with hemispheric functions of the brain. Often visual imagery, creativity and cognition are related to neurobiological processes of the brain.

Studies reveal the difference in the operation of the two cerebral hemispheres of the brain (Bogen, 1969; Nebes, 1971). Research show that the left hemisphere is considered "analytical" while the right hemisphere is "global" (see Levy et al., 1972). The left hemisphere analyses verbal mode while the right hemisphere is assigned for visuals, images and others. Frued (1949) described the function of both the hemispheres as follows: The left hemispheres coordinates the verbal interactions with our fellow humans everyday. The right is considered to regulate the emotions, metaphorical, fantasies, dreams, impulsive processes. Some researchers believe that, those people who are analytical and use verbal descriptions, use their left hemisphere frequently; while people who use "holistic approaches" operate their right hemisphere often (Mintzberg, 1976; Restak, 1976; Bakan, 1971). In simple terms, the left hemisphere is used for logical, analytical thinking, supposed to be used by mathematicians, scientists and others; the right hemisphere is used by people with artistic, aesthetic, spatial abilities, generally used by artists, poets, architects and others (Gardner, 1983; 1991).

Creativity is considered to use both the hemispheres, although the general tendency is to lean on the right hemisphere (Sperry, 1974; Galin & Ornstein, 1974). Utilizing logical thinking and using the imagery aspect of right hemisphere, creative innovation is attained. Schachtel (1959) argues that, creative individuals transcend from one hemisphere to another, rather than restricting themselves by either/or perspective of the world. Thus using a multimedia software creatively and efficiently involves the collaboration of both halves of the brain: with a balance of holistic (right hemisphere, imagery), analytical (left hemisphere) and cognitive processes of thinking. Teachers must be aware of the potential of visualization, and its affects on the learning process. Visual literacy though dormant for quite some time, needs to be a prominent curriculum agenda. The sensitivity to using multimedia effectively is increased with a classroom of visual literate individuals. It is seen that from the time of birth, an infant accumulates representation of his idea of the environment around him through perceiving the concrete objects and occurrences

around him. Before learning to formulate words or to speak, a child conceptualises his/her framework through imagery. Recognition power increases when his perceptual information matches with the concrete objects seen by the child. This further reinforces the connection and thus the child reinstates the information in his brain. Multimedia can invigorate the conceptual knowledge of a student and can direct a path towards better understanding of the abstract concepts.

Similar to the associative type of learning which the child undergoes when he/she relates to a static object like photos or slides and the individuals moving around; this pattern continues and is reinforced in a different surrounding too. This further concretizes the information stored in his/her brain cells. Similarly, complementary to multimedia stimulation with verbal information, laboratory experiments further reinforces the meaning of the chemical concepts.

3.0. Conclusion

In this paper, we have seen some of the major misconceptions students have in science and in particular electrochemistry. Students do not have a clear idea of the concepts and the microscopic level of electrochemical processes. Students cannot comprehend some of the principle concepts of electrochemistry. Educators have strived to make science learning meaningful. Difficulties arise during transfer of the science concepts in the real world settings. This proves that an indepth understanding of science concepts is required.

The objective for science education as specified in the science literacy section of the curriculum guide zeros in on the strong foundation of learning science concepts. In other words, the goal is to enable students understand the science concepts meaningfully and thoroughly so that they can use them in: their personal lives whenever required, use it in strange, unfamiliar situations in their environment, help them in using their basic concepts in future academic endeavors. Moreover, the guide specifies that students need to be aware of various career options to choose according to their capabilities. All of these require sound content foundation for appropriate application whenever required. As stated by Paivio (1986), the dual coding theory, pictures and words activate both visual and verbal codes. Visualization techniques can be revived by using multimedia software.

Williamson and Abraham (1995) suggest that using the technique of providing animations increases the understanding of concepts. This triggers the formation of mental models of the "phenomena." They believe that the "dynamic" feature of animation might increase deeper encoding of information compared to the static pictures. This further states that there will be an increase in reviving the visual imagination of students, thereby leading to better understanding of abstract conceptual models. Multimedia provides an innovative organizational structure for science learners, to represent their understanding and evaluate their knowledge structure through simulations and node-link structure. With the advent of multimedia, and its appropriate usage in the teaching and learning process, the experience of meaningful learning can be achieved. Constructing multimedia software with a specific science concept helps to represent the abstract concepts visually.

SIMULATIONS

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Though recognized as a legitimate and positive aspect of teaching and learning, simulations don't seem to be widely used by authors for the 2000 SITE annual. Perhaps the wide variation in defining "simulation" in education has contributed to the dearth of studies. The range in availability of hardware, courseware, and software in international locations where many of these investigations were done certainly has contributed to the variation in sophistication of data treatment. Additionally, though the global economy and international testing have moved countries closer in terms of educational goals, differences in educational philosophies have certainly contributed to the issues addressed and undertaken by this year's contributors.

Such is the strength of this section. The way educators have chosen to define and then implement technology in the classrooms of their districts and countries is as varied as the geographic locations of the schools. Regardless of the complexity or simplicity of the technology available or the cognitive entry level of the personnel proposed for using the innovation, readers can certainly find one or more situations which mirror their own. Reports of technology use for teacher-preparation as well as use with the P-12 students also increase variation.

The Papers

Bowers, Kenechan, Sale and Doerr report on the use of three multimedia case studies for preservice teachers. The goal of the study was to determine which of the three treatments was the most effective for helping preservice teachers observe the complexity of the teaching and learning process through the use of multimedia tools. The study compared the cases and then reported the most effective in supporting the teacher educators' curricular goals.

Hoic-Bozic, Ledic, Mezak investigated through the use of a questionnaire the effectiveness of www hypermedia courseware in teacher preparation in Croatia. The purpose of the study was to determine how the use of this technology increased preservice teacher learning and comprehension as determined by the students themselves. Student acceptance of an alternate teaching method was also investigated.

Baker and Wedman studied the nature of the Risko and Kinzer constructs for case-based instruction (CBI) and their viability for preservice teacher preparation. After addressing the nature of the constructs, the investigators question the effectiveness of how much transfer can be expected when the case studies are investigated are not closely related to new scenarios.

Klopfer and Colella wrote regarding the use of model-building in teaching high school mathematics. They contend that enable teachers to approach their curricula from a more holistic perspective and gain insights into the inquiry process and the concepts underlying their models. The also site evidence that teachers developing and using model building in high school classes strengthens the teacher understanding of the content and the students depth of understanding of the concepts taught.

Howard and Strang submitted two papers on the effectiveness of computer-based teaching for preservice teachers. Students completed a software-driven lesson planning activity followed by a debriefing session during which feedback was given and effective planning strategies were discussed. The second paper discussed the effectiveness of the Matrix Simulation developed during the first study in designing effective lessons for unmotivated students.

Khalili and Pete addressed the need for flexibility in fourth year information technology classes and how the virtual classroom has impacted that need. This action research project reveals how sensitivity to the needs of students has impacted the traditional curriculum and changed teaching and learning methodology.

Medina, Trentin, Gosta and Tarouco also discussed the benefits of the virtual classroom and its effectiveness in a high school physics classroom. They contend the simulated activities address all of the learning styles as measured by Felder and Silverman and increase interest and learning of secondary physics students.

Pow, So and Hung wrote two articles from their project where So, though a lecturer of Hong Kong Institute of Education, taught in a primary school using the technology which has been mandated by the government for use in all primary school three years hence. A documentary was

produced and will be shown which follows this process and comments on the impact on primary student achievement. Comment is also made on the need for staff training before the project should be fully implemented.

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DESIGNING MULTIMEDIA CASE STUDIES FOR PRESERVICE TEACHERS: PEDAGOGICAL QUESTIONS AND TECHNOLOGICAL DESIGN SOLUTIONS

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Abstract: This paper discusses some of the pedagogical questions and technological solutions that evolved as we developed three multimedia case studies for preservice teachers. The design goal of this project was to create a means for helping preservice teachers observe the complexity of the teaching and learning process through the use of innovative multimedia tools. The research goal of the project was to document how the different versions of the case have been implemented in various teacher preparation courses around the nation and then report which features of the case were most found to be consistently efficacious in supporting the teacher educators' curricular goals.

The problem we are addressing

One of the most difficult problems facing teacher educators is that prospective teachers lack the experience base necessary to meaningfully observe the complex and rapid interactions that occur in any classroom. This shortfall may be responsible for prospective teachers' well-known tendency to focus on classroom management issues (such as counting the number of girls the teacher acknowledges) rather than the more content-specific pedagogy that is taking place. Although these management issues are of interest and importance (especially to beginning teachers), they do not tell the whole story. In particular, they do not lend themselves to promoting the development of pedagogical content knowledge (Shulman, 1986), which includes the intricate interplay between elements of epistemology, psychology, mathematics and pedagogy. Due to its complexity, such knowledge cannot be transferred by narrative means. However, we believe that students can become mindful of such knowledge by observing how experienced teachers emphasize specific mathematical solutions or how the teacher and students develop taken-as-shared understandings of various mathematical meanings.

A second implication from this lack of experience in analyzing classrooms is that it prevents preservice teachers from engaging in deeper analyses of the relation between the teacher's actions and the students' understandings that characterize the concerns of reflective practitioners (Schon, 1983). The goal of our project has been to address these problems by designing CD-ROM based case materials that might enable mathematics teacher educators to bring the complexities of a classroom into focus. In other words, our goal has been to promote the development of preservice teachers' pedagogical content knowledge by facilitating access to critical classroom segments that promote discussions of mathematical content and pedagogy.

Design Theory

Our design theory is based on two related areas of research and development. The first area concerns the use of case studies to develop pedagogical content knowledge. According to Shulman (1986), there are several different types of case studies (i.e., prototypes, precedents, and parables) but all share one essential feature: they are not simply random anecdotes. Instead, they are stories that are chosen to illustrate a theory or communicate a moral. Thus, Shulman notes that effective cases should enable viewers to contrast general ideas with concrete, memorable events.

The second area of work that has guided our design efforts is the use of multimedia materials with preservice teacher education. The emphasis of most projects in this field has been to focus on asking 'how can we use multimedia to engage students in the processes of reflective practitioners?' We have drawn on the approach of Mousley & Sullivan (1997) who use pedagogical dilemmas to provoke detailed lesson analyses and to perturb users' assumptions about teaching and learning. The underlying assumption of their work, with which we completely concur, is that unless personal constructs are challenged, teachers are not likely to see any need for change. We have also drawn on the work of Merseth & Lacey (1993) who discuss the possible advantages of using multimedia case studies. These advantages include the potential to present multiple perspectives on given issues and the opportunity to actively engage students in their own explorations of the teaching and learning process. Although our earlier work has included multiple perspectives from various educators and mathematicians looking at the same video segment (cf., Barron, Bowers & McClain, 1996) we have chosen in this project to focus more directly on engaging students in their own explorations via the use of multimedia tools.

Overview of the Cases

Our work to date has involved the creation of three versions of one mathematics case: a one-day case, a four-day case, and a video-only version of the four-day case. Each of the cases involves similar content: a series of lessons involving data analysis activities implemented in middle school classrooms. The reason for creating three design versions was to research any differences in what each model could afford.

Pedagogical questions and technological solutions

1. What tools can we develop to encourage preservice teachers to look beyond superficial aspects of a classroom to observe the complexities of the teaching and learning process?

In an effort to clearly delineate some of the issues we found particularly critical, we developed an interactive issues matrix (cf., Barron, Bowers & McClain, 1996). As shown in Figure 1, clicking on any "X" in the matrix will bring the user to a video segment, teacher reflection, or lesson plan notation that pertains to the indicated issue and day. The intended goal of this matrix is to enable preservice teachers to investigate an issue or theme as it progresses over the span of the lesson sequence.

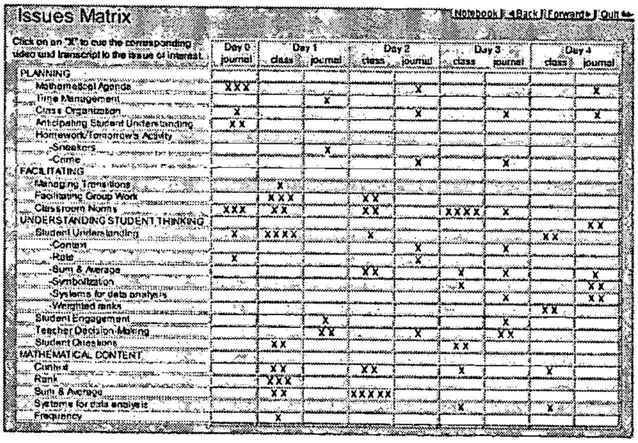

Figure 1. Issues matrix from 4-day case

A second technological tool that was designed to facilitate deeper analyses of the video is the bookmarking feature. This feature allows users to customize their investigations. For example, it can be used by methods instructors to mark a particular segment of video and ask a question in a linked text box. The feature can also

be used by preservice teachers to mark, annotate, save, and later retrieve specific segments for later review (as shown in Figure 2).

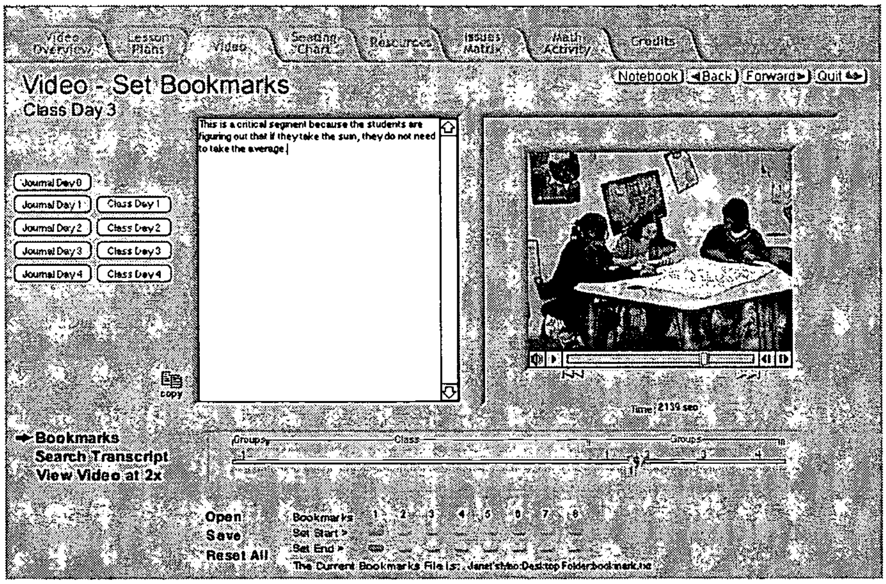

Figure 2. Setting a bookmark.

A third technological solution that we have developed to address the difficulty of conducting large-scale analysis across time is the <u>searchable transcript</u>. This transcript, which is linked to the video, is searchable by keyword or phrase. This enables pre-service teachers to search for particular mathematical topics or follow a specific student (via a name search) across time. For example, a user might want to investigate whether the teacher anticipated students' use of a computing average strategy and then search both the teacher transcript (as shown in Figure 3) as well as the classroom transcript for occurrences of this key word. The search results list can be saved via a text file that contains hypertext links to the keyword in the transcript and video.

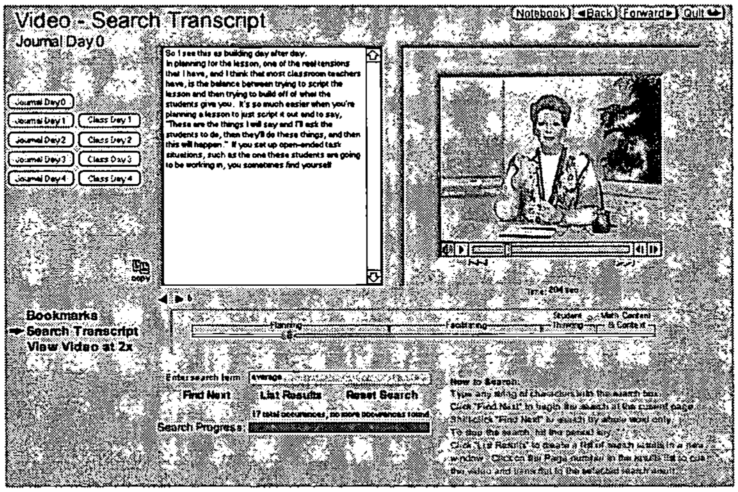

Figure 3. Results of searching linked transcript for word "average."

2. How can we engage preservice teachers in the process of teacher reflection?

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One of the issues we wanted to illuminate with the cases was the way in which experienced teachers reflect on their preparation and daily teaching experiences. To this end, we videotaped the teacher's initial reflection on her lesson plan as she prepared for her class each day and then again as she reflected on how each lesson was realized in the classroom and how she would subsequently revise the next day's lesson plan. These sessions were videotaped sequentially to capture the teachers' actual concerns as they occurred in time and therefore show both a) the value of a priori reflection on possible mathematical solutions, and b) the reality of how even a well-planned lesson can still lead to unanticipated student reactions.

3. How can we make this case study different from a video by exploiting the use of multimedia?

One difficulty that often arises in discussions of a shared video is how to identify students by name. When observers are only "introduced" to a student on video once or twice, they naturally have difficulty distinguishing them or recalling names to conduct a keyword search. To facilitate recognition, we have included pictures of each student arranged by group and desk location in the classroom. A second multimedia tool we have made extensive use of is the inclusion of scanned images of student work, copies of all lessons, and other auxiliary materials for the case. We believe that such artifacts distinguish a rich case from a video-based story, and will be researching this hypothesis over the coming year.

4. How can we engage preservice teachers in the mathematics of the lesson and encourage them to anticipate possible student strategies?

Another aspect of this CD that distinguishes it from other pedagogical cases is the mathematical activities section. In this section, we provide users with the actual information and data that the students in the video are using. Our goal in so-doing is to have the observers watch the teacher introduce each activity, and then engage in the mathematics of the lesson before watching the students' tackle the content in the video. We have observed that this activity gives the preservice teachers a better sense of what the students in the video are experiencing and also provides another perspective on the teacher's role in guiding the mathematical discussions.

5. How can we support methods instructors who are planning to use the CD in their classrooms?

As mathematics educators ourselves, one of our main pedagogical concerns was to build a system that would accommodate a variety of methods instructors who fall along the continuum between those who prefer directed questioning to those who prefer to devise their own questions. We therefore began with the premise that a separate facilitator's guide containing suggested questions and activities would be helpful. We modeled our guide after the work of Carne Barnett and her colleagues (Barnett, Goldstein & Jackson,1994) who have developed a number of techniques for bringing out issues embedded in text-based pedagogical cases. In addition, our research has shown that some instructors find the bookmarks particularly useful for further accommodating individual instructors' needs. For example, one instructor asked preservice teachers in his class to prepare bookmarks showing the ways in which the teacher conducted student questioning. One of our future development goals is to create a website that will enable instructors to upload and download others' bookmark files, thereby sharing their observations with a global community.

6. What technological boundaries will need to be overcome?

As with any cutting-edge technology project, there are boundaries that have to be pushed. We encountered and solved a number of technological obstacles through the diligent research and determination of our programmer. Some of the most critical resolutions included: 1) Fitting four hours of video on one CD-ROM, 2) Setting up a method for linking the transcript to the video, and 3) Creating an interactive version of the case with streaming video on the Internet.

Results and research to date

Our current work involves researching how the cases are used in methods classes. In brief, we have found the following: 1) Preservice teachers rate the searchable transcript as the most useful multimedia tool; 2) Instructors

feel that the extensions to the case, such as the mathematical activities and the in-depth video of target groups of students over time, support their efforts to communicate the complexities of the classroom in ways that video alone cannot; and 3) Teaching methods courses with multimedia requires a paradigm shift for most instructors who are used to the ease of showing a film during class and stopping it at appropriate times. To facilitate their efforts, we added a "View at 2x" feature that doubles the size of the video window and hence enables the video to be projected using an LCD projector connected to a computer.

These preliminary findings are informing our plans for more formal research. For example, we have found that researching the ways in which instructors change their uses of the case is more fruitful and interesting than just observing their initial use only. We have also realized that asking questions such as "What is the effect of the CD on preservice teachers' views of pedagogy, pedagogical content, and mathematics learning in general?" is not easy (or even possible) to measure. In fact, one colleague who used the case twice wrote

> The problem of noting change [in preservice teachers' views] is one that becomes particularly difficult whenever working with teachers in general, and preservice teachers in particular. Our preservice teachers are undergoing between 3 and 6 hours of instruction a day for the first 8 weeks [of the semester] they are spending time in their classroom observing their cooperating teacher and helping out, they are working with children in a variety of settings, they are reading, writing, viewing videotapes, and more. To consider the effects of even one entire course on their instruction is difficult, so imagine the complexities with trying to determine the effects of one three-hour session.

Therefore, we have redirected our research efforts to focus less on what the preservice teachers learned from their experiences with CD and more on what issues were raised during whole class or small group discussions that might have arisen if they were using video alone. In general, we can ask, "What did the CD make possible?" We have also decided to conduct some one-on-one interviews to answer questions such as what did they get from the use of the case and what opportunities were provided that would not otherwise have been attainable? We believe that answers to these questions will move the field of mathematics education forward by providing further concrete technological solutions to pedagogical questions.

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Evaluating the Use of World Wide Web Courseware in Student Teachers' Education: a Case from Croatia

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Abstract: This paper presents the outcome of the research that deals with the development and use of the WWW hypermedia courseware in student teachers' education at the Department of Information Science at the Faculty of Philosophy in Rijeka (Croatia). The purpose of this research is to explore how the use of WWW courseware improves the students' learning process as well as their comprehension. In this paper we present the results of the questionnaire about the effectiveness and quality of the courseware and the level of student acceptance of courseware as a teaching resource.

Introduction: Computer Technology in Croatia

In the countries throughout the world new methods and means are used to improve education, and special attention is being paid to the role of computer technology in this process. To achieve improvement with the computer technology, it is necessary to educate teachers, introduce new teaching and learning model, and develop appropriate teaching and learning materials: software for learning – courseware. While in some countries these efforts are strategically planned, in others, such projects represent isolated initiatives and modest attempts which merely have a goal to build computer infrastructure and give schools and universities access to the Internet.

This kind of situation holds for Croatia, where there are still no major projects for the introduction of computer and networking technology in education at the governmental level. Currently underway is the preliminary phase, conducted by the Ministry of Science and Technology and the Ministry of Education and Sport which would enable the development of the computer infrastructure and give Internet access to universities and schools via the Croatian Academic and Research Network (CARNet), an academic and research part of the Internet in Croatia (CARNet 1997).

Today, CARNet connects all four university centers in Croatia (Osijek, Rijeka, Split and Zagreb). In the next phase, the Internet access will be given to the primary and secondary schools and the process of building the computer infrastructure in the schools has been already started.

In addition to our non-adequate hardware and network outfit, the problem is that in Croatian schools and universities computers are used rarely, except in the subjects related to computer science. We consider that special emphasis of the role of computer technology in education (especially using WWW courseware) should be put at the colleges that educate student teachers. We hope that these students will use the computer

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Before the project described in this paper was implemented, the research has been conducted in the context of the projects supported by the Croatian Ministry of Science and Technology: 'Innovations in Computer Assisted Education' and 'Quality of Teaching in Higher Education'.
The research titled 'Innovations in Computer Assisted Education' was conducted from 1990-1996. The project involved exploring information technologies that would have a large impact on the use of computers in education. Of particular interest was the research in hypertext, hypertext databases and hypermedia (Hoic-Bozic, 1997).
The second research project 'Quality of Teaching in Higher Education' started in November 1996. The main goal of the project is to explore the quality of teaching at the Croatian universities, and to develop a model for improving teaching and learning at the Croatian universities.
The project 'Transforming Information into Knowledge: Online Courses in Education' has been supported by the Research Support Scheme of the Open Society Support Foundation.
The purpose of this research is to explore how the use of on-line courses prepared for World Wide Web and combined with other Internet technologies improves the students' learning process as well as their comprehension.

Methodology

The research has been conducted at the Department of Computer Science on a group of senior student teachers of Computer Science (25 students) in the context of the course The Internet Seminar where they have learned how to use Internet services. The lectures have been hold in the PC-room, on the computers in the local area network connected with the CARNet.
The research method was experimental: approximately one half of the Internet Seminar course's lectures have been elaborated traditionally (lecturing supported by the use of a projector, practices on the computer set by the teacher and by equal temporal setting), while the other half have been elaborated as a WWW courseware. The students have elaborated this other half of lectures on individual basis, by their own personal tempo and, in particular, the order of the topics presented within every single lecture.

Overview of the WWW Courseware

Even before this research, simply paper-based course materials have been placed on the Web so the students can access them in electronic format. In that way the students didn't have to make their own notes by writing out from transparencies and they had more time to explore the related resources on Internet.
The WWW courseware has been developed for the subjects about World Wide Web, e-mail, mailing lists and newsgroups, and HTML. According to the survey about students' previous knowledge, with some of these subjects the most of the students have been familiar before (using browsers, e-mail) but the other was completely new for them (HTML).
As the most appropriate method to deliver the content Web/Computer Based Training has been chosen (Driscol, 1998). The WWW courseware has been developed for the subjects about World Wide Web, e-mail and e-mail clients, mailing lists and newsgroups, and HTML. The main courseware page (home page) links together the modules as well as the WWW documents with short explanations about other lectures for traditional learning.
A special attention has been paid to organization of the courseware, navigational techniques and learner-content, learner-educator and learner-learner interaction (Driscol 1998, McCormack & Jones 1997). Navigation is enabled by a number of elements. The courseware page consists of a vertical bar with navigational buttons to

allow students' access to the main courseware elements: Courseware Home Page, Module Home Page, Help, Index, Search, Webboard, E-mail, Tests (Fig. 1). Apart from these buttons, there are Back and Forward arrows added to documents describing the lessons of the modules.
The materials for the course have been published on the Web server at URL http://top.pefri.hr/mreze/ .

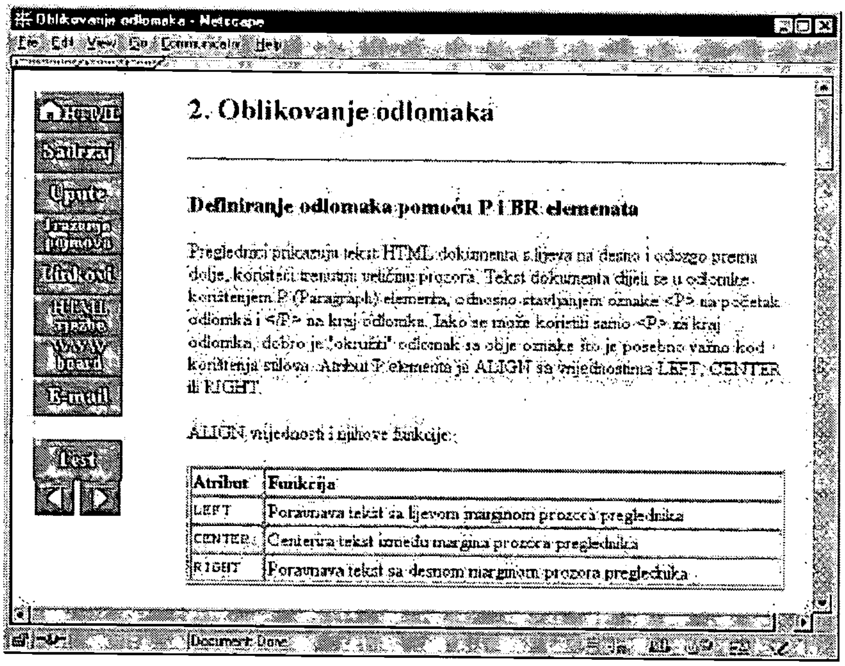

Figure 1: Example of a WWW courseware page

Results and Discussion

In order to explore the students' attitude concerning courseware usage, we developed questionnaire for students. According the experiences from the similar studies (Ciglaric & Vidmar 1997, Goldberg 1997, Zammit et al. 1999), and our own experience (Hoic-Bozic 1997, Radovan et. al. 1998), we prepared the list of statements, which were the core of the questionnaire. The students were supposed to express their opinions on the 1-5 agreement scale checking 5 if they strongly agree, 4 if they agree, 3 if they nither agree nor disagree, 2 if they disagree and 1 if they strongly disagreee with the statement.
We used the list of the criteria in two main queries:

1. effectiveness and quality of the WWW courseware
2. the level of student acceptance of the WWW courseware as a teaching resource.

Effectiveness and quality of the WWW courseware

The criteria regarding the evaluating the effectiveness of the WWW courseware were grouped into five groups: content and instructional design, media elements and aesthetics design, navigation, communication and evaluation (Hall 1997). The students were asked not only to rate the statements and to answer a few questions, but also to give their comments and suggestions about the WWW courseware.
The students answers to the statements are presented in the (Tab. 1) and (Fig. 2).
The WWW courseware had never been used before the research and the students provided a great deal of valuable insight in terms of changes that would improve the courseware. We will include the changes and improvements in the next version of the courseware.

	1	2	3	4	5	Mean
1. Content and instructional design						
Content was relevant to your knowledge level.			24%	64%	12%	3,88
Content was useful for your study.				40%	60%	4,60
Content was useful for your future work.		4%	12%	56%	28%	4,08
Content was clear and informative.			20%	48%	32%	4,12
Courseware was easy to use.			12%	72%	16%	4,04
2. Media elements and aesthetics design						
Pleasent and attractive colors.	4%		8%	64%	24%	4,04
Attractive page design.		8%	36%	40%	16%	3,64
Legible and clearly presented text.		4%	20%	48%	28%	4,00
Courseware should include more graphics.	4%	24%	40%	16%	16%	4,28
Understandable graphics (buttons).			8%	56%	36%	3,16
Courseware should include sound.	16%	16%	28%	36%	4%	2,96
Courseware should include animation.	16%	4%	44%	32%	4%	3,04
Courseware should include video.	16%	4%	56%	20%	4%	2,92
3. Navigation						
Topics of your interest were easy to find.			4%	56%	40%	4,36
Help page was necessary for navigation.	12%	44%	20%	24%		2,56
You could easily choose your own way of learning.	4%		12%	60%	24%	4,00
Courseware should include navigational map.	4%	24%	44%	28%		2,96
4. Communication						
E-mail is useful for communication with the teacher.		16%	24%	40%	20%	3,64
Webboard is useful for comm. with the teacher.		8%	32%	40%	20%	3,72
Webboard is useful for comm. with colleagues.		8%	36%	44%	12%	3,60
E-mail is useful for comm. with colleagues.		20%	36%	28%	16%	3,40
5. Evaluation						
Courseware allows to test the knowledge.		4%	44%	48%	4%	3,52
Courseware should include more exercises.			28%	60%	12%	3,84
Courseware should include final test.	4%	4%	28%	44%	20%	3,72
HTML test form was useful element of courseware.			24%	48%	28%	4,04

Table 1: Student evaluation of the effectiveness and quality of the WWW courseware

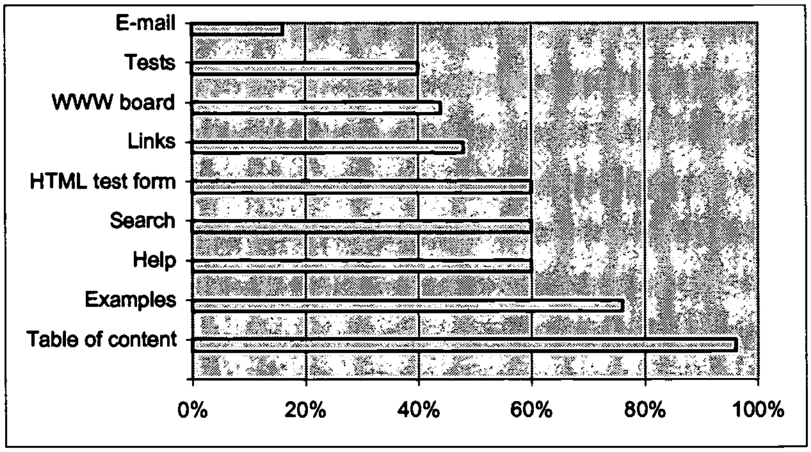

Figure 2: Student use of courseware components

Student Acceptance of the WWW Courseware

The second part of the questionnaire was administered to obtain information regarding student acceptance and reaction to the use of WWW courseware as a teaching resource, comparing it with traditional approach. The results are presented in the (Tab. 2).

	1	2	3	4	5	Mean
You were satisfied with the learning conditions.	8%	24%	56%	8%	4%	2,76
You were satisfied with the use of WWW courseware as a teaching resource.	4%		20%	60%	16%	3,84
The use of WWW courseware was effective for learning.	4%		16%	64%	16%	3,88
Compared to traditional lecturing method, you have learned more.	8%		44%	36%	12%	3,44
Compared to traditional lecturing method, you spent more time for learning.	4%	32%	40%	24%		2,84
Compared to traditional lecturing method, WWW courseware requires responsibility that is more personal.		4%	24%	56%	16%	3,84
Compared to traditional lecturing method, WWW courseware gives more opportunities for communication with the teacher.	8%	4%	40%	36%	12%	3,40
Compared to traditional lecturing method, you required more communication with the teacher.	20%	8%	48%	20%	4%	2,80
The opportunity to communicate with the teacher is important part of the courseware.		4%	36%	48%	12%	3,68

Table 2: Student acceptanceof the WWW courseware as a teaching resource

Despite the fact that the students were generally satisfied with the use of WWW courseware as a teaching resource, they did not think that they had learned more in comparison with the learning in a traditional manner. They spent less time for learning than they would have with the traditional lecturing method, because the WWW courseware requires more personal responsibility and concentration to learning. In addition, many students considered that the courseware components for communication with the teacher (e-mail, Webboard) were not very important. The students did not require more communication in comparison with lecturing. The main difficulty regarding the learning conditions was in gaining access to the computers and the courseware because our students only have access to Internet at the college.

There were 92% of students who did not lack any educational aspect included in traditional teaching. The rest missed the "live contact" with the teacher and the colleagues. If they could chose between a WWW courseware and a traditional lecturing, 76% of students will prefer courseware.

Conclusions

The paper presents the description and the results of the research which purpos is to explore how the use of WWW courseware improves the students' learning process as well as their comprehension. In order to explore the students' attitude concerning courseware usage, we developed questionnaire about the effectiveness and quality of the courseware and the level of student acceptance of courseware as a teaching resource.

The number of respondents in questionnaire was small because the research has been conducted on a group of senior student teachers of Computer Science (25 students). Because of the relatively small number of participants in the research, the results will primary help us to focus our future research efforts and to develop the strategy for introducing the WWW courseware as a teaching resource, for now as the supplementary method for traditional teaching. We would like to mention that not only this research, but also the use of WWW courseware, represents unique attempt at the University of Rijeka.

If we compare our research results with some similar projects (Bell &Kaplan 1999, Ciglaric & Vidmar 1997, Goldberg 1997, Psunder 1997, Young 1999, Zammit et al. 1999), it shows up that our students have nearly the same level of acceptance of WWW courseware as a teaching resource, regardless their different socio-cultural

background and availability of hardware. Also, as in some of the mentioned studies (Psunder 1997, Young 1999, Zammit et al. 1999), the level of computer-mediated communication between the teacher and students was low, probably because the students were not used to it. The educational strategy that we should use to increase students' participation in e-mail and Webboard discussions deserves further research.

We are quite satisfied with the results, especially because the participants are to be student teachers and we hope that they will use the WWW courseware in their future work, enabling the transfer of the new approach to education in Croatian schools.

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Preservice Literacy Teachers, Digital Literacy Portfolios, and Multimedia Case-based Instruction: Examining the Theoretical Basis for Case-based Instruction

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Abstract: Case-based instruction (CBI) is used in a variety of professional schools. Studies indicate that CBI can have promising results but they do not provide insights into the theoretical justification for using CBI. Risko and Kinzer (1994) identify five theoretical constructs for CBI: anchored instruction, reflective thinking, situated cognition, generative learning, and the ability that CBI has to prepare teachers to deal with the ill-structured nature of teaching. We studied the nature of these theories in a 16-week literacy course for preservice Elementary Education majors that used CBI in order to (a) extend the theories themselves and (b) reconsider their viability for CBI.

Case-based instruction (CBI) is used in a variety of professional schools. Schools of Business, Medicine, Law, and Education are finding promising results with CBI (see Christensen, Garvin, & Sweet, 1991; Merseth, 1997; Shulman, 1992). Recent innovations have included the development of video-based and multimedia cases. Fitzgerald and Semrau (see Fitzgerald, Semrau, & Deasy, 1997) are developing multimedia cases which provide embedded prompts within a hypermedia interface. Hughes, Packard, and Pearson (1999) developed video-based cases and found that the more time literacy teachers spent examining video cases, the better they were able to support their claims about teaching reading. Risko, Yount, & McAllister (1992) found that literacy teachers who examined multimedia cases during class asked more questions and more higher level questions than students in similar courses that did not use the cases. They also found that the students enrolled in CBI courses developed the ability to take multiple perspectives on various teaching issues and problems much earlier than their peers enrolled in similar non-CBI courses. In another study, Risko, Peter, & McAllister (1996) found that CBI had an impact on the students' ability to think flexibly in related field experiences and discussions in other courses.

While these studies are informative by focusing on the effectiveness of video-based and multimedia CBI, they do not provide insights into the theoretical justification for using CBI. Risko and Kinzer (1994) identify five theoretical constructs for CBI: anchored instruction, reflective thinking, situated cognition, generative learning, and the ability that CBI has to prepare teachers to deal with the ill-structured nature of teaching (see also Christensen, 1987; Merseth, 1997; Shulman, 1992). However, these theories typically emerged in non-CBI settings. We studied the nature of these theories in a 16-week literacy course for preservice Elementary Education majors that used multimedia CBI in order to (a) extend the theories themselves and (b) reconsider their viability for CBI. While many aspects to the nature of each theory emerged, in this paper we limit our discussion to aspects that challenge current conceptions of these theories.

Theoretical Framework

Theories of *anchored instruction* (Cognition and Technology Group at Vanderbilt, 1990) hypothesize that students need to have a shared context (anchor) to effectively discuss theirdivergent perspectives. Theories of *reflective practice* (Schon, 1983; Zeichner & Tabachnik, 1984) argue that effective teachers evaluate their actions and outcomes. Theories of *situated cognition* (Brown, Collins, & Duguid, 1989) argue that learning is contextualized--thus learning and instruction should represent the context in which the learning is to be applied. Theories of *generative knowledge* argue that learners do not commonly make connections between knowledge that is dispensed to them (i.e., via lectures) and situations where that knowledge can be used. (Bransford, Franks, Vye,

& Sherwood, 1989; Bereiter, & Scardamalia, 1985; Whitehead, 1929). Instead, learners make better connections when they generate knowledge (Risko, McAllister, Peter, & Bigenho, 1994). Last, case-based instruction is based on theories which argue that teaching is an *ill-structured* task (Clark, 1988; Greeno, & Leinhardt, 1986) and therefore learning and instruction should prepare teachers to make decisions based on constantly changing sources of information.

Methodology

Setting and Participants

This study occurred in a midwestern state university in a section of a course entitled, "Emergent Literacy for Elementary Teachers." The students were first semester Juniors who had taken 8 semester hours of introductory education courses during their Freshman and Sophomore years. They had also done over 20 hours of classroom observations during their Freshman and Sophomore years. This was however, their first semester of taking methods courses. There were 34 students in the class, 31 females and 3 males. All the students were Elementary Education majors.

The course was part of a block of literacy courses which included 2 semester hours of Children's Literature, 2 semester hours of Emergent Language, and 3 semester hours of Emergent Literacy for Elementary Teachers. These preservice teachers also participated in 2 semester hours of field experience in which they worked with a partner to teach 8-10 literacy lessons to a small group of elementary children. They collaborated with the elementary children's teacher to design, implement, and reflect on their lessons and the progress of the children's literacy abilities. The participants took this block of literacy courses as a cohort. In other words, the same group of preservice teachers attended Children's Literature, Emergent Language, Emergent Literacy and Literacy Field Experience (9 hours per week) together.

Digital Cases

The case-based instruction was based on elementary children's digital literacy portfolios. The interface (see web.missouri.edu/~fipse/index.html) gives users access to video segments of a child as s/he reads and writes with classmates, the teacher, and the case developers (who functioned as participant-observers in the elementary classrooms). Each video segment includes related artifacts. For example, if the video involves a child reading, then the artifact is the book that is being read. This allows the user to see what the child saw while s/he was reading. If the video involves a child writing, then the artifact is the writing sample that s/he wrote. This allows the user to see what the child wrote. Each video also includes a scenario which explains what happened before and after the video. The scenario includes the text from the book in the video so the user can mark what the child says when s/he tries to read the text. The video segments (with corresponding artifacts and scenarios) can be sorted by month and by content area (e.g., Literature, Social Studies, Science, and Math) so the users can either examine the child's literacy abilities across time or across content areas. The interface also allows users to mark video segments so they can randomly access these segments during case analysis and class discussions.

Data Collection

Due to the nature of our research questions, we collected several data sets which included information about classroom interactions, the instructor's reflections about class activities, the instructor's reflections about the aforementioned theories, students' answers to study guides as they analyzed the cases, videotapes of each class session, students' lesson plans and reflections from their concurrent field experiences, and audio tapes and notes from individual interviews with each student at the end of the semester.

Data Analysis

We used qualitative data analysis techniques to understand the nature of anchored instruction, reflective thinking, situated cognition, generative learning, and preservice teachers' ability to deal with the ill-structured nature of teaching. Specifically, we analyzed the instructor's reflections about the theories. We identified comments which extended current conceptions of these theories. We then analyzed data sets to confirm and disconfirm the

instructor's perceptions. For example, in order to confirm and disconfirm the instructor's reflections about theories of anchored instruction we reviewed videotapes of class discussions, students' answers to the study guide questions, and answers during individual interviews. The videotapes allowed us to examine the role of the anchor in class discussions. The study guides allowed us to examine the relationship between the anchor and the students' divergent field experiences. The interviews provided, among other things, information about the students' perceptions of how the cases helped them understand one another's field experiences. Similar procedures were followed to examine theories of reflective thinking, situated cognition, generative learning, and preservice teachers' ability to deal with the ill-structured nature of teaching.

Findings

While using multimedia case-based instruction to prepare elementary literacy teachers, we found the need to revise or extend theories of anchored instruction, reflective thinking, situated cognition, generative learning, and perceptions that CBI can prepare teachers to deal with the ill-structured nature of teaching. For example, theories of anchored instruction claim that learners can use a common experience (an anchor) to help one another understand each other's own background experiences. We found the opposite to be true as well. The preservice literacy teacher used their different field experiences to help each other understand the anchor (the cases). Current perceptions of anchored instruction are unidirectional (anchor-->helps learners understand one another's background experiences). This study indicates that the anchor and the learners' divergent experiences may be reflexively related (anchor <--> divergent experiences).

Theories of reflective practice advocate the value of helping teachers develop reflective metacognition. We found that preservice teachers' reflective practice may not transfer from one domain of thinking to other domains. The preservice literacy teachers grew in their ability to reflect on children's literacy abilities, however, during case discussions they were not reflective about alternatives to planning instruction. While the participants' lack of reflection became a valuable focus for further instruction, this finding raises questions about theories of reflective practice. Specifically, do teachers need to be trained in reflective practice that is specific to each aspect of teaching (e.g., children's literacy abilities, activities which foster children's literacy development who demonstrate certain literacy abilities)? Do teachers transfer their ability to reflect about one aspect of teaching (e.g., children's literacy abilities) to other aspects (e.g., instructional practices which foster children's literacy development who demonstrate certain literacy abilities)? How much practice do preservice teachers need before they transfer habits of reflective metacognition from one domain to another?

Theories of situated cognition argue that learners recognize when and how to use knowledge when they learn the knowledge in situations that are similar to where they will use it. Herein, case-based instruction appears to be a natural pedagogy which allows the instructor to situate the knowledge and thereby undergird students' abilities to access the knowledge when similar situations arise. While we found that the students recognized ways to use the course content in their field experiences, we also found that situated cognition was just as important to the instructor. The instructor had been an elementary teacher for seven years. She found that her knowledge of teaching and literacy was in many ways situated in her elementary teaching experiences. For example, while discussing Julie and Zane during CBI, the instructor raised issues of text "friendliness." In her experience as a teacher she learned that a child's reading ability was often determined by the text itself. If children read poorly it could be because they lacked background knowledge or vocabulary; they may have expected certain syntactical structures. However, if they were given an "friendly" text which supported their background knowledge, used their vocabulary and syntactical structures, then they could read well. At the time of this study, the instructor had taught preservice literacy teachers for eight years. She often thought about the importance of discussing "friendly" text but because the instruction was not based on analyzing children's literacy portfolios the topic was typically overlooked. In other words, the instructor's knowledge was situated within her own professional experiences as an elementary teacher. With CBI, the case reminded her of her teaching situation and she remembered to cover issues such as the importance of noticing if a text is "friendly" to the reader. Herein we found that situated cognition is not for learners only. Situated cognition is also critical for the instructor.

Students generated knowledge and questions throughout all aspects of the CBI experience. They questioned and learned from each other through discussions, written analysis, and field experiences. The findings of this study supports theories of generative knowledge which claims that learners make better connections between knowledge they generate and situations in which they can use the knowledge than when knowledge is dispensed to them (i.e., lecture; Whitehead, 1929). During data collection and analysis, we did not find any challenges to theories of generative knowledge. For example, during classroom discourse analysis, we found that within five class

sessions, the student initiated portions of the discussion went from 42% to 100%. While this dramatic shift occurred during CBI, the instructor encouraged the students to generate topics throughout the course. In other words, our findings do not indicate that case based instruction *causes* students to generate topics of discussion but rather it can be used to encourage students to generate topics of discussion. From the first case discussion session to the third case discussion session the frequency of student's questions and responses increased. However, during the fourth case discussion the question frequency from the instructor decreased and student to student interactions became the discourse pattern. Here students initialized questions, made observations of specific instances from the case and suggested solutions to the questions. During session four, the teacher did not initialize or redirect the discussion. The students generated the entire discussion.

Theories of the ill-structured nature of teaching examine how teachers need to be prepared to synthesize and orchestrate many sources of information simultaneously while making hundreds of decisions each minute (Clark, 1988; Leinhardt, 1986). Meanwhile, preservice teachers tend to want to know the specific steps necessary to teach a child to read and write. The challenge is to help preservice teachers understand that simply following the steps of a teaching strategy is not all there is to teaching reading or writing. During data collection and analysis, we found that the students gave alternate explanations and analyses of the cases. The individual interviews inquired about the student's perception regarding the ill-structured nature of teaching by asking, "Is there a right and wrong way to teach Zane and Julie? Explain." Student's responses consistently indicated an awareness that there were many ways to provide appropriate instruction.

Stacy: The way they did it was right, but you could also do it differently. And that would have been fine too.

Jill: Everyone has their own way of teaching. You learn by experience and change from there. As long as you see good results there is no right way.

The students recognized that one set of explanations was not necessarily right or wrong, simply different. The students even commented that they never realized there could be so many instructional alternatives. However, after five classes which used CBI, the students asked which epistemological stance was correct for literacy instruction: constructivism or objectivism. In other words, while the students were willing to accept different analyses of children's literacy abilities and different instructional methods to foster the children's literacy abilities, they still wanted to know which epistemology was right and which one was wrong. Their interest in diverse perspectives did not transfer from ideas for Zane's instruction to ideas about epistemologies. Herein, the value of divergent perspectives did not transfer from one area of teaching to another.

Summary and Discussion

While using case-based instruction to prepare elementary literacy teachers, we found the need to revise or extend theories of anchored instruction, reflective thinking, situated cognition, generative learning, and perceptions that CBI can prepare teachers to deal with the ill-structured nature of teaching. Current perceptions of anchored instruction are unidirectional (anchor-->helps learners understand one another's background experiences). This study indicates that the anchor and the learners' divergent experiences may be reflexively related (anchor <--> divergent experiences). Further investigations may want to examine if this reflexive relationship emerges in other settings. If so, researchers could ask such questions as: How similar do the divergent experiences need to be before they are reciprocally related to the anchor. In our study, the divergent experiences included a field experience in which each preservice teacher was analyzing a small group of elementary children's literacy abilities and then designing, implementing, and evaluating lessons to support these children's literacy development. While the preservice teachers worked with different children in different classrooms, it could be that their divergent field experiences were similar enough to foster a reflexive relationship with the anchor (case). If the preservice teachers are not involved in similar but divergent experiences, are their experiences and the anchor still related? Answers to these questions may help teacher educators understand the role and value of integrating field experience discussions with CBI. Such answers may also help instructors in other professional schools (e.g., business and medical) to determine the value of providing "field experiences" that correspond to their CBI courses.

Theories of reflective practice advocate the value of helping teachers develop reflective metacognition. We found that preservice teachers' reflective practice may not transfer from one domain of thinking to other domains. While the participants' inabilities became a valuable focus for further instruction, they raise questions about theories of reflective practice. Specifically, do teachers need to be trained in reflective practice that is specific to each aspect of teaching (e.g., children's literacy abilities, activities which foster children's literacy development who demonstrate certain literacy abilities)? Do teachers transfer their ability to reflect about one aspect of teaching (e.g.,

children's literacy abilities) to other aspects (e.g., instructional practices which foster children's literacy development who demonstrate certain literacy abilities)? How much practice do preservice teachers need before they transfer habits of reflective metacognition from one domain to another? Further studies need to be done in this area.

While theories of situated cognition have been under recent scrutiny (see Anderson, Reder, & Simon, 1996, 1997; Cobb & Bowers, 1999; Greeno, 1997), the discussion continues to focus on the learner. We found that theories of situated cognition can also apply to the instructor. In this study, because the instructor had been an elementary teacher, she remembered viable topics for discussion during class analyses of the cases. However, we were unable to triangulate this finding because only one instructor was involved. In order to confirm or disconfirm this finding, future studies need to be conducted in other CBI settings where the instructor has practiced the profession addressed in the cases. If this finding occurs in other settings, then theories of situated cognition may need to reconsider their focus on the learner and explore the impact it has on the instructor. Such a finding would be important for CBI because it could indicate that instructors who have practiced in the profession may provide higher quality instruction (as evidenced by providing situated knowledge to students) when they use CBI than when they do not use CBI.

Theories of generative learning claim that learners make better connections between knowledge they generate and situations in which they can use the knowledge than when knowledge is dispensed to them (Whitehead, 1929). Our findings indicate that preservice teachers did generate questions and information in CBI activities. Our analysis focused on the dialogue and question interaction patterns that were observed during class discussions. While beyond the scope of this paper, research that examines the nature and quality of questions that preservice ask about a case might inform teacher educators about the preservice teachers knowledge construction.

While studies indicate that CBI can help prepare teachers to deal with the ill-structured nature of teaching (Risko, Yount, & McAllister, 1992), we found that they still wanted right and wrong answers to some issues. In other words, we found that the students' value of diverse perspectives and alternate explanations was situated. They did not transfer the value of diverse perspectives and alternate explanations to different aspects of teaching (e.g., students could generate alternate analyses and interpretations of a child's literacy abilities but wanted to know which epistemology was correct, objectivism or constructivism). Herein, our findings challenge current notions that CBI can help students "develop a comprehensive view of teaching issues and problems much earlier than their peers enrolled in classes not using these cases" (Kinzer & Risko, 1998, p. 198). While this notion may be correct, it may also be limited to the context that the cases have addressed.

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Modeling for Understanding

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Abstract: The call for "using simulations and models" is nearly ubiquitous across modern science and mathematics standards and frameworks (National Council of Teachers of Mathematics, 1998; National Committee on Science Education Standards and Assessment, 1996; Project 2061, 1993). Yet, there is little specification or agreement about what "using simulations and models" means. This paper focuses on one method we used to introduce model design and creation to a group of high school teachers. Teachers with model-building skills can easily customize modeling environments for their classes. More importantly, model building can enable teachers to approach their curricula from a more holistic perspective, as well as gain insights into the inquiry process and the concepts underlying their models. The model construction process served as a means of strengthening the teachers' understanding of subject area content and pedagogical principles, and these benefits extend to their students.

Introduction

For thousands of years people have been creating models to help them better understand the world around them. Leonardo DaVinci built models of flying machines that some claim were inspired by his desire to understand the flight of birds. Sir Isaac Newton described the behavior of physical systems with sets of equations. Jacques Vaucanson built a mechanical duck that actually ingested (and eliminated!) its food (Bedini, 1964). These models not only helped their creators better understand the phenomena that they were studying, but also helped them to convey their new ideas to other people. Similarly, teachers often mobilize the power of models to help their students grasp important ideas.

An increasingly prevalent medium for building models, which enables the exploration of complex patterns and processes, is computer modeling. Like researchers who use models to investigate the spread of disease or the boom and bust cycles of industries, many educators have recognized the potential that modeling holds for developing students' understanding. In fact, the call for "using simulations and models" is nearly ubiquitous across modern science and mathematics standards and frameworks (National Council of Teachers of Mathematics, 1998; National Committee on Science Education Standards and Assessment, 1996; Project 2061, 1993). Yet, there is little specification or agreement about what "using simulations and models" means.

Certainly, simulation models are popular with kids—witness the excitement generated by SimCity (Maxis, 1989) or Civilization (Microprose, 1996)—but how can students best *learn* from models? Though it can be educational to experiment with pre-built models, a deeper understanding comes through building and manipulating models whose underlying structure is accessible (Klopfer, in press; Resnick, Bruckman, & Martin, 1996). However, creating models from scratch is far more time consuming than using models that others have constructed. Deciding whether to manipulate a pre-existing model or design and create a new model takes on special importance in the classroom, where time and technical resources are typically limited. Our research defines model building as an important component of model "use" and therefore focuses on developing ways to support teachers and students as creators, not just consumers, of simulation models.

Several common modeling programs, including Stella (Roberts, Anderson, Deal, Garet, & Shaffer, 1983), Model-It (Soloway et al.) and MatLab, enable model design and creation. Building models in these environments depends on the ability to describe aggregate changes in these systems using mathematical relationships.

StarLogo[1] (Resnick, 1994) offers an alternative approach. In StarLogo, you write simple rules for individual behaviors. For instance, you might create rules for a bird, which describe how fast it should fly and when it should fly towards another bird. When you watch many birds simultaneously following those rules, you can observe how patterns in the system, like flocking, emerge from the individual behaviors. In StarLogo, creatures, which we generically call "turtles,"[2] move around on a grid of "patches", which comprise the environment[3].

This paper focuses on one method we used to introduce model design and creation to a group of high school teachers. The teachers, who were drawn from many departments including Mathematics, English, Science, and History, had varying degrees of experience with computers and modeling—one teacher had never used a computer before the workshop. The following sections describe our method, evaluate its success to date, and suggest some reasons for that success.

StarLogo Community of Learners

Our StarLogo Community of Learners Workshops (Colella, Klopfer, & Resnick, 1999) help teachers develop the ability to create their own models in StarLogo. They experience the whole process of model building, from the conceptualization of an idea through the final implementation, analysis, and presentation of a model. Teachers with these skills can easily customize modeling environments for their classes. More importantly, model building can enable teachers to approach their curricula from a more holistic perspective, as well as gain insights into the inquiry process and the concepts underlying their models.

Workshop Organization

In our workshops, we adopted a learner-centered approach, both to engage participants in building models of personal interest and to minimize the need for lecture-based instruction about programming. We designed the Workshops to foster a playful, cooperative, creative spirit while at the same time providing adequate structure for learning how to build models. To accomplish this balance between structure and exploration, we organized the Workshops around a set of open-ended Challenges and activities that guided participants' explorations and provided the basis for critical review.

Each Challenge was a problem statement that was meant to get participants' creative juices flowing. The Challenges came with sample projects, which teachers were encouraged to explore. The Challenges and accompanying sample projects facilitated model design and construction, built familiarity with the StarLogo environment, and introduced the principles of complex systems. Here is an excerpt from a Challenge:

Introduction

Environmental influences on individuals can be quite important, but individuals frequently exert a strong influence on their environment as well. For instance, beavers build dams—changing the course of rivers; people cut down forests—altering the habitat; and termites eat wood—dramatically decreasing the stability of the original structure. In this Challenge you will combine the effects of individuals on their environment with the effects of the environment on those individuals.

Challenge

Start by thinking about new ways that the environment could change turtle [creature] behavior. You might build a world of patches that affect the turtles' position, color, or speed in different ways. To see an example of this kind of project, check out Speeding Bumper Turtles [a sample project].

Of course, turtles can also change their environment. As an alternative, you might build a project that asks the turtles to manipulate the patches in their environment. Perhaps your turtles will "move" objects in the patches as in the Turtledozers or Termites [sample] projects. How do these changes in the environment in turn change how the turtles react to the environment?

After receiving the Challenge, many workshop participants spent time exploring the sample projects. These samples illustrated some of the principles of, and possible solutions to, the Challenge. Some people chose to

[1] StarLogo is available for free on the web at http://www.media.mit.edu/starlogo

[2] Admittedly, "turtles" is not truly a generic term. It comes from the "turtle" in the Logo programming language.

[3] Picture a giant chessboard with creatures moving around on it, interacting with one another and with the squares on the board.

try out these samples to get some ideas for their own projects, while others dissected these sample projects to develop a better understanding of the underlying mechanisms that produced the observed patterns. Other participants elected to address the Challenge by building their own model from scratch.

Whether or not participants chose to start with the sample projects, the open-ended nature of the Challenge encouraged a wide variety of solutions. Workshop participants chose to investigate and apply aspects of StarLogo that were relevant to their own interests and concerns, and in so doing they created projects that reflected their interests and concerns. The diversity of solutions is evident in the following projects constructed in response to the Challenge that we described. These are just three of over twenty projects that we received, no two of which were alike.

Convection

This project models the process of heating and cooling. The different colored patches cause the "molecules" to heat up or cool down. When a molecule is on a red patch (on the bottom of the beaker) it gets warmer. In fact, the more "red" a patch is, the more it heats the molecule. Conversely, blue patches (on the top) cause the molecules to cool down. Hotter molecules rise to the top, and cooler molecules sink to the bottom where they are reheated, resulting in a convection current. In the sample (Fig. 1a) the hotter molecules are seen rising in the center.

Tortoise and Hare

This project is based on Aesop's classic fable of the tortoise and the hare. The tortoise and the hare must proceed through a racecourse. Along the way, both the tortoise and the hare run into obstacles (the squares seen in the path). When the hare runs into these obstacles it stops and waits a while, but the tortoise keeps on going. You can change the speed of the tortoise or the hare, and can alter how long the hare waits when it runs into an obstacle (by changing a parameter called "laziness"). The magnified sample (Fig. 1b) shows that the tortoise (far right) does in fact beat the hare (far left) to the finish line (the vertical line on the right).

Aggregation

In this project, the environment starts out with one painted patch at the center of the screen. The turtles move randomly. If they walk next to a painted patch, then they paint the patch that they are on and get stuck there. This behavior results in the branching growth pattern (Fig. 1c). While the author of this model didn't know it when she started, this simple process models a well-studied phenomenon, called diffusion limited aggregation, which is a growth process seen in systems ranging from lightning to cities to ice crystals.

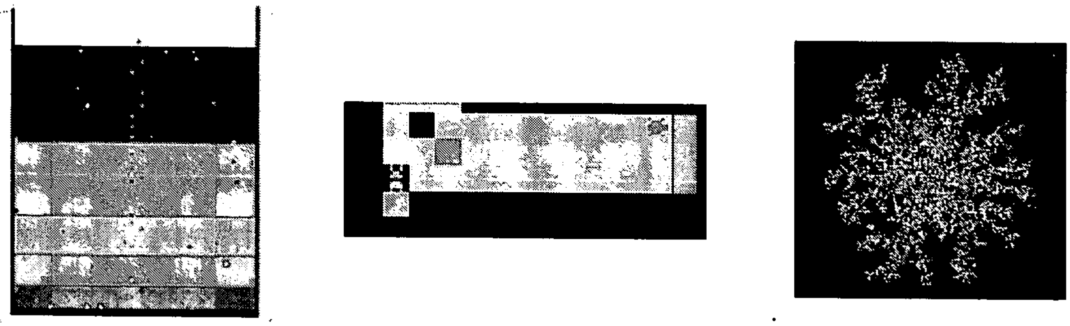

Figure 1a-c: Sample output from the three simulations (from left to right): convection (a), tortoise and hare (b), and aggregation (c).

Many of the Challenges were accompanied by "off-screen" activities that provided another way for participants to connect the abstract notions of dynamic complexity to their own personal experience. For instance, one morning, participants "flew" around the parking lot trying to form cohesive "bird flocks" without the assistance

of a leader. Though we do not provide a detailed explanation of the activities here[4], many teachers reported that the combination of activities and Challenges enriched their ability to think with and about simulations.

In post-workshop surveys teachers described the importance of the off-screen activities. "They [off computer activities] were excellent. They helped frame the big picture." The combination of these activities and the computer modeling Challenges proved to be effective for the teachers. "Pairing off-line and on-line activities [was] very powerful. The games gave us *great* insight into rules and actions which could profitably be explored on the computer [emphasis in original]."

Results

By participating in activities and generating solutions to the Challenges, teachers changed their beliefs about the concepts that they teach and the ways in which they can teach them. In particular, these teachers expanded their knowledge of the nature and role of models in research and education. Many commented that designing and creating their own models greatly increased their appreciation of models' capability to reflect patterns and processes in the real world. They noted that the Challenge structure of the workshops helped them build this understanding incrementally, in a manner that they could adapt for use in their classrooms.

By building a diverse set of models teachers not only created new content for their classes, but also explored different ways to engage students in various aspects of their curriculum. Not surprisingly, teachers reported a higher level of comfort in building and using models at the close of the workshops than they did at the beginning. In addition, the workshops challenged many teachers to rethink their notion of how they and their students build new understandings.

Scientific Method

At its best, the nature of the modeling process supports experimentation and investigation. Unfortunately, many people—including most of the workshop participants—view scientific experimentation and investigation as a rigid set of procedures that must be followed in sequence in order to arrive at a scientifically valid result. During the workshops we created an environment that mirrored the complex, collaborative, and non-linear nature of investigation in the scientific community (Kraut, Egido, & Galegher, 1990; Latour, 1988). After the workshops, both science and non-science teachers alike reported a change in their conceptualization of the scientific method. "[The workshop] supported and encouraged directions away from the 'traditional' scientific method approach, which is almost like 'drill-and-kill' in some classrooms." After successfully solving a difficult modeling problem, one teacher commented that "[this experience] made it clear to me that we enter experiments with good intentions of following the 'scientific method', get some observations [that] lead us astray, and quickly abandon our intentions to follow a hunch." While this methodology could be superficial if used exclusively, some amount of open exploration is a critical addition to teachers' prior conceptions of the scientific method.

On the final day of the workshop, one teacher articulated the following qualities of good experimental design:

Base [it] on previous experience, observations, and play,
Gradually identify possible variables; perhaps gather more information,
Eventually establish hypotheses,
Design experiments, and
Analyze results: draw conclusions that generate *NEW* observations, hypotheses, designs [emphasis in original].

This expanded view does not reject the common notions of experimentation and investigation as much as it places those activities in the context of creative exploration toward a goal. While many people associate the scientific method with only biology, chemistry and physics classes, the reactions of these teachers suggest ways that this pattern of inquiry might be effectively applied in many disciplines.

Teacher and Student Learning

The model construction process served as a means of strengthening the participants' understanding of subject area content and pedagogical principles. While we did not attempt to directly teach participants information

[4] See (Colella, Klopfer, & Resnick, in press) for further information about activities.

about their own subjects, we were pleased that the model building process helped them to confront challenging issues in their curricula. For example, one group clarified their understanding of genetics by building, debugging, and presenting a model of inheritance. Another pair of teachers solidified their understanding of molecular motion. "The workshop has also changed my idea of what programming in teaching is for. It is at its best when it facilitates learning, especially when a concept is better understood. I am pleased with the understanding of molecular motion that Bob and I achieved by trying to get a working model."

As teachers grappled with content-related issues through the process of building their own models, they began to see the value of this process for their students' learning as well. Teachers expressed appreciation for the way that designing and creating models enabled them to push beyond the limits of their pre-existing knowledge. "The class has deepened my understanding of learning. There must be a constant interchange between the abstract and the real. In teaching, I must always lead the students to learn in an open-ended way that also undergoes this interchange." In addition to teaching workshop participants about building models, we also modeled a pedagogical form that is underutilized in high school classrooms. We are pleased that teachers were so enthusiastic about adapting this method for their own use.

Student Results

The benefits of teachers developing simulations, instead of using pre-built simulations, extend to their students, even when the students simply use the models that their teachers created. For example, a few teachers teamed up to produce a series of ecology models and associated curriculum. The teachers then used these materials in their own classes and passed the unit on to a few colleagues for use in their classrooms. Some interesting differences emerged between the two groups of students—those whose teachers had actively participated in the creation of the models and those whose teachers were using materials constructed by others.

Both groups of students were given identical written instructions. The instructions described how to use the simulations and included some sample questions to which students could refer as they explored the simulation. The students were then asked to design and conduct an experiment to elucidate an aspect of the simulation that interested them. Many more students (60% vs. 15%) in the classes of the teacher-developers successfully designed and conducted an experiment, meaning that they identified a topic to explore and then ran the simulation under various conditions to investigate different responses. The other students simply wrote short descriptions of some behavior that they noted in one iteration of the simulation (e.g., all of the birds died) or described scenarios in which they forced the simulation to behave in a particular way (e.g., I couldn't get all of the birds to die).

Another disparity between the students of the developers and those of the other teachers concerned the complexity of the observations that the students made. The observations of the students in the classes of non-developers tended to be one-dimensional, tracking only one species in the simulation at a single moment in time (e.g., the wolves died). Multi-dimensional observations (present in 23% of non-developer's students and 56% of developer's students) addressed the interactions of multiple species and/or the dynamics of a species over time (e.g., a high wolf population seems to drive the sheep population down).

Both sophisticated experimental design and multi-dimensional observations reflect the potential for deep learning on the part of the students. The preliminary stages of our assessment of the effects of teacher model building suggest that such activity may contribute to increased student achievement. We are continuing to track the progress of the teachers and their students. In the future, we will use these results as a way to assess the long-term effectiveness of this teacher professional development program.

Future Directions

During the workshops, teachers have successfully collaborated on interdisciplinary projects. Model building is an inherently interdisciplinary process, and the workshops support and encourage cross-disciplinary teams. Yet, the structure and culture of many high schools make this same collaboration difficult. We are continuing to identify and develop techniques that will enable teachers to recreate the successes that they enjoy at the workshops in their own school environments.

Through the StarLogo workshops, we have attempted to broaden the notion of hands-on learning by providing a concrete, replicable example of learning through designing and creating. The process of exploration and investigation in which teachers engaged during the workshops can be extended to many areas of the curriculum. Teachers who have participated in the workshops note that it is sometimes difficult to integrate these activities with the rest of their curriculum. We believe that the best measure of the success of professional development activities

is their classroom efficacy. Though we continue to modify the workshops to address these issues, we are also creating ways to support teachers in their use of these activities throughout the year.

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Peer Collaboration and the Matrix Planning Simulation

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Abstract: Over the past eighteen years, computer-based teaching simulations have been used by over 2,000 pre-service teachers at the University of Virginia's Curry School of Education. Recent simulations have focused on a two-part lesson-planning activity in which participants first complete a software-driven interactive decision-making task and then attend a one-hour debriefing session during which individual feedback is given and effective planning strategies are discussed. A newly developed software tool, The Matrix Planning Simulation, is being administered to individuals and participant pairs. The current research focuses on assessing the impact of collaboration versus non-collaboration on participant lesson-planning decisions.

Introduction

Over the last eighteen years, while learning goals and technology have changed, participants have consistently rated Curry simulations as useful tools in teacher education (Strang, 1997). The newly developed Matrix Planning Simulation allows participants to focus on the dynamic processes of lesson planning via a easy-to-navigate and flexible windows-based Visual Basic tool (Strang and Howard, 2000). The simulation is currently incorporated in a foundation-building course that all preservice teachers at the Curry School complete early in their professional training. The present study explores the effects of peer collaboration during a lesson-planning task designed to help an unmotivated student.

Peer Collaboration

In an initial behavior-management study, participants were asked to teach a lesson to twelve "simulated" students, several of whom were preprogrammed to misbehave (Strang, Hoffman, and Abide 1993). Performance measures defined how the teachers addressed the misbehavior. No significant differences in the use of effective behavior-management skills were found when comparisons were made between participants assigned to work collaboratively and those assigned to work individually.

In 1999, however, a second computer-based study found significant differences between paired versus individual participation on a less skill-oriented teaching task (Strang and Howard, 1999). This simulation focused on the teacher's sensitivity to individual learner differences during the creation of lesson plans. Participants were given onscreen instructions and a manual but were provided no scaffolding or reciprocal teaching to assist them. Collaborating participants exhibited more complex problem solving as evidenced by their software navigation patterns and responses to a Likert questionnaire at the end of the simulation, while participants working alone exhibited more confusion and less complexity in problem solving.

The different outcomes of these two studies may relate to three key factors identified for successful peer collaboration. In 1987, Johnson and Johnson compiled a meta-analysis of 378 studies comparing individual achievement to achievement in cooperative groups. More than 50% of the studies favored cooperation, while fewer than 10% favored individual learning (Rogoff, 1998). In addition, student success with cooperative learning included these factors:

1. Motivation-This refers to extrinsic and intrinsic motivation. In cooperative learning, learners are held jointly responsible for the product of the activity and individually responsible for contributing to the group effort.
2. Intersubjectivity-This refers to the ability of group participants to communicate and arrive at "common ground." All group members contribute to a common solution or product.
3. Conceptual Change-This refers to the cognitive demands of the task. Cooperative learning is not helpful in skill development or in lower levels of cognitive engagement. Furthermore, the research findings suggest that collaboration may be most beneficial when the learning task requires higher-level problem solving.

The results of the Strang and Howard study (1999), which involved collaboration on a higher-level decision making task, may well reflect the impact of a combination of the three factors.

The Simulation Task

The Matrix Planning Simulation contains several features that are designed to support motivation, intersubjectivity, and conceptual change. The simulation is motivating because it is offered within courses designed early in the pre-service teacher sequence and with activities that directly relate to the stated future career plans of the participants. Intersubjectivity is addressed though the debriefing sessions that follow participation in the simulation and is encouraged by the nature of the computer-based task. Conceptual change is fostered through the sequence of lesson-planning activities that actively engage the participants.

The activities in the new simulation involve defining (1) who the pupil is, including grade level and individual learner traits; (2) what content will be taught, including subject matter, a lesson goal, and a Virginia Standard of Learning (SOL); (3) how content will be delivered; and (4) what post-lesson follow-up activities will be included in the learning experience. Upon completion of the four activities, participants rate the planning experience via eight computer-administered questionnaire items.

Following the simulation experience, all participants attend debriefing sessions. These group sessions provide participants individualized feedback on their performance and the opportunity to discuss the lesson-planning strategies with their peers. At the end of these sessions, participants are encouraged to provide feedback on the strengths and weaknesses of the simulation.

Group Assignment

The simulation exercise was a laboratory requirement in the fall 1999 offering of the Learning and Development course taught at the Curry School of Education. After identifying their teaching preference, the preservice teachers were randomly assigned to complete the simulation individually (N=43) or collaboratively (N=34).

Variables

Two categories of variables were selected to assess planning differences between the two groups.

1. <u>Overall Navigation Variables</u>. These measures depict the path that participants follow as they address the various phases of the simulation. Specific variables address completion time, choice reviews, and choice changes. The latter navigation variables are recorded through returns to previous screens and changes to choice selections pertaining to describing the challenging student.
2. <u>Specific Decision Variables.</u> These measures depict the choices that participants make as they develop their lesson plans. Specific variables address the number of lesson activities, the time allocated to pupil interactions, and the time allocated to specific cognitive pupil activities.

Preliminary Results

Non-collaborating and collaborating data for the six variables included in the two categories were compared via a series of *t*-tests. Table 1 presents the means and standard deviations for a category that included

three overall navigation variables. In this category, non-collaborating participants returned to review former decisions significantly more frequently than collaborating participants ($p < .05$). Non-collaborating participants also changed student descriptions more frequently than did collaborating participants ($p < .10$).

Group	Completion Time	Choice Reviews	Choice Changes
	Mean (SD)	**Mean (SD)**	**Mean (SD)**
Non-Collaborating (N = 43)	7.97 (3.81)	1.28 (2.05)	1.40 (2.27)
Collaborating (N = 34)	8.87 (7.28)	.38 (.95)	.62 (1.46)

Table 1. Means and standard deviations for Overall Navigation Variables

Table 2 presents the means and standard deviations for a category that included three specific decision-making variables. In this category, non-collaborating participants allocated more lesson activities than did collaborating participants ($p < .10$).

Group	Activity Decisions	Pupil Interaction	Cognitive Activity
	Mean (SD)	**Mean (SD)**	**Mean (SD)**
Non-Collaborating (N = 43)	17.74 (8.05)	58.84 (33.68)	37.44 (35.33)
Collaborating (N = 34)	14.68 (5.94)	60.59 (34.64)	40.59 (39.23)

Table 2. Means and standard deviations for Specific Decision Variables

Summary

It is important to note that data are still being collected for the two groups and that no post-debriefing sessions have been conducted. Furthermore, the effects of grade grouping have yet to be studied. While group variances are large for several of the current variables, preliminary analyses still reveal several significant group differences. The meaning of these of these differences will be better understood after data for the current variables are collected for all subjects and after all subjects complete the post-planning group debriefings. The analysis of rating variables generated at these debriefings coupled with the complete data set for the current variables will hopefully provide a clearer picture of both the immediate and the longer-term impact of collaborative versus non-collaborative simulation experiences on lesson planning in the Curry preservice teachers.

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An In Depth Look At How Learning In A Virtual Classroom Impacts On The Curriculum

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[redacted] Operating Systems IV is a subject taught to fourth year IT learners at Technikon Natal, a tertiary educational institution in KwaZulu Natal, South Africa. During 1998 the need to introduce elements of flexibility in this course was identified. As a result, a virtual classroom was used as a communal resource base and a construction site where learners collaborate. To date two cycles of this project have been executed. The new web-based approach to the course has led to substantial improvements in teaching practice. Furthermore, benefits have emerged well beyond the original aims of the project - the process that was set in motion at fourth year level, has begun to transform the broader curriculum. This paper reflects upon the first two cycles of an action research project. It deals with the impact of the World Wide Web on a traditional curriculum. Changing teaching and learning methodologies are discussed.

1 Introduction

One of the many problems experienced in education worldwide is learners' inability to transfer knowledge gained in formal education to the work environment. Candy (in Jones, 1997) indicates that one of the main roots of this problem at on-campus institutions is the excessive use of lectures. Laurillard (in Jones, 1997:1) points out weaknesses in the lecturing approach: "...lectures are not interactive, adaptive and do not allow students time for reflection." The traditional lecturing approach does not promote a sense of collaboration. Passive, isolated learning is particularly limiting for students in the field of information technology (IT), where sharing expertise through teamwork is becoming a major requirement of the profession (Jones, 1997; Fowler, Gasen, Roberts & Saltzberg, 1996). In order to counteract this problem, one of the main trends that has emerged in education is the increasing use of open learning, which enables flexible learning systems catering for diverse learning situations. Computer-Assisted Learning (CAL) has a major role to play in this regard, since the use of the Internet for open learning has become a worldwide trend. According to Lewis (in Plomp & Ely, 1996:377) there are many definitions of open learning, however, what all open learning scenarios have in common is "...an approach which seeks systematically to widen individuals' choice over their own learning."

During an analysis of Operating Systems IV (a subject taught to fourth year IT learners at Technikon Natal), the need to introduce elements of flexibility was identified as part of this action research project. Since the beginning of 1998, when the project was implemented for the first time, two cycles of this project have been executed. Through the cyclical improvement of teaching practice (Cohen & Manion, 1994), the new web-based approach to the course has led to substantial improvements in teaching practice. Furthermore, benefits have emerged well beyond the original aims of the project - the process that was set in motion at fourth year level, has begun to transform the broader technikon curriculum.

2 Virtual Learning For Fourth Year Students

Since all learners studied full-time, but held part-time jobs in the IT industry, they required a flexible approach to the course. In addition, communication between the lecturer and learners was limited to face-to-face meetings during specified periods.

2.1 Aims Of The OS IV Virtual Classroom

As a result of the specific conditions mentioned above determined during a needs analysis, the teaching team (which consists of the subject expert in Operating Systems and an educational technologist) developed the following aims in order to improve the course:

- a more flexible time-table;
- an easily accessible, shareable, up-to-date resource-base for the subject;
- an electronic communication facility.

Furthermore, the lecturer indicated the importance of active learner participation during the teaching process in order to facilitate transfer of knowledge.

The virtual classroom that was constructed as a result aimed to address the above issues.

2.2 Characteristics Of The OS IV Virtual Classroom

2.2.1 Learners Construct A Website

Vis a vis educational research, several warnings have been articulated with regard to incorrect Internet usage (Dowling, 1996; Duchastel, 1996). It is obvious that the Internet will offer no fundamental improvement to education if its use reinforces existing teaching paradigms. Laurillard (in Gilbert, 1997) points out that the mere transcription of teaching material into web pages serves no educational purpose: "Web-based teaching needs to be strategically integrated into the subject matter, teaching processes and learning experiences of a course." (Gilbert, 1997:3) Turoff (1995) states that the objective of using the Internet for learning must not merely be duplication of the characteristics and effectiveness of the face-to-face class but the improvement thereof.

The most rudimentary approach to WWW usage for teaching, is the "...go find out about Bengal tigers" approach, in which students are told to surf the WWW without guidance, to find information (Michelson, 1997). A somewhat more advanced method is the use of a website as a dumping site. This implies that lecturers provide links to on-line resources (lecture notes and external resources) and references to off-line resources. In this instance it is important to provide reviews of links. Accurate reviews enable learners to decide whether it is worth connecting to a remote site and they therefore do not waste time and money, downloading irrelevant information (Cronjé, 1997).

If active learning is a requirement in a resource-based learning environment (such as the WWW), students ought to be taught to build upon resources provided, to actively *find* their own additional resources (making effective use of search engines and bookmarks) and to *evaluate* resources for relevance and credibility (Berenfeld, 1997).

The most advanced use of the WWW for learning is the use of the virtual classroom as a construction site. Content generation by students leads to the active construction of knowledge. Berenfeld (1997:4) states that "...virtual publishing can authenticate learning by setting students' scholarship in the real world." Students can publish on the Internet in a wide variety of formats. The content can vary from text-based information such as links to useful sites to frequently asked questions (FAQs). Summaries of interviews with experts or write-ups of projects and more technologically advanced options such as interactive multimedia components are further examples. Projects in all these formats can be connected to broader knowledge bases through hypertext links.

OS IV learners had to deliver their group and individual projects in the form of web pages. The learners' home pages form the core of the OS IV knowledge base, which is shareable, easily accessible, cost-effective and continuously expanded every year. The OS IV virtual classroom therefore consists of learner contributions that are linked to the study guide, deadlines, instructions and core resources.

2.2.2 An Electronic Discussion Forum

In the constructivist paradigm knowledge is socially constructed (Merril, 1991). Providing students with collaborative problem-solving opportunities becomes important therefore. Turoff (1995) provides substantial research evidence that for mature and motivated learners, Computer Mediated Communication (CMC) can be more interactive and effective

than the traditional (physical) classroom. Collaboration on the Internet can take various forms: student-student collaboration; student-lecturer collaboration; student-external expert collaboration.

Regarding the constructivist learning environment it is important to focus not merely on end *products*, but to emphasise the *process* of problem-solving (Brehm, 1997) and to encourage learner self-reflection (Laurillard: 1993; McManus: 1996). Students must engage in metacognitive exercises which imply reflecting upon individual as well as group learning processes. Examples of how this can be achieved are, inter alia, on-line journals; student homepages; newsgroups; mailing lists (Gilbert, 1996) and e-mail discussion forums (listervs). The most common example of CMC is the use of electronic mail. CMC can be considered essential to a virtual classroom environment, as it personalises online learning.

The OS IV learners were given e-mail accounts and a listserv, in order to accommodate their need for flexible communication and problemsolving.

2.3 What Worked

The most significant benefits of this project have been the way traditional teacher-learner roles have changed, and the particular way in which learner and lecturer usage of the Internet has transformed the curriculum.

2.3.1 Changing Roles

Boundaries between teacher and learner began to blur. Learners were given the opportunity to teach one another. In the process, the lecturer also became the learner, benefiting from the expert-learners' knowledge. In addition the lecturer's role shifted from representative of the knowledge base, to virtual classroom manager, facilitator, mentor and guide.

2.3.2 Life-Long Learning Skills

Previously, the syllabus focused on teaching content only. In the virtual classroom, content was used to help learners acquire the life-long learning skills vital for final year students on the brink of finding jobs in the information technology industry:

- information literacy skills (learners learned how to search for, evaluate and use relevant resources);
- research skills (projects had to be written up from a research perspective);
- communication skills (learners were assigned roles and had to collaborate in groups);
- presentation skills (they had to present projects to the class).

2.3.3 Assessment

A **triangular assessment** method was used:

- Lecturer evaluation: the subject expert in Operating Systems and the educational technologist independently evaluated the project presentations and design of learner websites, while the subject expert evaluated the content of projects;
- Self-evaluation: each student had to allocate a mark to her/himself, based on her/his contribution to the group projects;
- Peer-evaluation: learners reviewed the content and presentation of peer projects.

Examination-based assessment is being replaced by **continuous assessment**:

From the traditional written examination occurring at the end of a semester, no inference has resulted that real learning has occurred in the OS IV virtual classroom. The exam has largely assessed the memorising abilities of learners. Learners who excel in examinations are not necessarily the best candidates. In contrast, the course in its new form lends itself to continuous assessment (in line with the principles of Outcomes-based Education). Learners continuously demonstrate competence by doing research and developing and presenting projects individually as well as collaboratively. It is therefore more appropriate than an exam at the end of a semester to ascertain at the end of each

practical module whether learning has occurred. As a result the end-of-semester examination has become redundant for this course. The OS IV lecturer is currently in the process of motivating for a continuous assessment model. The proposal was recently well received at a faculty board meeting.

2.4 Weaknesses, Problems And Recommendations

2.4.1 Closed Learning Systems Of Other B Tech Subjects

Learning flexibility was restricted by the traditional structure of learners' other subjects. While the OS IV course was run in open learning mode, other subjects were still taught in face-to-face mode. Learners were still required therefore to visit the campus on a daily basis.

2.4.2 Not Enough Use Of The Listserv

As learners saw each other in person every day, there was little need to make use of the listserv. Therefore the discussion of problems could not be captured in electronic format and kept in the form of "frequently asked questions" for future years.

2.4.3 Acquisition Of Internet Literacy At Undergraduate Level

Although the focus of the project remained on the subject Operating Systems, it was necessary to train learners in various aspects of Internet and World Wide Web literacy. Time problems were therefore encountered. Learners recommended that general Internet literacy skills should be taught during undergraduate years.

3 Virtual Learning For First Year Students

As a result of the above recommendation made by learners at the end of the first implementation cycle of the OS IV virtual classroom in 1998, the lecturer initiated a virtual classroom for first year students. A website was designed and implemented in 1999, for the subject End User Computing.

3.1 Aims

3.1.1 Acquiring Browser Literacy At First Year Level

End User Computing is a general Computer Literacy course. Learners can access relevant course materials on the intranet, using a web browser such as Internet Explorer or Netscape Navigator.

3.1.2 Improving Team Teaching

A team of four lecturers has been teaching the End User course, to over a thousand learners from numerous academic departments. Two significant problems were experienced as a result:

- Effective communication between lecturers has been difficult. Lecturers could not easily discuss common problems, or gain access to one another's course notes.
- It is a requirement that all students write a uniform examination, and it often happened that some lecturers had covered certain aspects of a syllabus while others had not.

The End User Computing virtual classroom aimed to overcome these difficulties.

3.2 Characteristics Of The End User Virtual Classroom

3.2.1 An Intranet Site

Course notes and multimedia lessons were made available to learners on the Technikon intranet, through the use of a web browser. Learners would not have the need to browse beyond the perimeters of the intranet site. There would therefore be no need to budget for Internet access.

3.2.2 Multimedia For Different Learning Styles

Quintana (1996) discusses the many benefits of Internet-based WWW education to the learner and the institution. Most of these benefits are related to easy construction of, and access to, a variety of open learning opportunities. He points out that another major advantage of the Internet is that one can use it to devise a variety of ways to learn and pitch it at learners' various learning styles (visual, auditory, inter-personal, intra-personal, linguistic-based and mathematics-based). Although the End User website is currently largely text-based, the plan is to use multimedia components to illustrate the subject content.

3.3 What Worked

During its first implementation in 1999, the End User virtual project highlighted crucial positive and negative aspects. Some of the benefits are:

3.3.1 Customised Course Content

In the past a variety of textbooks were used, in order to cover the syllabus. As the semester progressed, the End User website developed into a customised environment that addressed the syllabus directly.

3.3.2 Collaborative Teaching

Lecturers have had the opportunity to learn from other team members' teaching styles and approach to topics. In addition, other Technikons have expressed an interest in using the customised course content developed during this course.

3.3.3 Quality Assurance

Individual lecturers' contributions to the collaborative website have been visible to anyone on campus and this may well have had a positive influence on the quality of the work.

3.4 Weaknesses And Problems

All problems encountered were related to an inadequate infrastructure:

3.4.1 Bandwidth

Students were highly motivated by this mode of learning. As a result, too much traffic on the network brought the system down several times.

3.4.2 Firewall

Initially students were able to get out onto the Internet and therefore the need for a secure firewall arose in order to keep them within the boundaries of the intranet.

3.4.3 Access To Student Workstations

The already overloaded open access laboratories were unable to cope with the demand for student workstations.

5 Conclusion

"...Once we free ourselves from the mental limits of viewing this technology as a weak sister to face-to-face synchronous education, the potentials to revolutionize education and learning become readily apparent..." (Turoff, 1995).

During the year 2000, the project will be implemented for a third time at fourth year level (OS IV) and a second time at first year level (End User Computing). Other Technikons have expressed an interest in becoming collaborators in both these virtual classrooms. It is hoped that this collaborative action research project will continue to make a constructive contribution to the transformation of Higher Education in South Africa, and to education at Technikon Natal, where the mission is "to become the best educational technological institution in Africa".

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Laboratório Virtual

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Abstract: The virtual laboratory may be an alternative and satisfactory solution for educational purposes based on the learning by doing methodology. When virtual laboratories start being made available in the Internet, students who have access to it will practice the concepts learned in class in such virtual laboratories. The present work intends to describe a project of virtual laboratory construction and to test it in a learning environment to investigate the impacts of systems and technology of virtual labs in education. Also to verify the development of cognitive processes and to evaluate how much it will add to the students learning processes. This project proposes to improve students own knowledge by means of simulated activities and to evaluate which infra-structure (software and hardware) is necessary to support a virtual laboratory.

Introduction

The Internet has been growing around the world in an exponential rhythm. Not only the number of users are increasing but also a larger variety of new services are being offered especially those implemented from the new aggregated functions on the traditional browser, media plugins and helper applications. In this view, the present work proposes a new modality of utilizing the Internet in learning/teaching environments to instigate experimental activities in a virtual laboratory.

Evidences from research in the field suggest that the learned information is stored for longer periods of time, providing that the learner is an active participant of his learning process and that the simulated presentation encompasses the learner's various senses. There is a study which mentions that people retain approximately 25% of what they listen, 45% of what they see and listen and 70% of what they see, listen and do. In this way, whenever students have the possibility to do their practical lessons in the laboratory, chances are that their learning will take place in a more effective way. In addition to that, the facilities of a real laboratory are not always possible to be installed, as it involves high costs, the need of a special area for that, environmental issues have to be faced, security questions have also to be considered, among others. The virtual laboratory may then be an alternative and satisfactory solution based on the learning by doing methodology, mainly for the more technical areas.

From the ninety's on, learning environments based on computers have been developed and theoretically oriented by a set of concepts from the constructivism. According to Piaget, mentioned in Parrat, 1998, in such environments what is being emphasized is the learning proper as a construction process where students are the main responsible characters of their own learning. Diverse constructivist environments use hypermedia as a cognitive tool to give support to the constructing processes of knowledge. In this sense, using

technology in a simulated way (as in virtual labs) has been considered very promising for educational purposes. Such intentional learning environments or environments of productive learning, better known as enriched environments, are interactive, learner oriented, and constructivists, as they engage students in the use of mental abilities of higher levels. Thus, learning is assumed as a constructing process rather than a mere reproduction of knowledge where the students' learning and doing must be under their own control.

When virtual laboratories start being made available in the Internet, all students who have access to it will be able to practice the concepts learned in class by means of activities in those virtual laboratories. A great advantage here is the possibility of allowing all those who have access to the laboratories and which are non-existent in their schools and universities, for being expensive, hazardous, or non-viable. So, such laboratories which are difficult of being implemented, would then exist - virtually – in their premises, and bring beneficial

A virtual laboratory is of great value because it not only allows the use of laboratories of difficult or strict access or even non-existent but also can be used for doing the practical tasks as a kind of preparation, anticipating the use of a real laboratory for an indeterminate period of time and furthermore to be accessible 24 hours a day and seven days a week it can also be used for distance learning activities. It allows as well to modernize the laboratories by means of some experiment simulations which involve equipment or more updated processes not available in school.

Such learning tool or environment - to be more useful - must have a friendly interface in order to be used even by lay teachers in the computing sciences. Perhaps, one of the biggest social benefits of a virtual laboratory is its access availability for all students, via the Internet, no matter their level of knowledge.

Once the Internet sustains multimedia traffic and also offers a variety of tools, methodologies for the development of multimedia applications towards education, it is possible to develop virtual lab constructing methods to be used as an important help for education, providing that a laboratory is an important component in a lesson where students get practical experience. Particularly the Internet & WWW offer good resources for simulation in a real laboratory and use animations and interactivity, which meet the three pillar metaphor that sustains virtual reality: immersion, interactivity and manipulation. They are also present in a structure of a virtual laboratory.

This work intends to present a project of virtual laboratory construction. Various technologies will be tested and eventually be considered for the implementation of this virtual laboratory, including not only the WWW and HTML but also the expansions derived from the usage of CGI, VRML, Java, Javascript, audio and video applications on-demand and realtime among others. This project aims to construct a learning environment as follows:

- To give support to experiments done by a team geographically disperse;
- To investigate the impacts of systems and technology of virtual labs in education, in the development of cognitive processes which they can bring (to evaluate how much it will add to the students learning processes), because one of the virtual laboratory proposals is to allow students to improve their own knowledge; and
- To evaluate which infra-structure in the network level (software and hardware) is necessary to support a virtual laboratory.

Virtual Reality in Education

When developing instructional software, it is important to keep in mind the specific skill levels and learning styles which one is attempting to address, to ensure that the software is fulfilling a need which could not be met using simpler, less costly methods. As described above, students learn through a variety of different mechanisms, many of which are not utilized adequately in traditional educational methods. In addition to not addressing a particular students "preferred" learning style, we all learn more and retain more when information is presented to us multiple times, preferably through multiple channels. Virtual reality not only add to the variety of educational delivery mechanisms, but to specifically address those areas where traditional methods are weakest. Addressing each of the five dimensions of Felder and Silverman's learning styles in turn:

1.On the sensory / intuitive scale, most lectures stress concepts and theories, where students are looking for concrete facts, data, experimentation, and a way to relate the material to a "real" situation. Virtual reality can

provide a tangible representation of abstract concepts, such as a mathematical surface that students can walk on, or a world where "efficiency" takes on physical properties.

2.On the visual / verbal scale, virtual reality is highly visual, (although audible narration is also a valuable component). There is also another dimension to this scale, which is rarely even mentioned because traditional educational techniques have no place for it: non-verbal auditory stimulus. In virtual reality, auditory cues, (such as the sound of a door closing), provide very important contributions to the realism of the overall experience, and this component can easily be expanded to provide educational sound cues, such as the sound of bonds breaking as molecules react, or the changing "pitch" of entropy.

3.On the inductive / deductive scale, virtual reality is a natural medium for free-format explorations and learning by observational experience.

4.On the active / reflective scale, virtual reality is highly active and immersive. The main reason of virtual reality is to pull the user inside the simulation and make him/her an active participant.

5.On the sequential / global scale, virtual reality can help address the needs of the global learners, who must see the big picture, by showing the inter-relationships of the mathematical and abstract concepts with the physical realities described by those concepts.

The educative value of virtual reality is based not only on the knowledge transmission. Generally speaking, to educate children encompasses much higher levels of performance: it goes from the simple transmission of content to the development of capacities and the acquisition of personal and social behaviors, that assist the integration of the individual in the society. The creation of virtual laboratories where the participant can see, hear and manipulate objects as in the physical world, may constitute an important feature in the education scenery since in these simulated realities students will be able to discover, in an active and playful form, the knowledge previously transmitted solely by the teacher.

Allowing the experimentation of new and different realities - which can be more or less close to the real world and whose features and rules will be delineated in accordance with the objectives intended for its creator - virtual laboratories will be able to constitute valueable places of research and inquiry, true laboratories of interactivity and creativity. They not only allow teachers the pure and simple transmission of knowledge – actually more alive and dynamic - but the display of an ampler and more varied amount of information. Still, it will allow the participants - through analysis and experimentation, inquiry and criticism - the discovery of new realities that will assist them to understand and to acquire new knowledge. This task will be carried through with the cooperation of the teacher, who assumes a new role now.

Virtual Laboratory of Physics - Mechanics of Fluids

With all the new and challenging technology that surrounds us nowadays, we believe that students no longer content themselves with a traditional theoretical and teacher centered lesson. They rather seek for situations where they act and interact in teams contacting peers and other teachers who enable them to reach their thirst for some new information which may solve their daily academic problems in less time and above all in more effective ways. Students and teachers are all users of the most modern technological devices, such as radio, television, video, telephony, Internet, CD-ROMs, among other high tech gadgets, which are the result of an enormous technological evolution specially from the second half of this century on but mostly in the last ten years. By the same token, students' expectations follow the same pattern - which in fact still are far from this high tech reality. So, when their expectations are frustrated, learning levels and grades consequently decrease. Providing that it is already possible to have computing tools and technologies easily available in educational institutions it is also possible to use the already existent hardware and software designed for general purposes which can also be used for educational purposes. Consequently new computational technologies can be applied to improve learning situations in all levels of education. Thus, virtual laboratories are very welcome by schools, colleges and universities which seek for improvements and learning assistance in their learning settings as well as pupils are ever more demanding of faster and more effective ways of learning what they need.

Currently, the highly developed technology field of the computer sciences where personal computers are already capable of showing complex animations in real-time, new creation languages are sprouting as well as manipulation of virtual reality, the significant increase of the speed of network connections - Internet backbones as well as domestic connections to the Internet - associated to the great dissemination of the Internet/Information Technology in educational institutions as well as to domestic uses, we believe that all the necessary infrastructure for the remote access and use of a virtual laboratory for pupils has already been made

possible. From this all, a learning environment has been idealized - that takes advantage of all this technological advance - to test the ideas presented above.

An prototype of Virtual Laboratory of Physics is being constructed – The Mechanics of Fluids – which is essentially planned to test and evaluate a set of software and hardware technologies, in order to find the most adequate techniques and technologies for the development of other virtual environments in the WWW with the same proposal.

The Virtual Laboratory of Physics – The Mechanics of Fluids Project – is not an isolated project. Actually, it is inserted in a learning environment accessible by the WWW. This environment will contain:

- Tutorials: in this item, students have all the theory displayed (exploratory and explanatory texts, formulas, illustrations, animations, etc) concerning the subject in question (Mechanics of Fluids). This knowledge is essential to add to the learning process as well as to optimize the use of the virtual laboratory, even applicable to a real laboratory.
- Virtual Laboratory: it consists of graphical animations that intend to express in detail all the components involved in the experiment of the laboratory. This animation will behave as realistic as possible in accordance with the user interacting with the laboratory. For the construction of this laboratory it has been used animations done with the software Director 7.0 and using the Lingo language to control the reactions of the user in the laboratory. This laboratory could be manipulated by students and teachers, through the Internet, via Web, which must have installed the plugin ShockWave in the browser (e.g. Netscape Navigator, Internet Explorer, etc);
- Audio and Video: students will be able to consult at any time a series of videos, through the WWW, in the format RealVideo and also MPEG. They are all about real experiments that had been carried through and recorded in a real laboratory, also with audio of the teacher explaining the experiment. To visualize those videos, it will be necessary plugin RealPlayer for videos in the RealVídeo format and format MPEG can be visualized without the need of a plugin, once the Windows95 and MacIntosh themselves already show it;
- Electronic Mural: students and teachers have a space to display their messages – which are related to the subject in question - in the electronic board to all the members of the group. These messages can express doubts, present responses, tips, explanations, clarifications, etc. The systematics of use of this electronic board is that it allows the same postage privilege to all participants. At last, this electronic board has the same purpose of a message/acknowledgments board of a group of students;
- Exercises: two categories of exercises are presented in these topics. There are the solved exercises where students will be able to verify all steps that involve the resolution of typical exercises on the subject. Also there are exercises to be done where students will test their new knowledge learned on the subject proposed by the laboratory. These exercises are in general objective, of multiple choice, true or false and of matching columns;
- Interesting Links: There are a series of links for pages in the WWW that present topics related to the specific subject proposed by the Virtual Laboratory (Mechanics of Fluids). Also it has links for pages in the WWW for download of plugins necessary for the full functioning of all the functionalities of this virtual laboratory.

As a second stage of this project, it is intended to implement, in this Virtual Laboratory, intelligent agents in order to give better subsidies to the teacher towards the performance and behavior of each student when using the Virtual Laboratory. This is important and relevant to the teacher - once he possesses the data – to be able to, for example, take decisions to correct as soon as possible, the eventual deficiencies that students may present and which have been discovered with the help of such intelligent agents.

Conclusion

Virtual Reality is a technology that still is in a developing stage and much research is being done in hardware as well as in software for the virtual environment implementation. With the use of the prototype of the Virtual Laboratory of Physics - Mechanics of Fluids, even being in a developing stage, it is already possible to observe the improvement in the process of learning of those students who are using it showing a considerable increase in their interest for Physics. Even being an emerging technique, the prototypes that have been developed and the positive results reached here lead us to believe that this is a path that can be followed and always aiming at the improvement of the learning process.

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Challenges to the Implementation of IT in Education:
A Case Study in Hong Kong

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Abstract: The Hong Kong Special Administrative Region (HKSAR) Government, China, promoted the use of IT in education and aimed to have one-fourth of the curriculum incorporated the use of IT in assisting teaching and learning within five years. Three teachers in a primary school in Hong Kong were invited in this study. Each of the three teachers taught part of the subject syllabus with IT. They were then interviewed to express opinions, show feelings, share experience, and give suggestions. They are encouraged to report the encouragement and difficulties encountered during the teaching and learning process. All these first hand experience and challenges they faced are invaluable and are expected to be useful to shed some light on the implementation of IT in education in HK.

Introduction

The Hong Kong Special Administrative Region (HKSAR) Government promoted the use of IT in education and aimed to have one-fourth of the curriculum incorporate the use of IT in facilitating teaching and learning within five years (Hong Kong Education and Manpower Bureau, 1998). Mr. Tung Chee-wah, Chief Executive of HKSAR Government, makes it very clear in his policy address:

> "Within five years, we are aiming to have teaching in at least 25% of the curriculum supported through IT. Within ten years, we aim to see IT being applied comprehensively in school life, and all our teachers and Secondary 5 graduates being able to work competently with IT tools" (Tung, 1997, para 47).

This laid down a direction of change in the education system of Hong Kong in the coming decade. However, this move has put pressure on practicing teachers and teachers-to-be in acquiring IT skill that might not be acquired through traditional teacher education programs. This study attempts to reveal the present situation facing by the teachers of a primary school that tried very hard to meet the target set out by the HKSAR Government.

Background to the Primary School in Using IT in Education

A primary school in Hong Kong is selected for this study. There are about 40 teachers and more than 900 pupils in this primary school. Use of IT to teach is started recently. A room is reserved to convert into a computer lab. Since the lab is still being equipped, the teachers who teach computer classes would need to borrow notebook computers from the general office to the music room (temporarily set as a computer lab). At the moment, there are totally 13 notebooks for teaching purposes. As a result, a class of 40 pupils would need to be divided into several groups of 3 to 4 to share one notebook. This situation will carry on until the computer lab is ready. Nevertheless, it is the Government's policy to finance each primary school one computer lab with twenty computers (except for the pilot schools that might have more support). That means two pupils would need to share one computer in the computer lab under this standard provision. Recognizing the importance to increase pupil-computer interactions, the school head determined to set up a bigger computer lab in order to reduce the need to share computer among pupils. Unfortunately due to the physical limitation, the room could only accommodate 34 computers (2 for teacher's use and 32 for pupils).

Besides providing hardware, the Government also provides technical support through appointing an IT coordinator to the school. The major responsibility of the IT coordinator is to set up the computer lab and provide technical support to the teachers. This newly created position is expected to be a catalyst to the use of IT in teaching and learning.

Background to the Participants

Three teachers from the primary school were participated in this study. They are teachers in mathematics, English and Chinese. All of them have acquired basic IT skill from staff development programs sponsored by the Government and from the Hong Kong Institute of Education (a publicly funded teacher education institute). They are frequent computer users and have tried to produce some simple Computer Assisted Instruction (CAI) with PowerPoint. In short these three primary school teachers have attained the "comfortable" level of IT competency (Hong Kong Education and Manpower Bureau, 1998) that makes them good candidates to use IT in teaching. A teacher is regarded to have "comfortable" level of IT competency when s/he has the capability to use IT tools and make use of teaching resources available on the Internet and the Intranet etc. in classroom teaching and lesson preparation.

Method

Each of the three teachers would teach part of the subject syllabus (i.e. mathematics, English and Chinese) with IT. On the outset, they were asked to make notes on why to select the syllabus they would like to teach with technology and to identify its perceived advantages. They were then interviewed to share their actual teaching experience. This includes the production of their own multimedia teaching materials, preparation to use the multimedia materials in their classes including the technical set-up of necessary equipment and building up of a system to obtain pupils' feedback. In the interview, they were free to express opinions, show feelings and give suggestions. They are encouraged to report both the encouragement and difficulties encountered.

Encouragement

Attract Students' Attention and Bring Fun to the Classroom

It was found, from the interview, that the pupils were paying more attention in the class teaching with computers. The CAI did attract the pupils' attention and the teachers noticed that the pupils behaved better than ordinary classes. Even though the materials presented in the CAI is from the textbook, pupils seemed to have more interest in the CAI than the textbook. One of the teachers said it might be because of the sound she added in the CAI that brought about a more vivid atmosphere to the class. This simple CAI did lighten up a rather boring language class. *"I'm not using IT in every lesson... but I do enjoy teaching with IT. It seems that I have more to share with the kids and I get more responses from them,"* shared by one of the teachers.

"A good teacher should try the best to motivate pupils to learn. With this in mind I

explained one of the teachers. No matter how simple the CAI program was, it is the first and an important step for the teacher to teach with IT.

Encourage Collaboration Effort to Produce CAI

It might be because the positive feedback from the pupils, the teachers felt rewarded from their hard work. Together with the encouragement and support from the school head, the teachers gradually tried out the taste of teaching with IT. To many of those, computers are alien to them. With the help of the IT coordinator, who is responsible for the overall technical support and providing IT training to the fellow teachers in the school, teachers had developed a number of CAI that could be used in class. This collaborative effort and share rewards certainly had built up teachers' confidence in using IT in teaching.

Every teacher in this primary school had tried to produce CAI programs. They started from simple approaches like drill and practice, multiple choice questions, matching, etc. and they are gradually building up their own CAI bank. Each of the teachers did part of the syllabus and they believed that their school could meet the benchmark set forth by the Government.

Difficulties Encountered

Resources Constraints

"I like to use IT in my class but I hate to set up the giant LCD projector every

"The projected image is not bright enough..."

"Remember to book the LCD projector, otherwise..."

These comments did reflect the difficulties facing by the teachers. When teachers want to use CAI in their class, they need to set up the environment on their own. In using computer to teach (e.g. PowerPoint Presentation) in classroom settings, they need to set up a pre-booked LCD projector and connect it to a notebook computer. They may spend 5 minutes in setting up the equipment. To them, it is rather time wasting since they only have 35 minutes to teach. Moreover, there may be occasion technical problems that they may take extra time to fix. Hence they need to prepare some activities for the pupils while they're setting up the necessary equipment. This is a rather discouraging situation.

Apart from not enough hardware, lacking of quality CAI materials is another impediment. Although there are CAI materials currently available in the market, most of them are either not well design pedagogically or not fit for the syllabus. As a result, teachers

in the primary schools developed CAI materials on their own. This had inevitably imposed extra workload to the teachers.

Unclear Direction

"I think the Government could do more, it seems that we are losing direction in this information one of the teachers critiqued. The Government does not have a clear direction to guide the school to implement IT in education. The Government only set up the benchmark but did not provide enough guidance for the teachers on how they would adopt to this changing education environment. Teachers were rushing to attend IT training courses even though they might not know whether the courses were suitable to them. In many cases, frustration followed when there were discrepancies in expectation. One of the teachers recalled: *"I have attended a course on multimedia, but when I finished this 30 hours of training, I did not have any chance to use a scanner, not to mention on how to produce a sound file."* Another teacher added, *"I'm not interested in the computer hardware part. After all, I have forgot most of it. Fortunately, I still remember how to use PowerPoint".*

Suggestions and Experience Sharing

Who Should Do It?

"Teacher may not be the best candidate to develop CAI materials. The publishers may be the appropriate party to produce CAI materials just like publishing textbooks and teachers would then make the judgment to choose", said one of the teachers. *"Publishers may not be the best one to design CAI courseware but they are more professional in terms of production cycle, more accurate drawings, more attractive graphics, more research, better media production, etc."*, added another.

However, publishers in HK are not enthusiastic in producing interactive multimedia programs for the teachers. Some of them did attach CD-ROMs in textbooks but they are just multiple choice-type tests or simple matching exercises. This is certain not what these teachers expected and is far from what IT in education is about.

The three teachers had developed several simple CAI programs with PowerPoint. *"I have made one for mathematics but I would develop one for teaching Chinese later. I would make use of this CAI program several times but teaching different things such as reading comprehension, punctuation and grammar. It's more cost effective,*
teaches mathematics and Chinese. *"I've done one for teaching English. I know I can improve it but I don't know how to synchronize the animation and the voice,"* said the English teacher with disappointment. *"We think we can develop some innovative CAI programs provided there are enough multimedia facilities,"* said the teachers with confidence.

We wonder whether the teachers in HK are like the three teachers we interviewed. They seemed to have the motivation and energy to produce innovative CAI programs. Come back to the question. Who should do it?

How To Do It Well?

"Staff development is of crucial importance to promote IT in education", commented by the three teachers. To bring about successful teaching and learning with IT, quality training is a key factor. Only when the teachers are well equipped, they then could have

creative use of the technology. In this respect, we should on one hand provide quality IT training courses to the in-service teachers. On the other hand, teacher education programs should incorporate such training for the pre-service teachers. Only if there are quality training-courses available, the road to the success of effective teaching and learning with IT could be visualized.

To enhance the IT competency of teachers, IT training courses are not enough. Teachers in this primary school adopted a mentoring system. Those with better IT skills are encouraged to help those with less. Though the effectiveness of this approach to improving the overall IT competency of the school should not be over emphasized, the teachers do show great interest and are highly motivated to produce CAI programs when there are somebody ready to help.

What To Do Next?

At present, the use of IT in education is in its infant stage. It is still uncertain that use of IT to teach will yield effective learning. *"We don't know the effect (of teaching with IT) yet, but I felt that the pupils like it very much"*, shared by one of them. However, IT in education is more than the use of IT in teaching. We should also encourage learning with IT. By developing a culture to use IT to learn is what we should do next. We should let students use computers in their spare time such as recess or after school so that they would acquire the basic IT skill. *"There are four computers in each of the classroom in the primary school I visited. The pupils there enjoyed browsing the World Wide Web and playing educational games. It brings fun into learning"*, one of the teachers admired.

What actually is IT in education? We supposed it is a culture to use IT in both teaching and learning. We think developing this culture is what IT in education is about.

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The Matrix Planning Simulation: Preparing Preservice Teachers To Work with Unmotivated Students

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Abstract: This paper describes a Visual Basic simulation designed to provide participants with an opportunity to plan lessons for unmotived students and then to compare their planning decisions with those of classmates and/or other teacher cohorts. The Matrix Simulation, which can be completed individually or collaboratively in less than an hour, guides participants through a series of windows that address four important aspects of lesson planning. These include defining key characteristics of an unmotivated student, selecting appropriate lesson content, deciding upon an activity sequence, and developing post-lesson experiences. Initial field testing of the simulation reveals that it is both easy to use and offers participants valuable insights relating to lesson planning for unmotivated students.

Introduction

Since its inception in 1996, the Teaching Decisions simulation has enabled preservice teachers at the University of Virginia's Curry School of Education to explore fundamental aspects of lesson planning. Early versions of this simulation provided teachers-in-training as well as experienced teachers with clear feedback concerning their planning decisions regarding student spatial and activity assignments (Strang, 1996). Participant feedback prompted the refinement of planning goals to focus on those students who display low intrinsic motivation in the classroom (Strang, 1999). A newly developed Visual Basic tool, the Matrix Planning Simulation, focuses on planning lessons for unmotivated students. Differing from its predecessor, this simulation promotes a more open decision-making experience in which navigation is more intuitive and less regulated by preset instructions. In addition, participants can customize the experience by selecting a specific grade level and a student who presents a challenge that they anticipate encountering in their future classrooms. Finally, the activity assignment portion of the new simulation has been expanded from a sole option to a matrix that allows participants to develop as many as four interrelated activities.

Preservice teachers at the Curry School complete the new lesson-planning simulation as a laboratory assignment in a large lecture-based Learning and Development course that they complete early in their academic programs. The simulation can be completed individually or collaboratively in less than an hour. Task completion involves signing out program disks and instructions at the library, completing the simulation at a convenient PC computer, returning the disk--with its file records of participant decision making--to the library, and finally, attending a group debriefing session.

The purpose of this paper is (1) to describe the basic interactive features of the simulation, (2) to discuss the components of the post-planning group debriefing sessions, and (3) to offer preliminary research findings pertaining to the initial field testing of the new simulation.

Interactive Features of the Simulation

The interactive phase of the simulation consists of three parts: registration, lesson planning, and post-planning evaluation. Navigation through all phases is accomplished via clearly marked keyboard and mouse actions. During registration participants enter two pieces of information: (1) a pre-assigned identification number to create a unique performance data file for each participant or participant pair and (2) a name identifier for personalizing the post-planning feedback reports that trace the chronology of participant decision making during the simulation.

Lesson-planning Phase

The lesson-planning phase focuses on developing a productive learning experience for a student who presents clear motivational challenges. This phase addresses four important questions: (1) What are important characteristics of this student?; (2) what is the nature of the lesson content?; (3) what activities will link the student to the content?; and (4) what post-lesson experiences can be employed to further promote learning in this student? It is important to note that as participants sequentially navigate through the four parts of this phase, they can, at any time, review and/or change any decision that they made at any point in the planning.

Learner Characteristics

The first two windows in the lesson-planning phase allow participants to define important characteristics of a typical unmotived student that they have worked with or anticipate working with in their future classroom teaching. The first window requests information on student grade level (elementary, middle school or high school), gender (male of female), and motivational challenge (passivity or hyperactivity). A student name is also solicited. The second window presents a series of *Yes-No* student descriptors that range from family and home issues to social and emotional classroom issues. Participants can also enter additional text to further define what they believe to be key student characteristics not included in the option array.

Lesson Content

The second planning sub-phase is anchored to a window that displays a series of four options for determining the specific content that will be included in the lesson. These options include identifying a lesson subject area, choosing a State of Virginia Standard of Learning (SOL) goal (Virginia Department of Education, 1999), selecting a specific SOL lesson, and stipulating the length of that lesson.

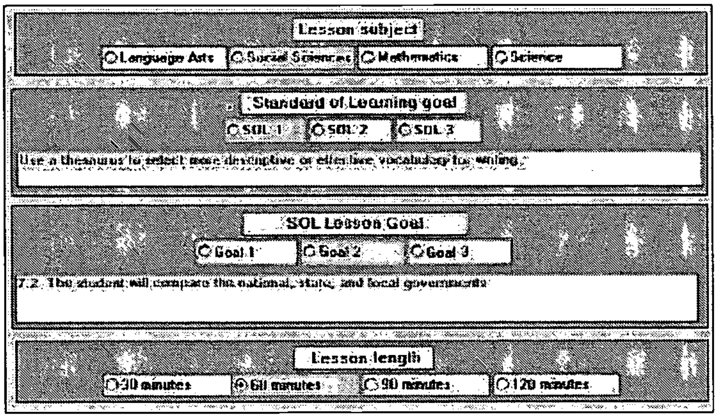

Figure 1: Option window for defining the content portion of the simulated lesson plan

Lesson Activities

The third planning sub-phase involves the construction of a lesson activity matrix. The dimensions of this matrix are defined by the number of activities (1 - 4) that will be completed during the lesson and the five variables that define the nature of each of these activities. The five activity-specific variables include (1) the behavior that the student will exhibit; (2) the size of the group, if any, in which the student will work; (3) the physical instructional aids that will be used; (4) the anticipated level of cognitive processing that the student will employ; and (5) the percentage of lesson time that will be devoted to this activity. The activity matrix displayed in Figure 2 denotes a three-part activity sequence that begins with the teacher briefly introducing the lesson to the class, followed by a relatively lengthy period during which the student collaborates with a classmate in solving problems at a computer station. The lesson concludes with a class discussion that addresses how well students understood the current SOL lesson content.

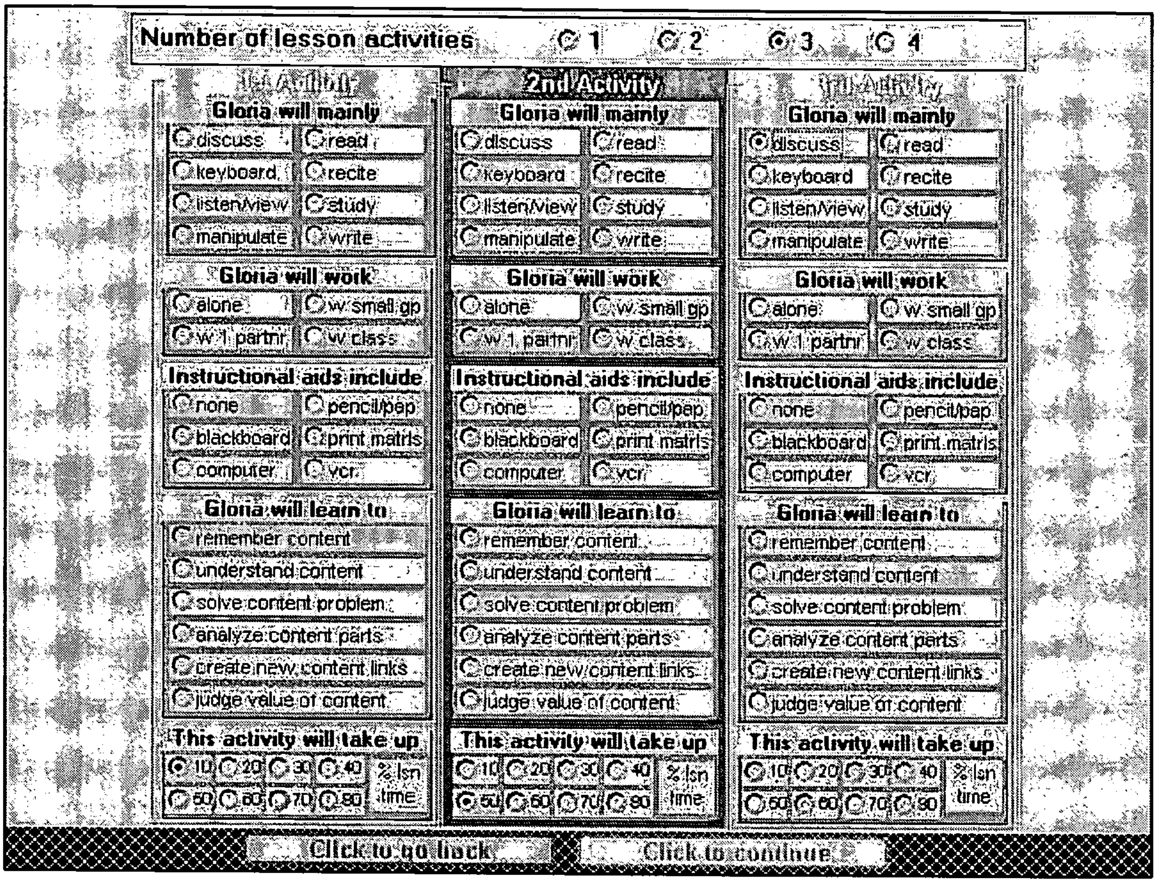

Figure 2: Option window for developing the lesson activity matrix

Post-lesson Experiences

The fourth planning sub-phase allows participants to determine how, if at all, the student will be helped with the current SOL content beyond the bounds of the activity sequence defined by the third planning sub-phase. Help options include one-on-one tutoring, customized homework, conducting a conference with the student's parents, and conducting a conference with a special-needs school counselor. A text box at the bottom of the window allows participants to submit their own suggestions for post-class assistance.

Immediate Post-planning Evaluation

Immediately following the lesson-planning phase of the simulation, participants complete a two-window eight-question rating scale of the simulated planning experience. Once this phase is initiated, there is no opportunity to return to the previous lesson-planning phase. Items range from ratings of the simulation's ease of use to its providing them with new ideas about how to teach. Participants can toggle across these windows, entering, reevaluating, and changing rating decisions until they wish to exit the program which is accomplished via two simple keystrokes.

Post-planning group debriefings

Participants attend one of several sixty-minute group-debriefing sessions within several weeks after the completion of the simulation exercise. At the onset, they receive individual printed reports that clearly describe the complete progression of the mouse movements and key presses that define their decision-making during the simulated lesson planning. After reviewing these Event Records, they are encouraged to share their planning decisions with classmates. During this interactive portion of the session, a group leader attempts to help the discussants to identify both common and individualized elements in their planning. After a short wrap-up, the participants individually complete an evaluation form that marks the end of the simulation exercise.

Preliminary Field Testing

Initial findings obtained from two fall 1999 presevice cohorts confirm the Matrix Planning Simulation's utility. During the exercise, collaborating participants worked in pairs while non-collaborating participants worked alone. Analysis of post-planning evaluation data reveal that 100% of the 34 collaborating teachers and 95% of the 43 non-collaborating teachers rated the simulation as easy to use. Completion times further confirm the simulation's ease-of-navigation. Completion times for collaborating and non-collaborating teachers averaged 8.9 and 8.0 minutes, respectively. Finally, even though there was no opportunity to contact the course instructor or any members of the simulation team during the decision-making portion of the exercise, valid data sets were retrieved for all participants that completed the exercise before the writing of this paper. A thorough discussion of the research findings derived from these data is found in a second SITE '99 paper (Howard and Strang, 2000).

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Application of Information Technology Teaching in a Hong Kong Primary School: A Road Too Far?

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Abstract: This paper is a record about the tryout of the application of Information Technology (IT) teaching in a Hong Kong primary school by a lecturer in a local education institute. The paper discussed the preparation for the IT teaching, the problems encountered and the limitations faced during the tryout. The implication of IT teaching is discussed and projected to the Hong Kong Special Administrative Region (HKSAR) Government's policy on IT teaching in primary schools. The paper is presented along with a 7-minute documentary video about the experience of IT teaching of the lecturer in a primary school classroom. In-depth interview is conducted on her expectation, problems encountered and her opinions on IT Teaching.

Synopsis of the documentary

The documentary program is about the practicability of application of Information Technology Teaching in a Hong Kong primary school. The Hong Kong Special Administrative Region (HKSRA) Government strongly encourages quality teaching with Information Technology. In 1998, the HKSAR Government had presented a consultation document about the Information Technology for Quality Education, Five-Year Strategy 1998/99 to 2002/03. In this consultation document, the Government proposed a lot of objectives in IT teaching, for instance, by 2002, 75% teachers should be "comfortable" IT users; 25% of the school curriculum should be taught with the application of IT. (Hong Kong Education and Manpower Bureau, 1998)

In this documentary, a Lecturer of Hong Kong Institute of Education (HKIEd) has tried to implement IT teaching in a primary school in 1999, three-year ahead of the benchmark in 2002. Winnie, Lecturer of the Department of Science, was involved in a six-week attachment scheme in a primary school in March 1999. She was assigned to teach "General Studies" in primary 4 and 5. Apart from gaining primary school teaching experience, she

wanted to find out the practicability of IT teaching in a primary school. Throughout these six weeks of attachment, Winnie had made use of a lot of IT equipment in her teaching. The equipment included a notebook computer with self-produced computer-aided instruction programs, a LCD projector, a visualizer, an OHP, a wireless microphone with PA system and a laser pointer.

The practicability and limitations of her tryout in primary school are just liked ripples in a pond. Her experience has tested the practicability of the Government's policy on IT teaching and set up an example to primary schools about how to implement the IT teaching

.

Treatment

The video program is in the treatment of documentary targeted for the Tertiary Education Institutions and the primary schools' policy makers and administrators. The format is in PAL VHS system.

Style

The major portion of the program is about the process of using IT in the classroom. The entire recording is done by DV camcorder with natural fluorescent lighting. The purpose is to have good quality of shooting under normal classroom lighting so as to minimize the interference to the normal classroom activities. The documentary is basically a reflection of Winnie's experience, inserted with classroom activities and necessary narration.

Structure

The documentary is divided into four parts:

1. Classroom activities about the application of IT in primary 4, the limitations and how to solve
2. Winnie's sharing about her objectives in using IT
3. Support behind the IT teaching in the primary school
4. Projection of Winnie's experience to HKSAR Government's Policy on the implementation of IT teaching

The linking of the four parts is by means of narration and Winnie's responses during the interview. The main emphasis on the response of Winnie is to purposely show the personality of Winnie. Female sometimes is stereotyped for technologically weak. Winnie's using of the technology demonstrated that IT teaching in classroom is not too difficult for female. This would give confidence to the primary teachers since most them in Hong Kong are female.

The Script

The script is originally written in Chinese and now is translated to English for presentation. Here is the translation of the script.

A lot of people walking in a dark corridor and say

Wrong classroom

Winnie talks to camera

Computer education is good, good, good.

I'm tired. Always bending to strike the keyboard wears my back.

Sometimes it's embarrassing: you are the only one in the whole school doing these things.

Narrator

The one pushing the trolley is Winnie. Her role today is a General Studies teacher for Primary 4 at the Tai Kok Tsui Catholic Primary (PM) School.

Her way of teaching is very different from other primary school teachers in Hong Kong. She uses quite a lot of education technology equipment to assist her teaching.
This equipment include:
Overhead projector
Screen
Visualizer
LCD Projector
Notebook computer and self-designed computer aided instruction software
Laser pointer etc.

Why does Winnie need these equipment for her classes?

Winnie talks to camera

I want the kids to experience. It is not difficult to teach them all the stuff. But teaching them all the materials do not mean that they will learn it...I want them to have a stronger impression.... For example, the computer software we use today can show different landscapes by inputting different years. Overhead projector cannot produce this effect.

Narrator

In fact, Winnie is not a primary school teacher. She is a lecturer at the Department of Science, Hong Kong Institute of Education. She is participating in an attachment scheme of the institute. Under this scheme, she has to teach primary 4 and primary 5 General Studies at Tai Kok Tsui Catholic Primary (PM) School.

The syllabus of General Studies covers a wide scope. In these six weeks, Winnie is expected to teach the following topics:
Knowing the Earth
The Earth's Crust Movement
Continents and Oceans
Knowing the Maps
Location of Hong Kong
Existing historic sites in Hong Kong
Pre-colonial of Hong Kong

To Winnie who has never taught at any primary school before, this is a whole new experience. She has always been teaching post-secondary students, in-service teachers, principals, etc. Her lectures usually last two to three hours. But her students this time are primary 4 children. Each class lasts only 30 minutes. A bigger challenge is that she has to use a lot of education technology equipment and self-designed computer-aided instruction software. The problems she encounters in the process are unimaginable!

For example, on the first day, she enters the classroom during recess, way before her class begins to set up the computer and the LCD projector. She adjusts the projected image and ensures everything is ready. Then when class begins, the amplifying system goes wrong.

Although it was not a smooth beginning, it went ok afterwards. Nevertheless, problems do appear.

Winnie talks to camera

I still think the cord is a pain. Every time I push the trolley into the classroom, I have to move the machine onto the desk. It's rather heavy. One time my clothes got trapped and it was quite embarrassing.

After all, they are electrical appliances. One time, the machine suddenly stopped and I couldn't figure out why. In fact it was only because of a loose plug.

Narrator

What do students think of this new way of teaching?

Two weeks later, Winnie received the first feedback during her primary teaching experience.

Winnie talks to camera

Computer education is good, good, good.

Narrator

Whether Winnie's trial is successful remains to be seen. But behind information technology teaching, there is a tremendous need for technical and resource support. For example, the computer-aided instruction software used in the classroom was designed and produced by the Centre for Learning, Teaching & Supervision (CeLTS) at the HKIEd in not more than a month time. All education technology equipment was loaned by the CeLTS. Technicians of CeLTS are assigned to provide onsite support for the first week.

If her role changes and Winnie is a real primary school teacher, would she have used these methods to teach?

Winnie talks to the camera

No for a few reasons: heavy class load. Look at my present workload, the assignments I have to grade, and the number of lessons I have to teach. I would not have had so much time to prepare. Second point, no matter how much I would like to, I would not have been able to produce such a program. This is a big problem.

Narrator

Winnie's attempt is like ripples in a pond. Three months after her attachment, Tai Kok Tsui Catholic Primary (PM) School invited Winnie back to the school to share her teaching experience. Her colleague who designed and produced computer-aided instruction software was also invited to share his experience.

Step by step, Winnie is doing what the Hong Kong Government has been advocating: information technology teaching. She has started the first step. How far do we have to go before we reach the information technology teaching as proposed by the Government?

Winnie talks to the camera

It's good to use IT in teaching. Teachers do not have to worry. The Government's IT education does not mean we have to use IT every second, every minute... For example when I teach map reading, although I only use the overhead projector along with activities, I have used the computer to prepare the whole process. I scan the map into the computer and print it from a color printer. This whole process depends on information technology. It seems demanding to teachers, but we just have to take one step at a time!

End of the script

Summary of the problems encountered

1. Local context CAI program is limited in Hong Kong. It is difficult for the primary school teachers to produce the CAI program by oneself alone. Most importantly, primary school teachers do not have adequate knowledge to produce CAI programs even if they want to do so.

2. Hardware provision for IT teaching is limited in primary school. Even the school has procured enough equipment for IT teaching, the incorporation of the equipment into primary school setting needs further consideration. The kind of trolley pushed by Winnie is acceptable for six weeks of teaching, but it may not be realistic and practical for teachers to push the trolleys all the days walking through the corridor.

3. Technical support in primary school is limited. Simple technical problems such as a loose plug will stop the teacher from teaching. The teacher will be helpless to decide whether to fix the problems in front of the class or proceed to teach without the planned activities with the equipment.

4. 35 minutes per class in primary school does not encourage IT teaching. Teachers have to prepare a lot while the time for each lesson is that short.

5. Too much workload in primary school will discourage the primary school teachers to make use of IT teaching.

Reflection

6. Referring to the Consultation Document on the Information Technology for Quality Education, Five-Year Strategy 1998/99 to 2002/03 presented by HKSAR Government, the term "Information Technology" has not been defined. Looking into the chapter about "Vision", it stated that the vision of the Government is to arouse and maintain the students' motivation to learn. The government hoped that with the use of

IT, teaching and learning would gradually migrate to a more innovative and interactive mode. The Government aimed to have teaching and learning in 25% of our curriculum supported by the use of IT in five years' time. (Hong Kong Education and Manpower Bureau, 1998)

At the end of 1999, the Curriculum Development Institute of Education Department of Hong Kong had presented another Consultation Document: Information Technology Learning Targets, to the public for comment. Though this Document still does not clearly define the definition of IT Teaching, it does provide some guidelines for the implementation of IT for learning in different stages of development. It states that from Primary 4 to Primary 6, students are expected to make use of IT tools in learning activities. Students should have the opportunities to get access to information via computer networks with support of teachers. (Curriculum Development Institute, 1999)

Based on these two documents, we may summarize that Information Technology is a mean to enhance teaching and learning. It should be innovative, interactive and students should get access to computer networks with support of teachers.

It is far from conclusion that Winnie's tryout is a successful one in IT teaching as proposed by the Hong Kong Government. Usually when talking about information technology, we are referring to two aspects. In one aspect, we are referring to the technological aspect about the integration of text, graphic, audio and video into the computer system and controlled by computers. In the other aspect, we are referring to the interactive nature of the system. (Waterworth & Chignell, 1997) In the first aspect, we can say that it is referring to the presentation aspect while the second aspect is referring to the learning aspect. Winnie's tryout is more like the first aspect about IT teaching. It needs further proposal and discussion to find out what the IT teaching in Hong Kong primary school should be.

2. Winnie did not use computer only in her primary school teaching; she had made use of other equipment such as overhead projector and visualizer. If we say that Winnie has demonstrated a tryout of IT teaching, could we say that she has demonstrated a tryout of the application of education technology in primary school teaching? "Education Technology" generally refers to the introduction of computers and related pieces of equipment to the classroom. (Wenglinsky, 1998) If it is the case, are we having a wrong agenda for primary school IT teaching? It needs further discussion on whether quality teaching with information technology or with education technology.

3. Six weeks of attachment conducted by Winnie is too short to conclude whether her way of teaching is successful or not. More teachers should try on using IT teaching and more interviews or questionnaires should be conducted for further discussion on the effectiveness of IT teaching in primary schools.

Conclusion

"It seems demanding to teachers, but we just have to take one step at a time."

Winnie's opinion in IT teaching is quite right in describing the situation now in Hong Kong. Though a lot of schools are encouraging the application of IT teaching, most of the teachers are still afraid of the policy. The reason is simply that technology and teaching together will create tough issues that education must address. (Rothenberg & Oglan, 1999) It is hoped that Winnie's experience will not frighten the primary school teachers while on the other hand, will facilitate more teachers to take one step forward on IT teaching.

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SPECIAL NEEDS

Section Editor:
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In late January, the Technology and Media Division of the Council for Exceptional Children held the TAM 2000 Technology Access Conference in Milwaukee, Wisconsin. The wide variety of presentations, ranging from discussions of assistive technologies, new hardware and software developments, and inclusion, showcased the innovative thinking, which has occurred in the past few years in the area of technology access for individuals with disabilities. Most technology conferences include sessions covering technology access. We will see more conferences, such as SITE, which provide a major strand focused on technology access, and conferences, such as the CEC conference in Milwaukee, which showcase the effective use of technology to improve educational opportunities and increase the independent living of individuals with disabilities and for those who are gifted.

The inclusion of web-based information into the curriculum of those who work with individuals with disabilities provides yet another tool for our parents and our teachers. The March 1998 final regulations for the Individuals with Disabilities Education Act (IDEA) require that accommodations for students with disabilities include assistive technology, therefore, student IEPs must address these needs for assistive technologies. The articles in this section of the SITE proceedings display the wide variety of research and study which is being devoted to the inclusion of technology into the daily lives of individuals with disabilities. Research continues, and the articles presented here provide an additional source of information for those with questions. We have teachers helping parents helping students helping teachers ... these are very admirable goals for any organization.

HAWAII SPECIAL EDUCATION TEACHER INDUCTION

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Abstract: The purpose of the *new* Hawaii Special Education Secondary and Elementary Teacher Induction Program is to enhance pre-service and intern teachers' practices of classroom management, parent/community communication, and technology usage throughout their first year of teaching. Participants in this program are familiarized in the unique culturally diverse traditions and procedures of their school communities. The Department of Education in Hawaii has projected, between now and the year 2005, a need to hire 200-250 special education teachers annually. Darling-Hammond (1995) argued that collaborations among teacher educators, beginning teachers, and experienced teachers have resulted in shared knowledge and norms of practice that further the development of the profession. The participants attended seminars to receive training in utilizing five standards of effective pedagogy (CREDE, 1997). Classroom instructional technology of PowerPoint presentations, overhead slides, digital camera images and electronic mail are modeled, and pre-service and intern teachers implement their usage in their classrooms with relevant curriculum.

Introduction

Student populations are becoming increasingly diverse in America. A successful teacher must be able to teach in an increasingly culturally diverse classroom. Teachers must work with other professionals, para-professionals, parents and the community to accomplish this success. It is very important for this collaboration as school districts have a duty to make good faith efforts to include students with disabilities in regular education classroom settings. The least restrictive environment (LRE) provisions of the Individuals with Disabilities Education Act (IDEA) require that children with disabilities be educated in regular education classroom unless "the nature and severity of the disability is such that education in the regular class with the use of supplementary aids and services cannot be achieved satisfactorily" (IDEA, 1997). Special education teachers, general education teachers, social workers, administrators and others are beginning to collaborate for the successful educational development of student teachers. Darling-Hammond (1995) argues that collaborations among teacher educators, beginning teachers, and experienced teachers will result in shared knowledge and norms of practice and further the development of the profession. The literature of practice in teacher education urges reform that includes collaboration across disciplines essential to educating teachers for increasingly diverse student populations (Miller & Stayton, 1999). Collaboration amongst teachers and other professionals is not complete without the collaboration of parents and the broader community. Effective family-school collaboration depends on professionals who are (a) sensitive to their own cultural experiences, values, and attitudes toward ethnically, racially, and culturally diverse populations, socio-economic levels, and gender groups; (b) knowledgeable about the linguistic, cultural, and familial backgrounds of the children and youth in their classes and the larger society; and (c) culturally responsive to and inclusive of diverse students' and pedagogical perspectives (Sileo & Prater, 1999). The Center for Research on Education, Diversity and Excellence developed five standards for effective pedagogy. These include (1) teachers and students producing together, (2) developing language across the curriculum, (3) making meaning by connecting school to students' lives, (4) teaching complex thinking, and (5) teaching through conversation (CREDE, 1997).

We are going to need over two million new teachers to replace retiring teachers and support an expanding student population over a short period of time. The need for qualified teachers is constant in Hawaii. Contributive factors include retirement, termination, long-term leave, student enrollment increases, and new programs. Currently, the 'critical' teacher shortage areas include Special Education. Vacant positions of schools in geographically remote locations are also difficult to fill. There were 1,008 teachers hired during the 1998-1999 school year, 42% of these new teachers were special education teachers (Teacher Employment Report, 1998-99). The projected need of new special education teachers continues through the year 2005. Currently the Department of Education has developed partnerships with several universities to provide 200-250 special education teachers each year as the Felix Action Plan, to bring the State of Hawaii

into compliance with the Felix vs. Cayetano Consent Degree (Felix Implementation Plan, 1998). If these new teachers are to enter the classroom prepared to utilize technology creatively and efficiently, there needs to be a comprehensive restructuring of teacher preparation programs (Carroll, 1999). The student population in Hawaii is very diverse. The current classifications for students and teachers in the Department of Education include Caucasian, Chinese/Korean, Filipino, Hawaiian/Part Hawaiian, Japanese and other. At the present time, according to the ethnic classifications Chinese/Korean, Filipino, and Hawaiian/Part Hawaiian teachers are underrepresented in the state school system. This presents critical issues such as the education of linguistic and cultural minority students and students placed at risk by factors of race, poverty, and geographic location (CREDE, 1997). The teacher retention rate in special education is five years on average. Teachers have expressed concern about their level of professionalism and knowledge of culturally diverse teaching and learning styles in Hawaii. Teacher needs according to the Comprehensive Needs Statement (1999) includes the following statement, "Teachers are under prepared for what is expected of them and are not knowledgeable enough about the life, culture, and community of their students to teach effectively." These issues address the need to promote and implement effective ways to teach linguistically and culturally diverse students. Our program attempts to address these issues through its teacher preparation programs.

The Pilot

Two teacher preparation programs at the University of Hawaii are currently being included in the teacher induction program. The Programs are the Bachelor of Education Degree (B.Ed.) Programs in Elementary or Secondary Education and Special Education and the Post-Baccalaureate Certificate (PBCSE) in Secondary Education and Special Education. The Bachelor of Education degree program prepares students to become eligible for an initial dual license in either elementary or secondary and special education. The Post-Baccalaureate program prepares students with a Bachelor's degree outside of education to teach secondary general and special education. The rapid advances in technology and the diverse student population and challenging communities necessitate the need for this induction program, which is in its pilot stage. Students in the programs are advised to have access to or to purchase a computer for the program. Collaboration with the Department of Education, University personnel, mentor teachers, parents, and other para-professionals at the schools with the pre-service and/or intern teachers has proven to be a valuable effort to retain special education teachers.

Students receive seminar opportunities utilizing the Center for Research on Education, Diversity and Excellence five standards for effective pedagogy through out the program. These include (1) teachers and students producing together, (2) developing language across the curriculum, (3) making meaning by connecting school to students' lives, (4) teaching complex thinking, and (5) teaching through conversation. The culturally responsive pedagogy focuses on and promotes social equality and democracy, and affirms diversity. The students are taught to recognize and respect the differences of the student and community population and utilize the commonalties among each student to unite the group. The in-service sessions focus on culturally diverse learning styles, self-assessment and instructional conversation emphasizing the use of technology. Classroom instruction on web page analysis, PowerPoint presentations, overhead slides, digital camera images and the mentors and university personnel model electronic mail. The pre-service and intern teachers implement their usage in their classrooms with relevant curriculum.
Experienced university teachers who are trained as mentors, work continuously building the bridges between the school personnel and parent/community members at the school placement sites throughout the school year. The university mentors provide assisted training by visiting their beginning teachers to observe lessons and offer feedback. The mentors model effective teaching strategies at the seminars and in classrooms using culturally relevant learning styles. The promotion of sharing personal information in a safe, non-evaluative atmosphere, listening to the new teachers needs, and risk minimization of shared experiences parallel learning styles of diverse students (G. Kishi and M. Hanohano, 1992).

Survey

Initial surveys were given at the beginning of the program to offer feedback to the university personnel once the syllabi and expectations were discussed. The idea of a computer community was also discussed as the students learned to sign on and use the University MAILE (Manoa Advanced Interactive Learning

Environment) system. The varying levels of comfort were expressed in the surveys as well as the levels of understanding. Many students had little computer usage while others use the computer daily. This was a benefit for the program as it portrayed a typical classroom range of abilities, experiences and educational different levels. Several comments are outlined below. "I don't know what my expectations are as far as grades go." "I don't know much about computers." "I like the pilot as it will give me more time to be creative in my coursework." "I like the freedom of getting my assignments off the computer." Other questions were asked addressing the issue of the importance of mentoring; these are a few of the comments. "Discussing lesson plans and our teaching give constructive feedback," "Discussing individual students with us helps us understand the students and their needs," "Modeling and demonstrating by the mentor teacher is helpful." The pilot does not allow any inferences to be made with this first survey. At the end of this school year (1999-2000), another survey will be administered to the teacher participants, mentors, school personnel, students and university personnel affiliated with the program.

Conclusions

The *new* Hawaii Special Education teacher induction program is in its pilot stage. As the program continues through its first year, an assessment of the participants' teaching practices will be conducted through interviews, reflective e-mail journals, surveys, and the use of a rubric assessment instrument in classroom observations. Participating teachers will share program information in faculty and community meetings during the school year and ask for enhancement feedback regarding the program. At the present time, we have observed the increased use of technology in the participant school sites. As the new teachers demonstrate their knowledge of this technology in their classrooms and in meetings, many other educators are benefiting from the possibilities of materials developed through technological means. The multiplication effect of modeling and sharing knowledge has also pervaded to the school staff, faculty, parents, and the community as teacher participants share the students' progress.

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The Impact of Group v Individual Use of Hypermedia-Based Instruction

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Abstract: Students enrolled in an undergraduate introductory special education class were provided the option of supplementing traditional reading/lecture instruction with an interactive multimedia program to determine if individual or paired use of the program produced greater learning than those who received no supplemental instruction. Learners who worked cooperatively in pairs achieved higher achievement scores on a criterion-referenced test than those who worked individually with the hypermedia program or the control group. Implications for the use of hypermedia instructional programs with novice learners are presented.

Introduction

Traditional college instruction in the form of lectures, text assignments, and projects may not be sufficient to facilitate the higher-order thinking that is required for the application of new knowledge. Hypermedia-based instruction, which simulates real-world situations, may help move the learner from the knowledge level on Bloom=s continuum of learning through comprehension, application, analysis, and synthesis to the evaluation level. In addition, learners working in small groups with a case-based multimedia program may acquire the knowledge and skills at a faster pace than those working the same program independently. This paper reports the preliminary findings from a study to determine 1) if group and individual use of hypermedia-based instruction impacts on the outcome of learning from traditional lecture and reading assignments and 2) what factors may influence performance.

The hypermedia instructional program Assessment and Planning in Emotional and Behavioral Disorders, part of the Teacher Problem Solving Skills (TPSS) series (Fitzgerald, et al., 1996; Semrau, Fitzgerald, Daniels, & Carlson, 1996; Semrau & Fitzgerald, 1997) is the case-based hypermedia program used in this study. The TPSS program is based on Cognitive Flexibility Theory (Spiro, Feltovich, Jacobson, & Coulson, 1991) in that there are multiple representations of the content and the learner may revisit the content in different contexts. In the TPSS program the multiple contexts are case studies which include problem solving tasks. To parallel the ill structured nature of the information related to behavior disorders, the program's content is purposely ill structured, and contains extensive scaffolding to facilitate schemata building on the part of the learner. TPSS focuses on assessment and observation of children across settings, types and uses of assessment information, program placements, support services, and resource planning. Although two cases are profiled in this program, *Jimmy* and *Joyce,* only *Jimmy* was utilized for this study. A unique feature of the program is the collection of data (date and time used, time spent in each program segment, choices made, sequence of activities, and written notes and responses) on a user=s floppy disk entitled *Student*, which provided some of the data for analysis. A thorough description of the program is provided by Fitzgerald, Semrau, and Deasy (1997) and Semrau and Fitzgerald (1997). The hypermedia program paralleled the class lectures and reading in the assigned class textbook.

Ayersman (1996), in an exceptional review of the literature, stated Ahypermedia has been shown to result in significantly higher levels of performance in a variety of content areas for college-age students@ (p. 515). He supported his position by citing the findings of Overbaugh (1995), Fitzgerald (1995), and Chen (1993) where subject performance was determined while using hypermedia programs. He goes on to say that Ahypermedia is at least as effective as lecture...comparisons of hypermedia treatments to lecture no longer seem to warrant research focus@ (p. 517). Evert (1996) looked at the benefits of hypermedia in a high school population and found that the hypermedia instruction group performed better than the traditional instruction group. Luna and McKenzie (1997) researched the effectiveness of hypermedia using a college-age population. Their data established a weak statistical link between hypermedia instruction and overall student performance. However, not all research on hypermedia-based learning has been positive. Rojewski, Gilbert, and Hoy (1994) supplemented the instruction of undergraduate special education students (novice learners) with the individual use of a hypermedia program and found no significant difference between these learners and those students who received no hypermedia instruction. In their study, students who supplemented their classroom instruction with a drill and practice program that presented the content in a linear fashion performed better than the hypermedia and control groups. Students in their study reported difficulty with the nonlinear hypermedia format, and this caused feelings of frustration and anxiety. This underscores the need to continue the research on hypermedia-based learning and learner characteristics.

Tergan (1997) critically reviewed the effects of hypermedia on learning. He specifically addressed the assumptions that learning is enhanced when content is presented in multiple contexts as in the TPSS program. Cunningham (1993) (as cited in Tergan, 1997) noted that a student=s engagement with hypermedia is a complex interaction of the user=s goals, prior content knowledge, and prior experience with hypermedia. Tergan cautioned that hypermedia may enhance the learning of persons with some knowledge of the content, but hypermedia use may depress the learning performance of novice learners due to the increased cognitive load of integrating the content and managing the program. To describe this condition, Wenger and Payne (1996) use the term Acognitive overload@. Tergan Asuggests that students need explicit modeling and scaffolding support in order to gain knowledge from a Cognitive Flexibility Theory-based hypermedia learning environment@ (p. 11). It appears that there is a novice learner effect which influences the performance of individuals who use hypermedia-based learning programs which may be remedied by supportive scaffolding, similar to that available in cooperative learning groups.

Crooks, Klein, Jones, and Dwyer (1996) addressed the use of computer-based instructional programs with student groups for teacher training. Their review of the literature revealed several studies which reported mixed results, some attributed to varying factors. In their study 128 undergraduate education students participated in a computer-based lesson for teachers who were learning to identify and write good assessment items. The subjects who worked individually on the computer program performed slightly better than the cooperative learners. Despite their results, they assert there is a strong rationale for using computer-based instruction (CBI) with groups of students citing better attitudes and increased task orientation as outcomes. Hooper (1992) studied the effects of peer interaction during CBI and noted a positive correlation between increased student interaction and increased achievement. Both studies justify a need for continued research on variables which have Arevealed positive results in favor of cooperative groups for various nonachievement measures@ (p. 110). Rogoff (1998) cited a number of studies by Johnson and Johnson where participation in cooperative groups facilitates achievement of individuals, particularly in higher order thinking skills.

Some of the factors influencing learning on a hypermedia program were explored by Fitzgerald, Semrau, and Deasy (1997) using the TPSS case study training materials. Their study of learner differences resulted in findings that learner differences (rank in school, prior experiences using computers, and cognitive controls of field dependence and independence) did not impact learning outcomes using hypermedia case study programs. They concluded that hypermedia-learning environments provide equally effective instruction for learners regardless of their differences, whereas the amount of time engaged in the use of the program was most critical to the outcome. Their study did not attempt to look at individual versus group learning, and the impact that group learning may have on program engagement time. Therefore, it seemed necessary to address in this study the question of whether group or individual use of hypermedia instruction is more beneficial.

The purposes of this study were to determine: 1) if individual or group use of supplemental hypermedia instructional materials has a positive effect on student performance as measured on a criterion-

referenced test of course content requiring higher-order thinking skills; and 2) what factors (anxiety of computer use, prior use of computers, time spent with the program, and grade point average) influence pre/post difference scores on a criterion-referenced test requiring higher-order thinking skills.

Method

Subjects

Subjects for this study (n=54) included undergraduate education majors enrolled during the 1996-98 academic years in the course SE 2623 Introduction to Exceptional Children at Arkansas State University. Participation in this study was voluntary and did not influence the grade of the participants in the class. The students were divided by random assignment into three groups: a control group, a group which worked on the multimedia program individually, and a group of 14 students who worked in pairs and 3 who worked in a triad on the multimedia program.

Measures

The subjects were administered the following instruments:

1. Spielberger's Self-Evaluation Questionnaire, a 20 item computer anxiety instrument, was based on a modified version of the Spielberger Self-Evaluation Questionnaire to which participants respond on a four-point scale of agreement/disagreement related to feelings and anxiety toward the use of computers. This instrument has been used in numerous studies to measure computer anxiety and has proven to be valid and highly reliable (Reed & Palumbo, 1992). For data analysis, the sum of the ratings was combined to form a total score.
2. Prior Computer Use Survey (Reed & Giessler, 1995) includes nine statements to which an individual responds that indicate expert knowledge of computer usage on a scale of 0 Ano knowledge@ to 9 indicating Aexpert knowledge@. For data analysis the sum of the item ratings were combined to form a total score.
3. A 38 item criterion-referenced multiple choice format chapter test was developed using the textbook test bank and instructor written questions, and used as a pre/post measure of change in knowledge and skills in the area of emotional/behavioral disability. The test items were selected to be representative of the chapter content and class sessions; and included higher order thinking skills such as comprehension, application and evaluation. For data analysis, the pre/post difference score was used for data analysis.
4. Time spent in Teacher Problem Solving Skills (TPSS) program was calculated by summing all of the time recorded on the *Student Disk*. The TPSS multimedia program is capable of recording the individual student's or student group=s activity while using the program.
5. Grade Point Average (GPA) was taken from each subject's transcript based on all class work completed.

Procedure

Prior to beginning the chapter on emotional/behavioral disabilities in the course Introduction to Exceptional Students, the undergraduate students volunteering to participate were divided by random assignment into three groups. All three groups were administered the instruments listed above. The TPSS multimedia program was made available for student use in the university computer lab and training in the operation of the program was provided to all except the control group to enable students to enter the program and make use of the features of the program. Students in the individual or group condition worked on the multimedia program to supplement their classroom instruction. Upon completion of instruction and working with the program, all subjects were administered the posttest which was same 38 item criterion-referenced test used as the pretest.

Results

During the academic years of 1996-98 data were collected for 21 control group subjects, 16 subjects who worked individually with the program, and 17 subjects who worked in small groups. Descriptive statistics for each variable for each group are listed in Table 1. The authors used a t-test to compare the means of the groups with a criteria for significance of .05. To determine the relationship of the academic

performance factors to the criterion-referenced test difference scores, Pearson r correlations were computed and compared to an established criteria.

Table 1 Descriptive Statistics for Variables for Each Group

Measure	Control (n=21) M	Control (n=21) SD	Indiv. (n=16) M	Indiv. (n=16) SD	Group (n=17) M	Group (n=17) SD
Spielberger's Self-Evaluation Questionnaire	41.61	11.73	41.13	8.21	41.93	8.48
Prior Computer Use Survey	30.76	17.75	30.67	16.73	32.93	16.36
GPA	2.99	.44	2.95	.53	2.63	.68
Pretest	17.57	6.29	18.50	5.15	17.00	4.54
Posttest	23.57	5.27	24.19	5.38	26.71	6.56
Criterion-referenced Test Difference Score	6.0	4.91	5.69	4.88	9.71	4.93
Time in Minutes Spent in TPSS	—	—	152.0	47.3	180.0	73.4

Research Question 1:

Does the individual or group use of hypermedia-based supplemental instruction result in a significant difference in learning, as measured by a criterion-referenced test? When comparing the mean difference scores of the individual ($\underline{M}$ = 5.69) and group ($\underline{M}$ = 9.71) users of the multimedia program a significant difference was found, $\underline{t}(21) = -2.350$, $\underline{p} = .025$.

Research Question 2:

Does the use of a hypermedia-based instruction result in statistically significant higher scores on the criterion-referenced test when compared to students who did not use the hypermedia-based instruction? The mean difference score of the individuals ($\underline{M}$=5.69) who used multimedia was lower than the control group ($\underline{M}$=6.00), therefore hypermedia use did not have a positive impact on the learning of this group of subjects. However, when comparing the mean difference scores of the control group ($\underline{M}$ = 6.00) to students who worked on the hypermedia program in groups ($\underline{M}$ = 9.71) there was a significant difference between the means, $\underline{t}(36) = -2.72$, $\underline{p} = .020$.

Research Question 3:

What academic performance factors (anxiety of computer use, prior use of computers, time spent with the program, and grade point average) are moderately related ($\underline{r} > .40$) to the pre/posttest difference scores on the criterion-referenced test? To answer this question, Pearson correlations were examined to determine if any correlations met the researchers' criteria. Correlations between the pre/post difference scores and the following academic performance factors are as follows: 1) anxiety of computer use ($\underline{r}$ = .203), prior use of computers ($\underline{r}$ = .028), time spent with the program ($\underline{r}$ = .292), and grade point average ($\underline{r}$ = -.011)
No factors measured in this preliminary data collection met the established criteria.

Discussion

Although the findings of this study should be considered cautiously due to the small number of participants, the primary finding is that learners working with supplemental hypermedia instructional materials in pairs or triads performed better on a criterion-referenced test of course content than the learners working independently on the same hypermedia materials. Furthermore, when comparing pre/post difference scores, it must be noted that the individuals who worked with the hypermedia materials did no better than the control group on the criterion-referenced test. Finally, no academic performance factors (anxiety of computer use, prior use of computers, time spent with the program, and grade point average) met the established criteria for a significant relationship.

The finding that there was no difference in learning outcomes between individual use of the hypermedia programs as a supplement to traditional classroom lecture and readings and the control group is

difficult to explain. While the researchers anticipated group learning outcomes would exceed individual learning outcomes, the absence of an added benefit to learning is perplexing. Perhaps as Payne (1996) and Tergan (1997) suggests, the individuals using the hypermedia program, learners in their first course in special education, had their performance depressed by the loosely structured content and the nature of the hypermedia environment.

Our finding on achievement is contrary to the study done by Crooks, Klein, Jones, and Dwyer (1996) where individual learners using CBI did better than learners working on CBI in pairs. However, our findings are consistent with those of Rojewski, Gilbert, and Hoy (1994) who found no significant difference in test scores between learners working individually with hypermedia instructional programs and control subjects. Furthermore, our findings are consistent with those of Singhanayok and Hooper (1998) who found higher achievement performance in students who engaged in cooperative learning. Singhanayok and Hooper (1998) found that students in cooperative learning groups spent more time than individuals interacting with the computer program. The students using the TPSS program in pairs also spent more time, an average of 30 minutes, or 20% more time than those individuals using the TPSS program.

From a theoretical prospective, Lev Vygotsky believed that children learn from a dialectical process by sharing problem solving activities with others (Vasta, Haith, & Miller (1995). Piaget believed that cognition is a collaborative process where individuals engage in shared thinking (Rogoff, 1998). This theoretical prospective could explain why students in this study who worked in groups performed better than individuals working alone.

Another explanation for a group performing better than an individual could be that the very nature of special education planning and placement is a collaboration between professionals and parents. The program, Assessment and Planning in Emotional and Behavioral Disorders (Fitzgerald, et al., 1996; Semrau, Fitzgerald, Daniels, & Carlson, 1996; Semrau, & Fitzgerald, 1997) was designed with that collaboration process in mind. Therefore, our study allows us to expand upon the position of Rowjewski, Gilbert and Hoy (1994) who stated Ahypertext may promote a forum with which to engage students in the process of learning and application as opposed to the acquisition and recall of facts@ (p. 258). This observation appears to be true when the learning occurs in pairs when each individual in the dyad or triad is able to reciprocally encourage, support and scaffold the learning of the other individual. The findings of this study seem to indicate that collaboration is preferable to individual efforts when novice learners engage in learning activities using hypermedia learning programs. It is clear that hypermedia instructional programs are valuable learning tools; however, research on the interaction of types of hypermedia programs, the anticipated learning outcomes, the nature of the content, characteristics of learners, and learning conditions in which the program is used must continue.

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Assistive Technology Meets Instructional Technology: A Standards-Based Approach to Implementation in Teacher Education

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Abstract: The issuing of the new IDEA legislation adds a new challenge to technology integration and educational reform efforts. This new challenge relates to equal access to learning opportunities in general education for all students. The reauthorized legislation focuses especially on students who experience overt personal disjunction in the general education classroom, commonly referred to as special needs students. This study examines the implications of findings from a literature review and field experience on assistive technology in a teacher education program. Special attention is given to strategies for developing an assistive technology curriculum for preservice and graduate teacher education by restructuring instructional technology programs that prepare K-12 teachers.

Overview

Under the P.L. 105.17, Section 504 of the IDEA 1997 legislation student eligibility for special education is not a requirement for services under this section of the law. Therefore, the term special needs imply a much larger population and more inclusive group of students than ever before. The accommodation of special needs students may include, but is not limited to instructional and assistive technology, technical support, and services. This is significant because teachers will not only be required to learn and integrate new computer technologies, but must now be prepared to create inclusive learning environments. This will only be possible through the help of assistive technologies. This means teachers will need new levels of knowledge and awareness, instructional and technical skills to meet these new challenges and standards. These new challenges are incorporated into the new high quality teaching standards that will require teachers to demonstrate their ability to teach all children in ways that improve their achievement levels. Without adequate access to effective professional development for educators and administrators, the efforts of IDEA and other reform measures aimed at improving the quality of teaching will be thwarted.

As result of the movement towards increasing inclusive learning environments, we have a new body of literature that is emerging to explain new professional development, technical support, knowledge and awareness, and information needs of educators. Considering the broad nature of this subject, this examination is focused on K-12 education. Preliminary examination of this subject indicates there may be a special concern about access barriers to professional development and new technologies in inner city, metropolitan, and rural schools for teachers and learners. As a result this examination will attempt to focus on the following thematic issues:

1. Problems or biases in the previous research and theories about the use of general and assistive technology to include special education students in the general education classroom.
2. Contradictions in the legislation and literature that represent gaps in existing views.
3. Information that might help the reader to develop new ways of framing issues surrounding assistive and general technologies and inclusive education, especially for minority students in inner-city and rural schools.
4. Ideas about assistive and general technology in the IEP and strategies being employed to adapt general education curriculums.

Summary of the Findings

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The traditional literature review in educational research is typically valued because it can be very powerful. This power can set the tone of the research by reporting what others have done which can have the effect of supporting preliminary assumptions. Considering this potential risk, the focus of this session is to minimize this potential by positing specific questions and reporting what the literature, research, legislation, and practitioners report. The intent is to make an original contribution and stimulate dialogue to expand understanding, knowledge, and awareness of challenges that inclusive technology present to educators and administrators in K-12 schools.

Therefore, this session will extend beyond simply summarizing what others have written about or attempted but will also provide an analysis of this information and how it is influencing teacher education programs in higher education. The review will attempt to show how implementation guidelines can have an impact on interpretation of the IDEA legislation in this process. These different interpretations influence the context and implementation of assistive technology and inclusion in practice. These interpretations in practice could result in further limiting or expanding access to adequate professional development and technology and service needs of students and teachers. Without a system for gauging progress in this area, it will be impossible to determine the impact of IDEA on teaching practices and services to special needs students in these programs and in practice.

The review will result in a speculative framing of the issues. This framing will help construct a conceptual context of the problems that might emerge for educators and Teacher Education in their attempt to support inclusion (Equal Access) in Schools. Four components will help contribute to this process:

1. Researcher's experiential knowledge, technical background, and personal experience
2. Existing theory and research
3. Pilot and exploratory research

Practical Questions About Education for Individuals with Learning Disabilities Legislation and AT/IT Integration

1. What is the nature of the IDEA legislation and its authorizations?
2. What actions are state departments of education and teacher education programs taking to address the requirements of IDEA and Section 504?
3. What are the prevailing attitudes and perceptions of administrators, educators, and parents about the IDEA legislation?
4. What does the research show about the impact of AT/IT on special need students and their academic achievement?
5. What are best practices in AT/IT integration in the inclusive learning setting?
6. What kinds of support services and resources are accessible to help educators, schools, and parents?
7. What does "technical support" mean" in this environment?
8. What does "equal access" mean?
9. What type of professional development do educators and administrators need to increase their "knowledge and awareness" of the new inclusive education environment and new technologies?
10. How do educators access training in AT/IT?
11. How do educators access information about assistive technology, training, technical support, materials, and technology?
12. What is the projected impact of this new legislation on teacher education programs, and especially programs to train K-12 educators?
13. What are some potential and existing access barriers to inclusive education, AT/IT integration in higher education?
14. What are educators' views on curriculum adaptation and AT/IT in the IEP?
15. How is AT/IT documented in the IEP?
16. What are the criteria for judging the quality of AT/IT in the IEP, curriculum, and in practice?
17. How is AT/IT accessed and implemented in early childhood education?
18. How significant is IDEA and AT/IT in K-12 education?
19. How is the impact evaluated?

Legislative Actions

To establish the grounding for the review the following questions are addressed in this section.

1. What is the nature of the IDEA legislation and its authorizations?
2. What actions are state departments of education and teacher education programs taking to address the requirements of IDEA and Section 504?
3. What are the prevailing attitudes and perceptions of administrators, educators, and parents about the IDEA legislation?

The IDEA Legislation and Authorizations

The Individuals with Disabilities Education Act (IDEA) authorizes three programs to support and improve early intervention and special education for infants, toddlers, children and youth with disabilities. The **IDEA Amendments of 1997, P.L. 105-17**, is the most significant and comprehensive reauthorization of IDEA since its inception in 1975. The research reports that the proposed rules are challenged for failure to incorporate past policy interpretations on issues not addressed in the statue.

Therefore, there is a very active political environment tracking congressional rulemaking process as states' localities attempt to implement the changes enacted. This review is focused on Educational Improvement. The rule is that most disabled students should be offered services according to an individualized education program (IEP) within 60 calendar days of parental consent of the initial evaluation. A congressional research reports states that educators have complained that this timeframe is unreasonable

P.L. 105-17 undertakes the effort to increase access to learning for children with disabilities. This effort is focused in three primary areas: IEPs, performance goals, and assessments. Prior law did not call for performance goals and was silent on the participation of disabled students in assessments administered to students at large in school districts. Under the new law states are required to include students with disabilities in state and district-wide assessment programs, with appropriate accommodations. States and local districts have until July 1, 2000 to develop alternative assessments for students who cannot perform on regular assessment (p. 11).

The mandates that are most significant relate to the development and content of the IEP: The IEP team, Special factors, and Contents of the IEP.

1. IEP team must consist of educators. This IEP team is expanded to include, if appropriate, the teacher of the general education classroom where the child would be placed.
2. There are five special factors that the IEP team must take into account: behavior problems, limited English, blind, special communication needs, or *special technology needs*.
3. The programming of the IEP must be related to the general education curriculum. The IEP must also include references to modifications needed to allow the child to participate in the district or statewide assessment programs or an explanation of why not and a description of the alternative assessment process. This process must reflect any parental influence or involvement.

There are many issues that have emerged as a result of these measures. Some critics argue that IDEA's accountability rules restrict practices that could benefit other students while doing no harm to others. This type of policy is known as a Pareto policy (p. 12).

However, under this law new special programs are authorized at "such sums as may be necessary" through FY 2002. Programs supported include:

1. State competitive grants program for special education reform and improvement. Under certain circumstances these funds could be used to train teachers in new instructional approaches.
2. Coordinate research and personnel preparation (e.g. early childhood education, innovations and development, personnel development, and special studies).
3. Coordinated technical assistance, support, and dissemination program (E.g. parent training, clearinghouses, regional resource centers, and technology applications).

State Departments of Education and Teacher Education Programs

The research shows a trend in SDEs to support professional development programs for educators and teacher education programs that focus efforts on adapting the entire curriculum using multiple technologies (**Cormier, Folland, & Skau, 1998**). Several states have incorporated provisions for assistive technology for general education in their technology plans to meet teacher training and the learning needs of special **needs** students (Vermont, Maryland, Kentucky, Arizona, Connecticut, New Mexico, Wisconsin, and others).

The work of educators describes how a single book can be adapted using thematic activities supported by technology. **Metheny (1997)** believes that one of the most difficult challenges faced by teachers is educating students who have special needs to achieve outcomes or standards expected of all students. He emphasizes that the strong push for higher standards of learning poses a challenge to states and schools to implement these standards to ensure that they include all students.

Another observation is the emphasis being placed on software for special needs students that are designed to provide a wide range of options. Many of these options allow hardware/software to be tailored to meet student's needs (**Hurley & Shumway, 1997**). Teacher education programs are showing interest in integrating assistive technology with emerging instructional technology programs as they revamp their programs to meet not only IDEA requirements, but NCATE technology and diversity standards (**Bohren, 1999**).

Molly Mead (1995) advocates that teacher education programs must place more emphasis on principles of effective instruction to appropriately use technology. The effective strategies include demonstration-prompt-practice, pace, wait time, and coaching. She adds now that computers are used in education a new challenge facing teachers is selecting appropriate software to match both curriculum goals and the student's stage of learning.

To meet the growing need for training and professional development the use of telecommunications (Internet) is establishing virtual learning communities for educators and administrators to acquire more just-in-time learning opportunities. An interview conducted by the Research Institute of Assistive and Training Technologies discusses distance learning training modules being prepared for pre-service teachers in early childhood education. The modules will focus on infusing technology into the early childhood curriculum (**Benton, 1997**). Despite the best intentions of many efforts, recent studies reveal that a very small percentage of teachers feel comfortable working with special need students in the general classroom (**Riley, 1999**).

<u>Implications for Program Development in Teacher Education</u>

The implications for program development and restructuring of technology infusion components of teacher education programs will be presented and discussed in this session.

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Infusing Technology into a Preservice Teacher Education Program for Special Educators

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Abstract The presenter of this session will describe the process by which technology has been infused into the preservice teacher education program for special educators. Presently, 9 credit hours in technology are required of all special education majors.

Overview & Perspective

Students with disabilities continue to be integrated into inclusive classrooms (NCERI, 1994). In fact, over 4 million students with disabilities spend the majority of their day in inclusive classrooms with general and/or special educators (NASBE, 1992). In addition, an increasing number of students with disabilities in inclusive classroom utilize various technologies (Behrmann, 1995; Flippo, Inge, & Barcus, 1995). Specifically, 2 million students with disabilities use assistive technologies in the inclusive classroom daily (Behrmann, 1995). In response to the increasing role technology plays for students with disabilities, the Council for Exceptional Children, the largest professional organization for special educators, has cited technology training as one of its many preservice competencies (CEC, 1994). Accordingly, as more students with disabilities are integrated into inclusive classrooms, it is important that general and special educators become competent with the usage of technologies and integrate these into the teaching process. Therefore, the purpose of this paper is to present recommendations for course programming focusing on the integration of technology. The paper builds upon previous paper presentations with a specific focus on how to develop special education programs which have strong technology components.

Course Goals & Objectives

In the spring of 1998, Towson University was granted program approval from the Maryland State Department of Education (MSDE) for a major in Early Childhood Special Education leading to a Bachelor of Science Degree, Similarly, in the fall of 1999, Towson was granted approval for a second program by MSDE for a major in Secondary Special Education with a Bachelor of Science Degree. Presently, Towson has submitted a proposal to MSDE for a Bachelor of Science Degree in Elementary Special Education. With this final program approval from MSDE, Towson University will have a comprehensive program of preservice special education. As part of the required course work for each of these programs, students are required to complete 3 courses or 9 credit hours in technology. These courses include Using Information Effectively (ISTC 201), Utilization of Instructional Media (ISTC 301), and Assistive Technology for Students with Disabilities (SPED 413).

Students are first introduction to information and its importance to teaching in the class ISTC 201, Using Information Effectively in Education. This class is an introduction to gathering, evaluating and communicating information. Emphasis is on using team collaboration and problem solving to examine current issues in education. Students review the history of information in education; define the current issues in education; develop team building; develop strategies to locate information from a variety of sources; assess information validity and usefulness; examine the ethical use of information; report information in written reports and oral presentations; and consider the future of information in education. Sample projects and/or assignments include research papers, PowerPoint presentations, Internet scavenger hunts, and team presentations on hot topics in education via multimedia. Optional assignments for more technologically advanced students include building a home page on the Internet, developing an extensive software review, and becoming an expert on a particular software package and making a presentation to the class. The class is taught in a computer lab setting using a constructivist approach. Cooperative learning and group learning with individual accountability are the primary teaching strategies.

In ISTC 301, Utilizing Instructional Media, materials, devices, techniques and settings are presented in an overview of the field of instructional technology. Laboratory experiences are provided in the operation of instructional hardware. Students gain experience in the evaluation and integration of current educational technologies into classroom instruction; produce an educational technology portfolio which demonstrates proficiency in curricular integration of media and technologies; analyze various technology and media resources including hardware, and software with an emphasis on computing applications and effective use of the Internet with K - 12 students; develop support strategies for employing technology, media, and materials within the K - 12 learning environment; and recognize and utilize representative present and future applications of technological systems in teaching and learning strategies. Sample projects and/or assignments include creating a technology portfolio, completing projects which are web-based or use Hyperstudio, and constructing sample lesson plans which incorporate technology.

In SPED 413, Assistive Technology for Students with Disabilities, students design instruction for students with special needs using assistive technologies. The purpose of the course is to familiarize special and general education teachers with various assistive and instructional technologies which may be used in the classroom to assist students with special needs and to demonstrate how these technologies can be integrated into the instructional setting. Specifically, students review learning styles and differential characteristics of children and youth with disabilities and apply this knowledge to the selection and use of technology in the classroom at the age appropriate level; identify low and/or high technology accommodations appropriate for children and youth with disabilities; identify the historical and legal foundations which support the use of technology for children and youth with disabilities; evaluate & develop a review and comparison of computer software appropriate for a specific disability; investigate the availability and use the technology appropriate for children and youth with disabilities; investigate & demonstrate testing accommodations (low and high tech) ; demonstrate strategies to integrate staff and parent training of assistive technologies for students with disabilities; and demonstrate the integration of technology through lesson/unit planning for children and youth with disabilities.

Sample projects and/or assignments include creating an assistive technology portfolio, downloading and modifying lesson plans from the Internet for students with special needs, consulting and making technological recommendations for students in the reading clinic, and writing a reaction to a visit to a school based site and where assistive technology is integrated into the classroom.

Critical Shortages in Special Education

The infant/primary and secondary special education program approval came about as a response to the critical shortage need in special education. According to projections in the Maryland Teacher Staffing Report 1999 - 2001, during the 1999 - 2000 academic year, Maryland required 987 new special education teachers --- 71 of these teachers at the infant/primary level and 416 vacancies at the secondary level. Based upon these projections, Towson is attempting to address the critical shortage need for special educators with the newly approved programs in infant/primary and secondary special education. A key component of the infant/primary and secondary majors in special education at Towson University is technology. The aforementioned courses build upon a hierarchy of skills to better prepare special educators and form a strong technological component to the special education major at Towson University.

Outcomes & Impact

There are several important outcomes of these programming efforts. First, these programs serve as models for other special education programs throughout the country. Secondly, they address the critical shortage need of infant/primary and secondary special education. Finally, these new programs further the mission and the strategic plan of Towson University to emphasize technology across the campus.

Time Line & Completion Dates

The infant/primary special education major was implemented in September of 1998 and the major in secondary special education was subsequently implemented in September of 1999. Plans are currently underway to secure program approval for a major in elementary special education. This program will also lead to a Bachelor of Science Degree and is anticipated for the spring 2000 with implementation scheduled for the fall 2000. With the approval of this final program, Towson University will have a fully operational major for generic certification in infant/primary, elementary, and secondary special education.

Evaluation Plans

As students exit each class, they evaluate the effectiveness of their technological preparation and they also complete performance based outcomes which demonstrate their technological

competence. Upon exiting the special education major/program, students will be tracked through surveys. A key component of the survey will be questions about technology and their use of it in the classroom setting as well as student perceptions as to how well prepared their undergraduate training prepared them for the use of the technology in the classroom.. Evaluation data will be used to modify course syllabi. Current dissemination plans include presentations at local, regional, and national organizations such as the Maryland Association of Educational Users of Computer (MAEUC), the Eastern Educational Research Association (EERA), and of course the Society for Information Technology and Teacher Education (SITE).

Summary

In summary, this paper provided participants with (a) an overview and time line of the program and implementation process, (b) an outline of the course objectives & goals (c) outcomes and impact of the project, (d) time line and completion dates, and (e) evaluation and dissemination plans of the project.

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Web Enabled Teaching Aid for Non-orthographic Languages

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Abstract: In conjunction with the technological advancements of Telecommunications and Information Technology and the outbreak of the World Wide Web (WWW), the production of educational software is undergoing a shift towards the shared resource paradigm. Recognizing the need expressed by people with special needs and special education teachers in enabling students to access such resources, this paper describes the design and the implementation of a Web-based, open system for the effective support of the teaching process of non-orthographic languages for people with special needs. There will be a discussion on user requirements, system specifications and characteristics as well as the system's architecture. Features that enable learner centered education and fulfill teachers' needs to prepare, organize and update the training material in a cost-effective manner and focus on content specification and other high level tasks, while developing courses, will also be mentioned, followed by reached conclusions and plans for future work.

Introduction

Information and Communication Technologies have undergone a rapid development over the last few years, with the Internet and multimedia technologies experiencing the biggest growth. In this respect, new prospects and mechanisms were introduced to the educational community (Ewing et al, 1999), greatly affecting teachers and learners alike (Gilliver et al, 1998). Both teachers and learners seek out new forms, sources and methods for acquiring and transferring knowledge, elevating their needs and demands, while courseware shifts from the traditional monolithic model to the collaborative co-development of shared and accessible material.

While the educational community opts for open, accessible and shared courseware, there is a number of students with special needs who want to harness what education has to offer them, but because of their disabilities seem to have less chance. Especially in cases of mild-to-severe mental disability, they can't use a natural language nor communicate with speech, thus they need to use an *Alternative or Augmentative Communication (AAC)* system usually taking the form of a non-orthographic language (in contrast with a natural-orthographic one), sometimes in conjunction with written text. Non-orthographic languages in general, belong to *Graphic Representation Systems (GRS)* since they use standardized graphic symbols (ranging from photographs resembling the depicted object, to abstract linear drawings with no apparent relation to the referred object) as their building elements and to convey communication content. Apart from their specific sets of symbols, icons and associated meanings (see Fig. 1), non-orthographic languages may incorporate syntax and grammar (like Blissymbolics, see Bliss, 1965) thus requiring substantial effort and time from both sides (teachers and learners) in order to be taught efficiently. For a more detailed and comprehensive description of the various types and characteristics of GRSs one can consult (Fuller et al, 1992).

To become a literate reader though is by no means an easy task (Ehri, 1993). To teach an individual to communicate via a non-orthographic language is much more complicated, especially during the early stages of learning (von Tetzchner and Martinsen, 1992) since graphic symbols are not as easily or naturally passed on from parents to children as the words of a natural language are. For that purpose there have already been

development efforts (see Kouroupetroglou et al, 1990), while research discusses the potential results of using graphic symbol systems in the process of acquiring or developing natural language skills (Gerber & Kraat 1992).

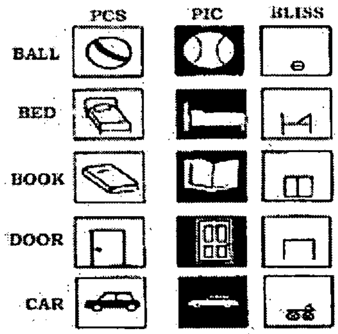

Figure 1: Representation of various concepts in different non-orthographic languages

Students with special needs have a right to equal opportunities in education, but they are more difficult to train since they require more specific and sometimes individualized training. Moreover, to use a non-orthographic language not only does the student need to be properly trained but also the teacher requires to be properly aided. However, the special education teacher is usually left alone in his/her effort though, without much technological assistance. A teaching aid in the form of a piece of software would be a major asset, and yet such software hardly exists due to its diverse nature. Let us not forget in the meantime, that teachers constitute the most important factors for the direct and successful implementation of new technological advancements especially in the field of teaching non-orthographic languages. Therefore the need to provide the teacher with easily accessible and effective support becomes obvious. Nowadays, the most promising medium to support the teacher is with no doubt the World Wide Web (Astreitner et al, 1998). The Web's potential lies in its flexibility and ease to provide properly devised educational support systems which enable access to various information resources, such as Data Bases, Electronic Dictionaries, and on-line context-sensitive learning aids (Metaxaki et al, 1988).

In the light of the above, the design and implementation of a WWW based, open and flexible system that can handle multiple natural and non-orthographic languages and their elements in a variety of formats and representations will be presented. Because of its open and flexible presentation nature in can act as an aid to the special education teacher in the course of teaching non-orthographic languages to students with special needs.

System Design

Our design was based on a vast number of technical specifications derived from a user requirements study and will be presented henceforth in brief. The main design goals though, called for multilinguality, reusability, flexibility, openness, efficient development and access to shared educational material, and most importantly the ability to offer a learner-centered education.

User Requirements and Specifications

For the last two decades, application of non-orthographic languages and graphic symbols, has become widely accepted in a vast number of cases of children who can't speak or suffer from some language disorder, and who are in need of learning a language (McNaughton & Lindsay, 1995), (Stephenson and Linfoot, 1996). Users of a standardized non-orthographic language, combine a number of graphic symbols in order to put together a sentence (von Tetzchner & Martinsen, 1992), but in order to convey communication information to a natural language speaker a link or association to a natural language needs to be present. Such a link, in written and spoken forms, becomes necessary to any kind of application used to facilitate teaching or use of a non-orthographic language for the prospect of a future transition to the natural language as well. The importance of verbal language information in the framework of multi-language AAC systems has already been recognized and described in the field (Antona et al, 1999).

The need of in-time preparation, structuring and update of the educational material in a cost effective and viable manner is also imperative for the teacher of non-orthographic languages (Norman and Spohrer, 1996). Additionally, since learner centered education is considered more appropriate for non-orthographic language students, the courseware needs to have some degree of personalization. However, the various characteristics (abilities, skills, requirements and preferences) may vary significantly for each non-orthographic language learner. One of the most important requirements though, regardless of learner characteristics has to do with the effective access and manipulation of the learner's vocabulary. The teacher would need to select, organize in sections, modify, update and expand vocabularies according to the learner's communication and language capabilities and preferences. Different educational resources should be able to be successfully unified or combined in a single educational package, and should also be generic enough so that people outside their development team would express interest in them. What's more, adaptation, modifications and update costs, language barriers and constraints, as well as cultural differences of the educational material are also important elements of the educational software distribution and must be considered accordingly. Moreover, it is well understood that certain symbols in a GRS may convey different meaning according to cultural and national context. The system's design should ensure that on the one hand such differences are compensated through the provision of alternative symbol sets and different languages and proper associations, and on the other that no restrictions whatsoever are going to be present in terms of locality, culture, language or accessibility.

Moving towards a global learning scenario, necessitates making the learning resources more accessible (Collins et al, 1996), while requirements for more effective learning call for the educational content and information to be readily accessible by the teacher. The main factors in this process are the production cost of educational material, the delivery cost, availability and delivery both in time and on demand, availability of educational material as independent as possible from specific location or time barriers. Therefore true internationalization, global access around the clock, and multilingual support should be considered. Additionally, computer-based systems designed to support such a teaching process should be open, catering for reusability, and able to offer a large number of either non-orthographic or natural languages (Kouroupetroglou et al, 1993, 1994). Moreover, such a system should allow the teacher or a team of teachers to focus on the definition and structure of the educational content and other high level activities while developing courseware.

Implementation

The developed system at large, constitutes a multilingual environment for both natural/orthographic and non-orthographic languages. It can be viewed as an on-line multilingual lexicon, able to manage, store, retrieve and depict the various language elements in a multitude of forms and multimedia representations including text, phonemic, pre-recorded speech, pictures, and video / animation. It can also hold user specific information concerning vocabularies, plus multiple modifiable dictionaries per learner. The system also provides omnidirectional "word-by-word" translation between the elements of the various defined languages, after specifying the source and target languages and desired concept for translation. The system is open and expandable by means of user profiles, languages, and language elements and representations. Since the system uses multimedia elements (as one can realize considering the variety of representational media) can fall into the multimedia application category. Interactive multimedia have earned a prominent status among software developers due to their variety and flexibility and the ease of incorporating different learning modes. However since there's no guaranteed way of applying such a technology effectively, constant evaluation is imperative. In this respect, and in order to develop the software described herein, there was an extensive use of the generic methodology and instrument for the multimodal evaluation of interactive multimedia (Kouroupetroglou, 1995).

Technology

The software has been developed as a 32-bit application to run under MS-Windows (95/98/NT). The architecture that was chosen for the web part of the application was the Server Side technology. The reasoning behind this choice is twofold, since according to that, all the time and resource consuming functionality are handled by the Web Server, while the Client receives information in simple HTML format, thus rendering our application independent form the Client software. Such architecture calls for compatibility between the various development

tools and the database and the web server. In this sense, we incorporated Active Server Pages (ASP) technology, essentially a mixture of VBScript code and HTML (ASP, 1998), which works on a Microsoft Internet Information Server (IIS) acting as the Web server software (see Fig. 2). The aforementioned combination of technologies allows for a Web Interface that caters for the dynamic construction of queries to the Data Base. The web user enters the parameters (s)he wants and the query is put together by the Active Pages engine and passed on to the CDB. Another important aspect and functionality of the web interface is the dynamic production web pages bearing the result set coming from the CDB. The Web pages used in our application were designed and developed using Home Site 4.0 and MS Front Page 98 along with MS Visual InteDev 6.0. The CDB was designed using ErWin Version 2.6 and implemented in MS-Access 97.

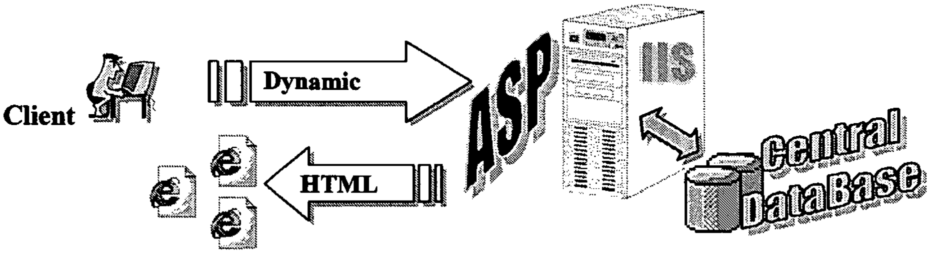

Figure 2: The general concept of Active Server Pages

Structure

The essential structure and architecture of the system (depicted graphically in Fig. 3) follows the design specifications set, and consists of the following functional components: a) a Central DataBase (CDB), where all information on users, languages, concept elements and representations is stored, b) a multi user software application to manage the CDB, c) a compact, mobile User-specific DataBase (UDB), d) a software application to access and manage the UDB, and e) Active Server Pages to access the CDB via the WWW (see Fig. 4).

The Central DataBase handles a variety of different information concerning users, languages, language elements and representations. More specifically, the CDB manages: a) a set of concepts which have a meaning independent of language (we use the notion of the interlingua for this set, see also Dorr 1993) , b) a set of orthographic and non-orthographic languages, c) sets of written (in text) representations of the various concepts in every orthographic language defined, d) a description for each concept and for every orthographic language defined, e) sets of graphic representations for each concept and for every non-orthographic language defined, f) one or more pictures, videos and/or animation for each concept (if necessary), g) three sets of spoken representations of each concept in every orthographic language defined (in prerecorded male, female, and child voice), h) onomatopoetic representation for each concept, and i) user specific information, in order to be able to map users with sets of languages and concepts.

The User DataBase, is in essence a subset of the CDB, and is produced by the teacher's actions according to the specific requirements for each individual learner. The UDB consists of one and only pair of orthographic and non-orthographic language (the learner's native natural language and alternative communication system respectively), and a subset of concepts relevant to the learner's vocabulary, along with all the associated concept representations. Extra care has been taken towards providing student vocabulary manipulation facilities, as well as offering the ability to adapt the system to the specific needs of each individual learner. In this respect, a specially designed software application allows the teacher to modify at will the UDB to better match the student's learning curve. In this respect, the teacher can make modifications to the vocabulary size (by means of defining the part of UDB "visible" to the learner), and structure (by organizing the individual language elements into subject categories according to whatever subject matter is felt more appropriate for each individual learner).

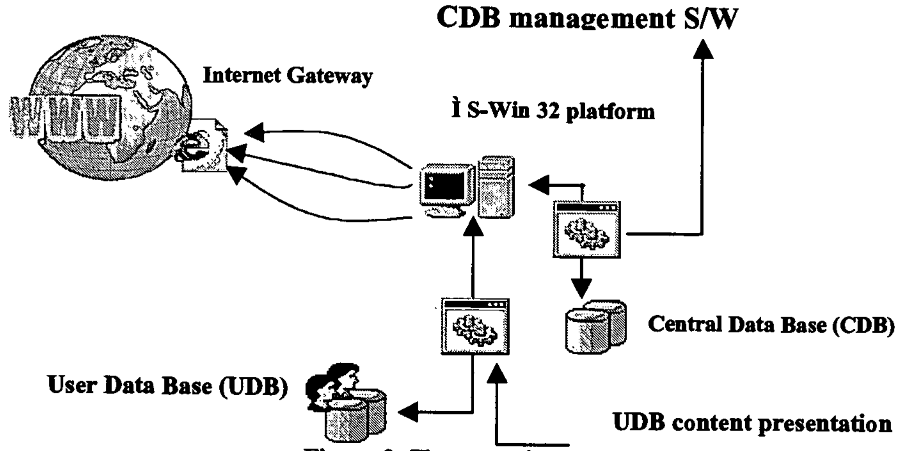

Figure 3: The system's structure

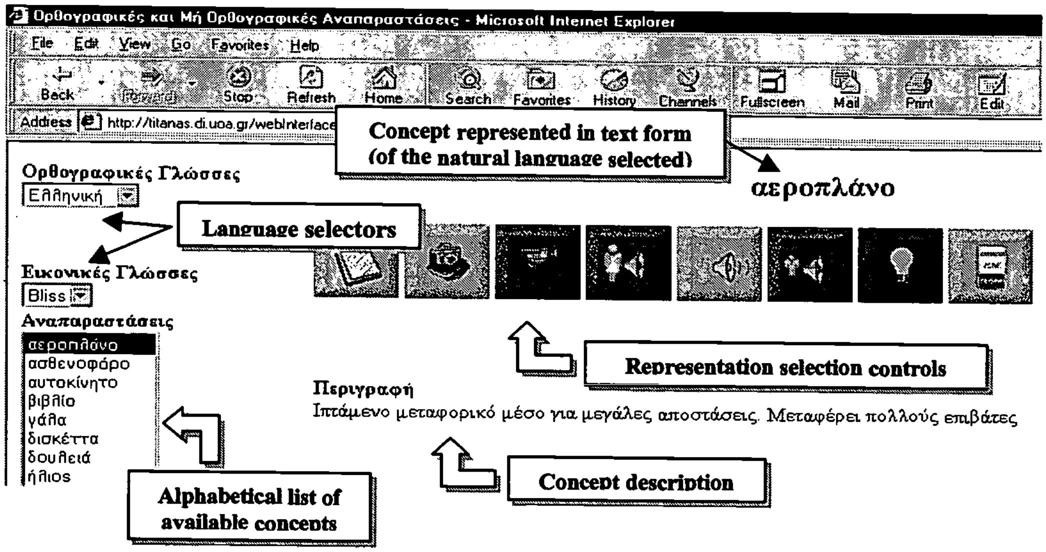

Figure 4: The Web Interface (presented in Greek)

Conclusions

The developed system fulfills the crucial need to prepare, organize and update the training material on time even online, free of any constrains brought forward by the environment or location, or even the operational platform (it is managed over the WWW). Teaching non-orthographic languages can change radically in the not so distant future by using what technology advancements have to offer. The system we have developed constitutes an integrated web-based environment that can cover the basic requirements of special education teachers to provide learner-specific educational content towards learning non-orthographic languages. The system is currently undergoing user trials in real life situations in the process of refinement and adaptation with the evolving technology and user needs. Our plans for future enhancements include, full support in all supported media representations of the BLISS language in Greek and English transcript, modification of the user interface incorporating special accessibility options for people with special needs in order to provide universal access to the system, extended user profile mechanisms holding user characteristics, skills, abilities and communication requirements, and the provision of both web-based and stand alone local versions of the lexicon, using ActiveX, JAVA and XML and ADO technologies. Another promising enhancement would be the inclusion of language specific grammar and syntax information that would allow for better and more correct whole phrase translation. The teaching process would also benefit even more should our system cooperate with other computer aided teaching applications specifically in the non-orthographic language domain.

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Special Needs Software Evaluation: Choosing the Right One

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Abstract: Choosing the right software for children with high incidence disabilities can be challenging as the selection of titles grows in our technology rich marketplace. Teachers are expected to select appropriate software for the classroom as well as recommend software to parents for supplemental support. Unfortunately, having more software choices does not make the task of selection less difficult. This study was designed to (a) provide a better understanding of how special education teachers in elementary grade classrooms evaluate and select computer software for use with their students and (b) suggest alternative characteristics to be considered for inclusion in evaluation instruments designed to aid the novice evaluator based on the analysis of teachers' needs.

Introduction

Currently, pre-packaged consumer oriented software selection is becoming a topic of discussion in the teachers' lounge and at parent teacher conferences. As the looming technological revolution forces technology integration into all classrooms, teachers of children with high incidence disabilities (learning disabilities, emotional/behavioral disorders, mild mental retardation, and developmental delays) continue to face the confusing task of selecting software. For those teachers charged with the selection process, making the right choice becomes very complex and may be uncomfortable as well as professionally challenging. Understanding the selection process regarding instructional software is not a new research paradigm. The evaluation of educational software has been under scrutiny for almost two decades. A review of literature shows the enormity of studies conducted as well as a wealth of models and evaluation instruments to be used by consumers of software. Unfortunately, all of the previous research may not have provided the foundation for transfer of this knowledge into teacher education programs or today's learning environments. To supplement traditional special education teaching methods, school districts are acquiring numerous software titles that are being sold as an interactive multimedia designed unit of instruction. According to some software publishers their products will "…build skill, confidence, and a lifelong love of learning" For Ages 9-12. The Learning Company, *The Clue Finders Reading Adventure* and "…children will learn an entire year's worth of reading, writing, math, and other essential 2nd grade skills" The Learning Company, *Arthur's 2nd Grade*.

For teachers, deciding if software is of value for the vast continuum of students with high incidence disabilities in our classrooms may prove demanding. Determining the instructional value of the pre-selected software may be difficult if not impossible by teachers who are allowed to read only the

description posted on the outside of the boxes or the synopsis that has been supplied by the publishing company. Most software programs have been marketed as beneficial for the development of a variety of skills our children need to obtain or improve. To add to the selection confusion, those brightly colored software packages seen in every retail store or publisher's catalog carry a variety of ratings or developmental level ranking to suggest they have been reviewed by some educational "authority". But for many of our special education teachers, just looking at the box to validate the accuracy of the selection process may be insufficient.

Each teacher must draw conclusions from some form of evaluation system regarding their students' ability to reach the instructional outcomes described by the manufacturer. That is, if there are learning outcomes included and described on the software package. Making the most appropriate decisions becomes very difficult for any teacher without an in depth knowledge of instructional design. According to Smith & Vokurka, (1990), "Special educators must also realize that learners with the same condition may not respond in the same manner to the same software program. A program that is effective with one may not work with another. Software selection should not be haphazard" (p. 38). Additionally, selection of the most appropriate software programs for children with high incidence disabilities, without proper teacher training on software evaluation, may increase the likelihood that an instructional unit might not meet specific instructional objectives or in some cases hinder the learning process.

Historical Perspective

A plethora of software evaluation studies were conducted in the 80s and early 90s (Allessi, & Trollip, 91; Borgh, & Dickson, 86; Haughland, 92; Malouf, et al, 89; Moore, 90; Nave, et al, 83; Richards, 93; & Smith & Vokurka 90.). "Organizations sprang up for the sole purpose of reviewing and recommending good instructional software (Roblyer et al (1997, p 116). One study by Malouf, et al, (1989) identified eight sources that were used by special education teachers to evaluate software. These preferred sources of information for selecting software for use with students with disabilities included: (a) talking with other educators; (b) tryout with students; (c) tryout without students; (d) written ratings/descriptions from evaluations or reviews; (e) pictures of sample screens from evaluations or reviews; (f) school system lists of recommended software; (g) documentation or manual included with software; and (h) software catalogs/advertisements. It appears that not much has changed in the last ten years with regards to the way special education teachers select software titles for instructional purposes.

Researchers from regular and special education have attempted to create models for software selection. The model posited by Smith & Vokurka (1990) describes their conceptualization of the steps for evaluation that establishes the interrelationships between people and procedures. These include: (a) define program parameters; (b) assess needs; (c) analyze content and analyze students characteristics; (d) develop/revise IEP; (e) select communication strategies (f) develop selection instruments (g) select software; (h) field-test software; (i) implement use of software; and (j) modify/adapt software. They distinguish between and the management process and the instructional process for software selection. According to Smith & Vokurka "The selection process must be grounded on the principles of functional utility of the chosen software and not on the creation of 'window dressing'" (p. 37). They also suggest an effective evaluation instrument ought to be: (a) easily used by evaluators; (b) organized in understandable and legible format; (c) detailed enough to present a reasonable determination of the value of a program and short enough not to discourage use; and (d) include a final overview that at a glance indicates the evaluator's recommendation.

As the research in the area of software evaluation progressed throughout the decade, the fundamental concerns of teaching and learning foundations have not been disputed. Researchers such as Lahm & Nickels (1999) still report it is "Essential for all teachers is the knowledge of procedures for determining if a software program or assistive device has potential for a student or class of students. Often school districts have a particular procedure defined for general software evaluation, but the specific learning needs of students in special education may demand additional or adapted procedures. The essence behind this set of skills is the assurance that technology will be matched to the student's specific needs, with the goal of keeping the student on target within in the curriculum and moving toward meeting the student's IEP

Moore (1990) has a variety of recommendations that he suggests ought to be used by those who work with special needs students. His list includes: (a) contacting software companies to acquire the product descriptions that correlate each program to specific curriculum areas and academic levels; (b) gathering information from the national organizations for special needs to have them help in the identification of appropriate software that has been evaluated by "educational software experts who know how to critically assess a software program", and (c) obtaining a working copy of the program to preview it as well as review the documentation. Concerning the program's instructional soundness he states "unless you are and expert, you may not be able to make that kind of an assessment,…. however, if the program looks good on the evaluation criteria it will score well on other counts as well" (p. 61). His evaluation criteria are fundamental and look at these characteristics: (a) computer compatibility; (b) documentation thorough, clearly written, and well organized; (c) focus on skills (d) supplement or complement work; (e) appropriate for age, grade, & reading level; (f) can it be customized; (g) design features – music, colors; and (h) use of adaptive devices. Another example of the characteristics used in an evaluation instrument is represented here by the Northwest Regional Educational Laboratory, *Evaluator's Guide for Instructional Packages* (1994).

Content Characteristics
The content is accurate
The content has educational value.
The content is free of race, ethnic, sex, and other stereotypes.

Technical Characteristics
The user support materials are comprehensive.
The user support materials are effective.
Information displays are effective.
Intended users can easily and independently operate the program.
Teachers can easily employ the package.
The program appropriately uses relevant computer capabilities.
The program is reliable in normal use.

Instructional Characteristics
The purpose of the package is well defined.
The package achieves its defined purpose.
Presentation of content is clear and logical.
The level of difficulty is appropriate for the target audience.
Graphics/color/sound are used for appropriate instructional reasons.
Use of the package is motivational.
The package effectively stimulates student creativity.
Feedback on student responses is effectively employed.
The learner controls the rate and sequence of presentation and review.
Instruction is integrated with previous student experience.
Learning can be generalized to an appropriate range of situations.

Purpose

This study was designed to (a) identify the characteristics special education teachers in elementary classrooms believe to be important to consider when evaluating and selecting educational software; and (b) identify their students' favorite software titles.

Methodology

Participants

The participants from this study were employed in two school districts in Southeast Florida. The first school district had a total student enrollment of approximately 145,000 students and district two had a total student enrollment of 80,000 students. Both school districts gave permission to contact each elementary school with an ESE program and request their teachers complete our survey. A total of 182 surveys were distributed and 115 completed surveys were collected for a return rate of 67%.

Teachers surveyed included: (a) specialists teaching in varying exceptionalities resource classrooms; (b) teachers instructing in self-contained E/BD classrooms; (c) teachers providing instruction in classrooms implementing inclusion, and (d) teachers serving students in pre-K exceptional student education classrooms.

Design of the Instrument

The instrument was developed by generating a list of important items based upon our prior experiences developing surveys and the review of literature. Second, we created an initial draft of our instrument designed to elicit information from teachers to answer the research questions. Ten exceptional student education teachers reviewed the initial draft and provided feedback and suggestions for improving the questionnaire. Based upon their responses, questions identified as unclear were removed and the instrument was re-written to shorten the length.

The second draft of the instrument was piloted with 18 exceptional student education teachers from six elementary schools. The pilot test helped us to further refine the instrument by reorganizing the question sequence and removing information that did not address the research questions. The final survey contained 19 items and required approximately fifteen minutes to complete.

Data Collection

The data was collected both quantitatively and qualitatively using the Technological Needs Survey -ESE Teachers-questionnaire. After approval from the university as well as the school district central administration to conduct the study, a letter was sent to each elementary school principal in the county requesting permission to survey the ESE teachers. A two weeks deadline was requested for return of completed surveys after which time we made a follow-up phone call as a reminder. All questionnaires were returned after eight weeks for data analysis.

Data Analysis

The quantitative data from the Survey items were analyzed using SPSS for Windows v. 10.0. A Microsoft Access for Windows 95 database was designed to improve the reliability and ease of entering and organizing the data from the completed surveys for descriptive analysis only.

The qualitative data from the teachers' written description for choosing software titles was analyzed as described by Miles and Huberman (1994). Data were coded for recurrent patterns to identify themes. Two researchers independently read and unitized the data, completing the first level coding. Additionally, the data were then pattern coded and grouped into themes. The researchers then met to compare pattern coding. When differences existed, the researchers discussed and mutually agreed upon a common pattern. The researchers identified themes through concept mapping of the data (Carley, 1993). When analyzing qualitative data, this process is analogous to the cluster analytic and factor analytic devices used in statistical analysis (Miles & Huberman, 1994).

Results

The survey results indicated that special education teachers identified many of the same characteristics evident in numerous evaluation instruments available today to aid in the software selection process. Content analysis of the qualitative data has led the researchers to identify four areas that are salient and distinguishable from current evaluation scales criteria. These characteristics include the thematic content identified as: (a) individualizing; (b) integrating; (c) diversity; and (d) narration. Further study will be undertaken to support these findings.

The following list categorizes the characteristics and their indicators

WELCOMING
Indicators: **Entertaining, Interacting, Pacing, Timing,** Gaming, Tutoring, Clarifying Instructions, Pricing
BUILDING SKILLS & KNOWLEDGE
Indicators: Self-Correcting, Rewarding, Practicing, Reinforcing, Evaluation/Assessing, Scoring, Charting

INDIVIDUALIZING
Indicators: Adapting, Assisting, Keyboarding Skills
INTEGRATING
Indicators: Meeting Standards, Meeting Curriculum Goals, Specializing in Content Areas, IEPs
NARRATION
Indicators: Reading/Non Reading, Storytelling
PROVIDING DIVERSITY
Indicators: Bilingual, Multicultural, ESOl/ESE
TECHNOLOGY ACCOMMODATING
Indicators: Used by current technologies in classroom

This list identifies the most selected software titles chosen for use in the special education classroom. These software titles are dated and indicate a lack of current software selection by the teachers sampled.

Choice	*Title*
1st	***Just Grandma & Me***
2nd	Bailey's Book House
3rd	Math Blasters
4th	Millie's Math House
5th	Dr. Seuss ABC Instruction
5th	Reader Rabbit
6th	Carmen San Diego
6th	Jumpstart Pre K
6th	Student Writing Center
6th	Treasure Math Storm
7th	Earobics
7th	Jumpstart K
7th	Kid Pix
7th	Magic School bus
7th	Print Shop
7th	Sammy's Science House

Findings

This study provides a better understanding of the characteristics special education teachers in elementary classrooms identify when they consider evaluating and selecting educational software for use with their students. The study has also provided the researchers with crucial information for developing a software evaluation scale specifically designed for use by teachers of students with high incidence disabilities.

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Effective Technology Practices in an Inclusion Classroom: A Proposed Teacher Training Model

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Abstract: This paper reports on the rationale for a study designed to determine the effectiveness of technology enriched assignments integrated into a pre-service teacher education program for future special education teachers. The requirements of new federal legislation which emphasizes the inclusion model are discussed. The role that technology can play in implementing effective teaching practices in the inclusion classroom is explored. The possibilities of enhancing recognized effective teaching practices such as strategies training and curriculum based assessment through technology is discussed. Methods for determining the effectiveness of a technology integration plan into pre-service teacher education programs are explored.

Acknowledgements

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Review of the Literature

Federal Legislation

For over 25 years, research reviews and position papers have called for the education of students with mild disabilities in general education classroom settings. Of particular concern has been the lack of evidence that separate class placement improves the academic achievement or quality of life of students with mild impairments (Waldron & McLeskey, 1998). Recent federal legislation places a priority on educating children with disabilities in regular education environments. A provision in the Individuals with Disabilities Education Act (IDEA) states that students with disabilities should be removed from the general education environment "only when the nature and severity of the disability is such that education in regular classes with the use of supplemental aids and services cannot be achieved satisfactorily" (20 USC Section 1412 (5) (B)). Recent amendments to Part H of the IDEA of 1991 have promoted the use of computers and assistive technology to enhance and further the educational options of students with disabilities. Despite federal legislation, there is some resistance to implementing the inclusion model among regular educators. Some of the concerns regular educators express when considering an inclusion model for providing services for students with special needs include:

1. Discipline problems
2. Providing appropriate instructional activities and materials
3. Negatively impacting the academic progress of "regular" education students as well as special education students in the classroom. (Tyler-Wood, 1996).

Effective Inclusion Practices

Researchers in special education have proposed that technology offers a potential method of solving one of the greatest deterrents to inclusion by offering the potential of truly individualized instruction that addresses all students' specific academic needs (Woodward and Reith, 1997). The effective implementation of technology into the regular classroom setting offers many possibilities for implementing an individualized instructional plan for any student with specific learning needs. It is important for future

special educators to utilize effective technology based instruction so that special educators can assist regular educators with implementing an effective inclusion model.

Training Technology Fluent Teachers

Sheingold and Hadley (1990) estimate that it takes between five and six years for teachers to master the use of computers and technology, and implement effective technology into everyday teaching practices. Sheingold and Hadley further hypothesize that if pre-service teachers were well prepared this time would decrease significantly.

Teachers have indicated that their greatest barrier for use of technology is a lack of understanding of how to use it in classrooms. (Hancock & Betts, 1994). A recent survey of teachers indicates that only 28% of teachers believe they possess adequate computer skills, 48% of teachers surveyed state that their computer skills could benefit from improvement, 17% indicate their computer skills are limited and 7% indicate they possess no computer skills (Tyler-Wood, Putney, & Cass, 1997). In certain areas of technology the need for training for educators is even greater. Lesar (1998) indicates that in the field of assistive technology 92% of pre-service teachers indicate inadequate preparation.

To address the need for computer competence among future teachers, many colleges and universities have implemented a technology-specific course (Hess, 1990). Stuhlmann (1998) indicates that a single course offering in technology isolates the subject and does not provide pre-service teachers with learning activities that demonstrate how technological applications may be used in specific academic disciplines. Harrington (1993) indicates that colleges of education must develop systematic plans for integrating technology into teacher training programs if future educators are to use technology effectively

Benefits of an Inclusion Model

As previously stated, one of the major concerns regular educators express regarding inclusion is the effects that the model will have on the achievement of "regular" students in the inclusion classroom. The academic skills and levels of students in the average classroom vary greatly. Many students with significant academic deficits who are referred to special education do not meet criteria and continue to receive services in the regular class setting. Often the student who is denied access to special education services is considered a slow learner and can present significant challenges both behaviorally and academically to the teacher in a regular classroom environment. It is possible that some of the techniques and strategies used in special education can benefit any child. Whitworth indicates that more and more children fall into the "gray area" between regular and special education. There continues to be a significant overlap in the needs of these "gray area" students and students who actually meet criteria for services from special education (Roblyer & Edwards, 2000). Although academic goals may vary for regular and special needs students, Hanley has assigned many of the same benefits and limitations to technology for all students, regardless of the groups in which school systems place them.

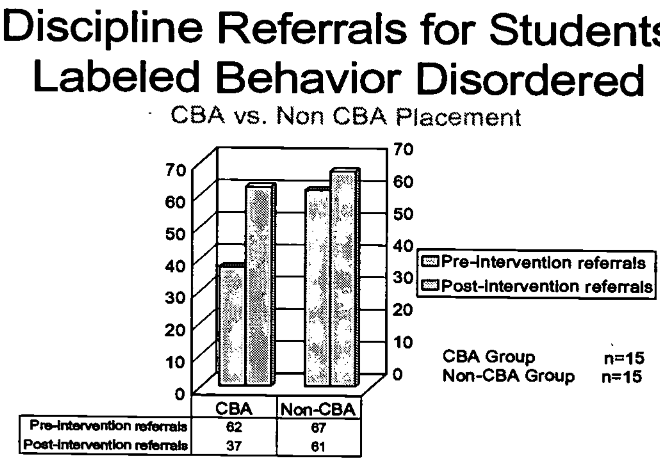
Effective Teaching Practices Enhanced Through Technology

There are some possible "tools" which could benefit all learners and assist all educators to meet the educational needs of students who have special learning needs but who do not qualify for special education services. These tools include curriculum based assessment (CBA) and strategies training enhanced through computer usage. Jones (1998) indicates that CBA includes systematic monitoring and recording of a students' performance in the school curriculum as a basis for obtaining information to make instructional decisions. Rapid developments in hardware and software have allowed special education teachers to develop ongoing assessment systems that track student progress on a daily basis. Combining technology with curriculum based assessment allows a teacher to frequently assess skills and transform data into a detailed picture of student progress (Woodward & Rieth). CBA offers a dramatic alternative to traditional concepts of instructional technology used in special education. Rather then using technology for merely drill and practice activities, CBA attempts to modify daily instruction based on the results of systematic assessment procedures. Using the adopted "regular classroom curriculum", the teacher administers skill tests or probes from a domain of items reflecting the schools adopted curriculum. Deficit areas and areas of strength are readily identified for all students. Appropriate instructional materials including specific software can be used to remediate a student's weakness and further enhance a student's

strengths. Because CBA allows each student to experience instruction at the appropriate level, all students including high ability students can benefit from instruction based on CBA.

One of the main concerns that teachers have with implementing an inclusion model involves controlling student behavior. Tyler-Wood & Pemberton (1999) have demonstrated a reduction in discipline referrals for students labeled behaviorally disordered after a CBA program was implemented. They hypothesize that students are less likely to engage in inappropriate behavior when classroom instruction is at a level where students can meet with success.

Figure 1



When students with special needs use the computer for skills beyond the drill and practice level, it is essential to provide for the development of metacognitive planning, evaluation and monitoring. (Woodward & Rieth). Typically students with special needs experience significant difficulties in these distinct areas. Learning strategies are defined as techniques, principles or rules that enable students to learn, to solve problems, and to complete tasks independently (Mercer & Mercer, 1998). For a number of years, special educators have recognized the need to provide training from broadly applicable strategy instruction to strategies that are highly content specific. There is a vast amount of literature concerning effective strategy instruction. There is a general consensus among experts that strategies need to be taught explicitly and in context and that successful strategies instruction requires focused practice and long term follow-up. Technology can be an important component of strategies training. Carnine and Boriero (1990) have successfully used the computer to provide a strategy for solving traditional mathematics problems. When a mathematics problem was presented, a computer program displays a keyword strategy for analyzing word problems. Students met with great success using the keyword approach. Historically, intensive strategies training has been implemented primarily with students served in special education. However, strategies training can provide benefits for many students.

In general, it appears that the effective implementation of a technology based instructional plan can greatly assist in alleviating the three main concerns regular educators express concerning the implementation of an inclusion model. Technology can assist with providing appropriate curriculum and instructional materials for special needs learners. By providing assessment and instructional materials at the appropriate level all students as well as special education students in the inclusion class can benefit from more individualized instruction. Some research also indicates that appropriate instruction can reduce the occurrence of discipline problems. The current literature indicates great potential for effective computer use in inclusion classroom. Recently enacted federal legislation emphasizes the importance of implementing an effective inclusion model.

Technology Standards in Teacher Education

The importance of integrating technology into special education teacher programs has been recognized by the National Council for the Accreditation of Teacher Education (NCATE) (Wise, 1997).

To facilitate inclusion it is important that pre-service teacher education programs for future special education teachers incorporate the effective use of technology into the curriculum. The most desirable model is the integration of technology use in teacher education course, especially methods courses (Dickson, 1989). NCATE and the International Society for Technology in Education (ISTE) have collaborated on evaluation standards for teacher education programs. The role of ISTE is to suggest standards for technology education (Thomas, Taylor & Knezek, 1994). ISTE and NCATE have both developed a list of standards that recommend teacher technology competencies. Of particular note is that NCATE reviews technology pre-service teacher competencies within an entire teacher education program. Competencies cannot be addressed by a single course labeled "the technology course." Prior models that recommend a course to incorporate technology into the curriculum may not meet NCATE or ISTE standards. Clearly, our current challenge is to determine an effective model for training pre-service teachers to effectively use computer technology particularly in an inclusion setting. One course cannot meet the technology needs of pre-service teachers.

Effective Technology Integration Programs

Stuhlman (1998) sought to determine if a sequence of courses with practice-oriented technology components changed pre-service teachers' perceptions of the role of the teacher and of the use of technology in classrooms. Stuhlman discovered that reinforcement and practice in technology over time had an enormous impact on pre-service teachers' abilities to implement technology into lesson plans and to transfers skills to other educational situations. Although the sample size is somewhat limited, Stuhlman's research indicates that infusing technology into teacher education programs is vital if we are to produce teachers who are prepared to educate students to meet the challenges our society holds. It is just as imperative to determine technology skills that will enhance student and teacher participation in an inclusion model classroom.

The Proposed Study

The proposed study provides an opportunity to train pre-service special education teachers to use technology to implement effective teaching methods in an inclusion classroom. In four pre-service curriculum courses, special education pre-service teachers will be required to complete assignments which integrate technology into recognized effective practices such as strategies use and CBA. Through funding provided by the Department of Education though a Preparing Tomorrow's Teachers to Use Technology Catalyst Grant the effectiveness of the technology enriched assignments integrated into pre-service curriculum courses will be determined. Using a survey, students' level of technology proficiency will be determined prior to entry into the technology enriched pre-service curriculum for future special education teachers. A group of students who completed the same courses without experiencing the technology enriched assignments will serve as a control group. A minimum of two technology enriched assignments will be required in each pre-service course. Each special education pre-service teacher is required to complete a portion of student teaching in both a special education classroom and a regular classroom situation. Lesson plans for the control group and the technology enriched group will be monitored to determine if the technology enriched group incorporates more technology into their lesson plans. At the conclusion of the student teaching experience, the control group and the technology enriched group will complete a post-intervention survey to determine perceived level of computer competence. Students in the technology enriched group will also provide feedback on the effectiveness of the technology enriched assignments they completed as part of their teacher training program.

Potential Impact

Data generated from this study should provide valuable insight into:

1. The effectiveness of the technology enriched assignments dealing with strategies training and curriculum based assessment.
2. Determining if providing pre-service teachers with technology enriched training increases their perceived level of computer competence

3. Determining if providing pre-service teachers with technology enriched training increases the number of technology enriched assignments student teachers implement during their student teaching experience. Data gained from the current study will assist pre-service training programs in determining effective methods to educate effective inclusion model educators.

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Teaching Faculty and Future Teachers About Web Site Accessibility: Issues and Challenges

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Abstract: Kent State University considers itself a highly "on-line" university. Yet, it lacks a comprehensive vision resulting in significant resource and teaching gaps. An example of this is in preparing future teachers in both general and special education licensure programs to make technology accessible to students with disabilities. Individuals are making efforts to address some of these issues. The presentation reviews these efforts and remaining gaps at the university, department, and course levels and identifies suggestions at each level to support a more consistent approach.

Problem Statement

Kent State University considers itself to be one of the most "on-line" universities in the country. It regularly posts technology updates on its home page (Garmon 1999). It markets itself to potential undergraduate enrollees as providing email access from every building on campus and that every student has received an email account as of Fall 1997. Yet, there have been significant difficulties in supporting this image and the infrastructure and training available at the University has not been able to keep pace with the technology marketing. For example, all students received their email address in Fall 1998, however the campus dormitory buildings, from which most of these students needed access, were not fully wired until late Spring, 1998. For graduate students, there has been a significant problem with remote and off-site access. They have had limited access capabilities since Spring 1997, however each connection had a time limit of 10 minutes. For many, this made such connections practically non-functional.

The University has not developed a comprehensive technology vision of itself that integrates efforts occurring across campus. Much is driven by a need to compete with nearby universities. Efforts to use technology for individuals with disabilities is often based upon basic compliance; avoidance of ADA (Americans with Disabilities Act of 1990) complaints is the motivation for most efforts. These are also met with mixed success. For example, a new Recreation Center has been marketed as providing all students and staff with state-of-the art facilities and accessibility. A review of the nearly-completed building showed that wheelchairs could not move into and around the children's nursery, and the lack of sufficient stopping distance for the ramp to the swimming pool put persons in danger of skidding into the pool. Building plans had been reviewed for these issues prior to their finalization.

Kent's interest in and commitment to technology could be a tremendous asset in providing increased services to students, and particularly to those with disabilities. The ability to adapt input and output modes to meet individual user needs is one of it's greatest contributions for equalizing accessibility. By creating an informed and unified vision, the University could expand this accessibility in conjunction with its other technology efforts.

The University is making considerable efforts to seek new recruitment pools of students. Those with disabilities are such a potential pool. This type of recruiting supports a trend for an increasing number of students with disabilities who are entering postsecondary and university settings (Wagner 1993). In addition, Kent was originally founded as a "normal" school to train teachers. Legislative mandates and ongoing emphases to include all students with disabilities in the regular public school classroom (Individuals with Disabilities Education Act of 1990; Amendments of 1997) place learning about disability and accessibility as a critical competency for teachers in carrying out these mandates. Kent's College of Education had a strong interest in technology and commitment to produce qualified teachers. These interests and programs could complement each other very effectively and efficiently. The largest pool of future teachers includes programs in infant/toddler, elementary, secondary education, and administrative licensure through the Curriculum and

Instruction Department for general educators. The Special Education is a large and growing program area that provides licensure in all disability areas except for visual impairments.

Future teachers are currently receiving no training in adapting and adaptive technology features. They also learn none of the cautions and issues. For example, the Windows 95 icon-based menus initiated a new type of barrier for those with visual impairments which they had not faced with prior text- and DOS-based menus. A number of Kent faculty are concerned about adequately preparing future special education and general education majors for using technology in ways that support the unique individual needs they will meet when working with public school students with disabilities. In addition, University faculty are not being given the tools to present a model of this accessibility. There is a significant University and Departmental drive to build web pages for every major office and department, and for individual faculty to have homepages. There has been little attention given to accessibility to this web-based information. To date, there has been no policy discussed or implemented, or any University-wide recognition of this as an issue. There is one little-known website which provides a lengthy description of suggestions, concerns, and processes to use in considering this task (Garmon 1998). The University is currently operating in a "technology-reactive"mode to pressures from the community and its constituents.

University-Level Efforts

Some of the individual faculty have begun efforts to raise issues of accessibility and present more "technology-proactive" recommendations at several layers: at the university level, the department level, and the course level. At the university level, the University ADA Committee oversees accessibility complaints and makes recommendations to the Vice President. The Committee initiated a Technology Accessibility Working Group in Fall 1998. This group has made efforts to gather information on student and faculty activities related to technology accessibility in order to implement a proactive approach aimed primarily at the faculty; this uses a "bottom-up" approach to systems change. Two of the Working Group members collaborated to post a web-page with concise suggestions that could be implemented by individual faculty (Mitchell & Lilly 1999). This contrasted with the prior, little-known document that involved department-wide discussions and committees (Garmon 1998). This new page is organized for several "quick-tips" suggestions for faculty, as a place to start. The site provides hot-links to mandates on disability rights, "The 60-second Seminar" (Freed 1996) and resource sites including the Trace Center, and the "Bobby" site for web-site "validation".

The Working Group will initiate planning efforts with the University personnel training department to develop a number of 30-minute seminars to address building accessible websites. These seminars will be included in the general professional development seminars that are advertised and offered each semester. This will help to achieve two goals: to provide training at the faculty level to support further implementation of accessibility and provide role models to students; and to make faculty aware of and knowledgeable about these issues so that they will be able to instruct their students more effectively. From this "bottom-up" approach, it is hoped that faculty and departments will be motivated to craft guidelines and policy which will then, influence University Administration to do the same. The Technology Working Group will present efforts to the ADA Committee Marketing Working Group so that individual and departmental efforts are publicized within the University Committee.

A second university-level effort took a more "top-down" approach in which one of the Working Group members made a presentation to the University Technology Committee (UTC) about making computer labs accessible (Mitchell 1998). This individual had researched a series of recommendations for low-cost hardware and software solutions for creating generic, accessible workstations. The proposal created two workstations, one for each of the Windows and MAC platforms for a total that was less than $1500. The UTC took the suggestions but has not yet submitted them to a higher governing body. A number of new building projects have been initiated at the University but none have received this or other information on worksite accessibility; there have been some efforts made to comply with building accessibility mandates.

Department-Level Efforts

Through information sharing at the Technology Working Group and ADA Committee, three individuals are in the process of investigating making computer labs with accessible workstations at each of their departments

(Departments of Speech and Audiology, Special Education/Rehabilitation Counseling, and Professional Development/Classroom of the Future). Speech and Audiology is in the process of installing one lab with the two accessible workstations. Hardware and software has been purchased and space allocated. The lab is in the process of resolving compatibility issues across both platforms through the department network . The two other faculty have passed these recommendations to their departments and colleges but there have been no funding or purchasing commitments made to date. Both currently have lab space allocated.

The Special Education program area has not had much involvement in technology accessibility issues to date. They have faculty with some expertise and in many ways, should be a key component in implementing accessibility projects. To date, there have been superficial discussions about encouraging web page development with a much greater emphasis on scheduling each faculty member to teach at least one course using distance education technology, although implementation has been hampered by a lack of facilities and supportive infrastructures. The department echoes administrative concerns to ensure they have a competitive edge on other neighboring universities in terms of recruitment.

The department underwent a 2-year process of redefining its curriculum including restructuring its several disability licensure programs and rewriting its courses. The state changed and significantly updated its certification/licensure programs and the department used this as an opportunity to update its offerings and program structure. Thus, the department has a strong interest in remaining current and credible. However, it has not been able to take a proactive stance on issues of accessibility. It has been raised as an issue but few of the faculty find it of concern. This is despite having an affiliated faculty member in Rehabilitation Counseling who is legally blind and uses specialized computer-viewing equipment.

The lack of department and faculty interest means that very few, if any, students currently learn about computer accessibility issues or challenges. In addition, few faculty include technology-based teaching in their courses. Some of this is due to the lack of sufficient technology within the College of Education (one IBM lab, one MAC lab, one multimedia lab, and one moveable station with LCD display across 80 faculty). The impact on students is to further reduce their opportunities to see and learn about its use. In terms of general accessibility preparation, there is almost no available assistive technology to share with students. It is addressed theoretically but there are few opportunities to see equipment other than videotape presentations. This situation will need ongoing discussions to raise awareness and then later, to investigate additional equipment purchases.

The Instructional Technology program area is within the same department as Special Education. They have previously been responsible for providing all beginning teacher students (general and special education) with a 3-hour class in instructional media (overhead projectors, making slides, laminating, basic computer skills). This course has not addressed much of the instructional change occurring as a result of Internet use. Students have no background preparation in applying web-based activities to instruction, building homepages, or in multimedia applications for teaching (e.g., PowerPoint). This information is available at the graduate level through the Instructional Technology masters program or through electives. Undergraduate future teachers remain by far, the largest group of students within the College but are unable to take these courses.

The Curriculum and Instruction department prepares all special education and general education students in core content areas of education. In response to state-led licensure changes in Fall 1997, they revised their curriculum and organized instruction to use "instructional blocks" rather than standard coursework sequences. This resulted in the elimination of an introductory special education course and the introductory technology course. Two special education faculty collaborated for two years in organizing these changes to include critical special education instruction. However, these faculty were not included in final course and implementation decisions. As the teacher preparation program currently stands, these issues will be taught be general education graduate students and are no longer considered within the special education program's domain, except for voluntary monitoring.

The Instructional Technology program also lost their introductory course during this change. They have been able to keep a one-hour instructional block to teach about technology and computers. This could be an opportunity to provide more current technology competencies and could include accessibility information as part of a web-site development module. It is unlikely that the Instructional Technology program area would suggest this in the curriculum at this point. One of the faculty in this program area is a member of the UTC, however the program area has shown little interest in accessibility or University-wide technology issues. There primary interest is in supporting their own program including an ongoing struggle to maintain, service, and update their equipment and to compete effectively for College resources in order to do so.

Course-Level Efforts

At this time, no courses within the College of Education teach general or special education majors about Internet, web-page, or multimedia products, or address computer accessibility issues and challenges. Two introductory courses that existed until Fall 1999 could have been used to prepare all teacher education graduates in these competencies. These are now out of the control of the related program areas and are scheduled to be taught be graduate students who are unlikely to have accessibility awareness or skills. The rationale for the new "block" scheduling of education courses was to permit flexible, in-depth learning opportunities in an integrated and thematic manner. Although pedagogically progressive, the expertise of special educators and instructional technologists is not being included.

The current focus on inclusion of students with special needs in the regular classroom places all education graduates in the position of needing to know these strategies. The education block courses will carry the primary content preparation for future teachers including theoretical discussions of working with students with disabilities. Without the involvement of key program area faculty, these graduates will not know how to provide this accessibility information. The current schedule also has significantly reduced instructional time given to special education and to technology instruction. These 2 courses could have been used to address the range accessibility issues that will face these future teachers.

Without students who have background technology skills, faculty are generally unable to assign web- or multimedia-based assignments unless they are willing to use course time to teach the prerequisite skills themselves. At present, one individual special education faculty member requires web portfolios of the students. Faculty cannot demonstrate use of technology because there is a lack of equipment. At present, teacher graduates may leave with little more than a knowledge of some basic applications and email.

Conclusion and Recommendations

In summary, the University's eagerness to be networked and "on-line" is not being supported by development of a comprehensive vision, through basic faculty and student training, or by strengthening infrastructure support mechanisms. Almost no attention is being given to accessibility issues. Yet, all levels of educational institutions are serving increasing numbers of students with disabilities. The following are some suggestions for ways that these skills could and should be addressed for this and other teacher preparation programs.

College of Education Course and Department-level Strategies

Use bottom-up strategies to raise faculty and Department Chair awareness of issues; tie this to University-wide goals to increase enrollment and to faculty obligations to be "current" and responsive to students' future needs.

Provide a few interested Special Education faculty with time to learn accessibility strategies; include at least one representative of the Instructional Technology program faculty in this training also. Use these individuals to continue awareness-raising and involvement in bottom-up change strategies.

Involve at least one interested faculty member from the Curriculum and Instruction department in discussions of technology and/or training (e.g., ADA Committee, needs to co-teach key "blocks"of content, content of interdisciplinary courses should be be reviewed and approved by their respective faculty. Build consensus and a commitment for ongoing collaboration that is overseen at the Department Chair level.

Make presentations at the monthly College Teacher Preparation Council meetings to raise general awareness and concern regarding future teacher competencies. Raise issues about current curriculum and lack of involvement of key, trained faculty. Have Department Chair raise this as an issue at the College Dean's and Chair's meetings.

Develop strategies that build on general awareness: Department policies/projects regarding technology must also address accessibility; faculty projects and assignments using technology should also include aspects of accessibility.

University-wide Strategies

Use Personnel Bulletins to emphasize "easy" ways to learn about making accessible web pages (advertise "30 Minute Seminars" and "quick tips" on ADA web page)

Identify a cadre of interested faculty and staff who are willing to serve as resources across the University; include individuals from the personnel training department and have them co-teach initial faculty training seminars, if desired. Publicize training efforts and successes; utilize and involve the ADA, UTC, and other relevant standing committees.

Use top-down strategies to raise awareness at the Vice President and Dean level that address ADA compliance regarding technology; cost-effective ways to support accessible web pages and laboratories with dissemination of software and hardware recommendations; show students with disabilities as a new recruitment pool and the low-cost nature of these recommendations which comply with the University Mission and the President's goals.

Develop strategies that build on general awareness and move toward University-wide policies/projects regarding technology that must also address accessibility; propose Administrative modeling of technology accessibility for departments, faculty, and students.

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SOCIAL STUDIES

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Social Studies has experienced a tremendous transformation regarding the integration of technology. Despite remaining a discipline whose status in schools and society is much less than adequate, professional social studies educators are engaging in dynamic technology oriented projects. These projects not only have a very positive influence on the discipline of social studies itself, but we are also witnessing a greater impact on our students, other teachers and professionals, and society in general. The papers included in this section demonstrate creativity, passion, and a transformative focus so needed in integrating technology into social studies education at all levels.

The first paper provides an overview of activities by Project Impact partners headed up by Cheryl Mason at the University of Virginia. The goal of the project is to improve technology integration in teacher preparation programs. This paper highlights the efforts of Project Impact in social studies in the areas of teaching social issues, government documents online, digital resource centers, GIS, and other web resources.

Wellman, Creedman, and Flores of UCLA describe a project in California whereby participants worked in online collaborative workspaces to develop technology materials. The focus of the materials development is to support historical thinking and understanding in K-12 classrooms. The authors suggest that problem based and constructivist principles are essential in using technology to support historical thinking. The CH-SSP web site holds the completed materials.

John Lee of the University of Virginia presents preliminary finding regarding a study assessing pre-service teachers' knowledge development regarding the teaching of history using digital resources. The findings indicate a distinct difference between historical content knowledge and pedagogical knowledge regarding history.

Dawson and Mason focus on the concept of collaborative dialog in a case study that included web-based multimedia and threaded discussion groups among social studies educators. Preliminary findings indicate the importance of instructional strategies that relate to knowledge construction and interactions among the geographically disparate.

Interdisciplinary applications for Geographic Information Systems (GIS) are the focus of the paper by Alibrandi and Keiper. Successful examples of GIS integration that offer interdisciplinary applications are included. Successful integration is enhanced through teacher collaboration and the combination of GIS and other technology applications.

The Learning with ISLA (Information System of Los Angeles) project is described in the paper by Vogt, Kumrow, and Kazlauskas. The project web site includes a variety of resources that facilitate the use of primary research materials for the humanities. The web site development process and ideas for applications are also included.

Asan from Karadeniz Technical University in Turkey suggests the technology integration can facilitate students' active involvement in problem solving and critical thinking in the social studies. Analyzing the effectiveness of specific courseware for primary social studies students in Turkey is the focus of this study. A transformation from a traditional teacher -directed focus to a more student-centered model is also described.

The use of online discussion groups within the social studies program area at the University of Houston is the focus of the paper by White. The goals of facilitating reflection, critical dialog, and developing a community of learners are described. Examples from student postings and responses are included. An analysis of the effectiveness and ongoing issues regarding online discussion in social studies is provided.

Integrating technology in elementary social studies is the focus of the last paper in this section. The study describes pre-service students' integration of technology in methods course assignments. Findings suggest that students rarely went beyond basic expectations in integrating technology.

Waking the Sleeping Giant: Social Studies Teacher Educators Collaborate to Integrate Technology into Methods' Courses

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Abstract: This paper presents an overview of the efforts undertaken by a collaborative group of social studies teacher educators to identify and develop appropriate models of integrating technology into social studies teacher education. The goal of the Impact Project is to facilitate and accelerate change in the nation's teacher education programs, encouraging university faculty to incorporate appropriate uses of technology in teacher preparation programs. The Impact Project promotes appropriate uses of technology in specific content areas. Specific modules and activities are described.

Technology has been called the sleeping giant in the social studies curriculum (Martorella, 1997). A giant, because technology holds extreme potential in our society and in our social studies classrooms. Sleeping, because of the dearth of research, development, and implementation about technology integration by social studies educators. One group of social studies teacher educators, however, have joined together to rouse this sleeping giant. These teacher educators are collaborating together as partners in Project Impact.

The goal of the Impact Project is to facilitate and accelerate change in the nation's teacher education programs, encouraging university faculty to incorporate appropriate uses of technology in teacher preparation programs. The Impact Project promotes appropriate uses of technology in specific content areas. This multi-year initiative has supported the development of technology-infused modules to be used in the social studies curriculum and the identification of existing technology-infused social studies curriculum materials. While the Impact Project targets faculty members who prepare teachers, the materials developed may also be used by practicing teachers. In fact, most of the materials developed have been field-tested in K-12 classrooms by practicing teachers.

Effective integration of technology into the social studies can better promote the goals of education in a democratic society by making learning experiences more active and authentic and by promoting critical thinking. The initial phase of the Impact Project included the creation of technology-infused lessons and of lessons that utilize existing software. We are making concerted efforts to develop lessons for each of the disciplines within social studies. Additionally, we are including a variety of the technology applications used in the social studies. The following sections will highlight modules and instructional materials currently being piloted and developed by Impact partners.

The Impact Materials

Teaching Social Issues

Teachers who wish to emphasize the study of social issues in their social studies curricula have two considerable challenges facing them. First, the typical public school curriculum is often highly structured

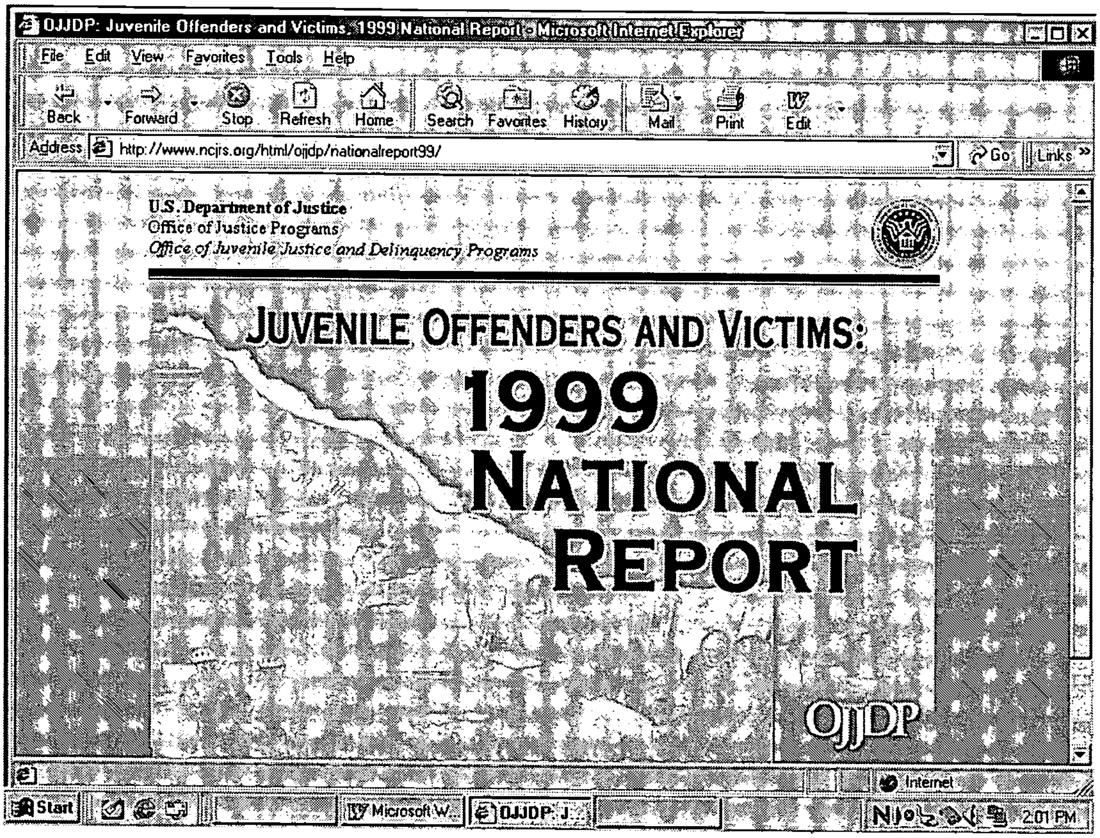
and somewhat rigid in terms of scope and sequence. It is unusual to find a separate course on social issues in many schools. Thus, teachers must find creative ways to infuse the study of social issues into the preexisting curricular structure - assuming they have the time to do so. Second, teaching materials for the study of issues may not be as available to teachers and likely take a lower priority in budget considerations than history or geography texts that are purchased for all students.

We have designed a module that invites teachers into an exploration of major social issues, facilitates their knowledge and understanding of these issues, and helps them think of ways to infuse this study into their social studies curricula. Although we cannot, in this module, provide extensive information on a wide variety of issues, we have chosen to focus on six that seem prominent in U. S. society at present: environmental issues, censorship, health care, poverty, gun control, and prejudice and the spread of hate crimes. The module design asks teachers to provide a rationale for incorporating particular topics into a preexisting social studies course, and to use knowledge from multiple perspectives and disciplines in order to understand these issues. For more information about this module, please visit http://www.citeforum.org/social/resources/modules/socialissues/.

Government Documents as Online Primary Sources

Government documents provide a valuable source of up-to-date, consolidated information on topics that are relevant to current issues of interest. The data often have a national scope and applicability, and the statistical information is typically presented in user-friendly formats. Increasingly federal agencies are making reports and data available via the Internet. Online availability facilitates access to evolving knowledge bases nationwide. As updated or new information becomes available the sites are often revised so that users can be assured of accessing the most current information available on the state of our nation.

Among the online resources that may be of interest to students in Government, Sociology, and Psychology classes is the U.S. Department of Justice Office of Juvenile Justice and Delinquency Programs *Juvenile Offenders and Victims: 1999 National Report* available at http://www.ncjrs.org/html/ojjdp/nationalreport99/toc.html The report provides the most current information available on juvenile crime, juvenile offending, and the juvenile justice system. In addition to providing students with national statistics on juvenile delinquency and victimization, this information resource may be incorporated into lessons to evolve students' knowledge of juvenile justice and develop students' skills in analyzing statistics and trends.



Juvenile Crime in America: What Do We Value? is a module designed to foster secondary students' examination of justice through empathic understanding and procedural knowledge. The lesson evolves students' value formation by assuming the perspectives of juvenile victims and offenders. Moreover, students directly access facts and figures to analyze statistical briefs on population characteristics, juvenile arrests, juveniles as victims, juveniles in court, juveniles as offenders, and juveniles in corrections. Using these national statistics as a guide, students engage in a collaborative group process of creating a story around a juvenile crime using the perspectives of both the juvenile offender and the victim. The national report serves as the basis for creating characters' social situations, including descriptions of their families, ethnic and economic backgrounds. Students may then create a scenario that is descriptive of the situations and causal variables that preceded and followed the crime for the offender and victim. By examining the multiple perspectives of offenders and victims, students may engage in reflection on the complexity of juvenile justice and initiate problem solving in the form of action plans to improve the lives of children and youths and reduce juvenile crime.

Other literature sources may be used to further students' understanding of victim and offender dynamics and the general state of children. Additional online resources for accessing data include the Federal Bureau of Investigation (http://www.fbi.gov), the National Clearinghouse on Child Abuse and Neglect (http://www.calib.com/nccanch), the Bureau of the Census (http://www.census.gov), Bureau of Labor Statistics (http://www.bls.gov), National Center for Health Statistics (http://www.cdc.gov/nchswww), National Center of Education Statistics (http://www.nces.ed.gov), Federal Interagency Forum on Child and Family Statistics (http://childstats.gov), and the National Clearinghouse on Families and Youth (http://www.ncfy.com).

Prior to the advent of online government primary sources with statistical databases, students were relegated to textbooks with sample information that often was out-of-date and was typically accompanied by interpretations that detracted from the experience of students to evolve their higher level processing skills. As current information becomes more easily accessible online, it is increasingly important that students

have the opportunity to develop their critical analysis capabilities and acquire the motivation to shift from apathy to action in addressing social issues.

Digital Resource Centers

For some time technology has been touted as having the potential to alter the landscape of education. The development and use of web based resources has begun to alter that landscape by changing the relationship between K-12 schools and universities. The most powerful example of this changing relationship can be found with Digital Resource Centers (DRC). Exemplary DRCs are web based academic collections that include the following four elements.

1. The resources have the potential of transforming university teaching and learning.
2. The resources can stand the test of peer review.
3. Each center has a connection to K-12 education.
4. The products are relevant for K-12 education (Bull, Bull, Dawson, 1999).

The unique combination of academic and K-12 educational interests inherent within DRCs developed as a result of the World Wide Web. Through the web DRCs are making primary source documents, maps, census records and other social studies related materials available to K-12 students and teachers. Social studies related DRC's have a broad range of applications in college and university education programs and in K-12 classrooms. The structure of DRCs represent a mechanism for delivering to K-12 schools social studies resources that have to date been in the hands of a select number of advanced college level students and researchers.

The dramatic potential of Digital Resource Centers have been recognized and to a degree realized by the Virginia Center for Digital History (VCDH) at the University of Virginia. The center produces and maintains digital history related projects. More information about the center may be found at: http://jefferson.village.virginia.edu/vcdh. VCDH staff and university students research, design, and create these projects. The center also designs instructional materials for K-12 schools. VCDH currently has six active projects and two in the developmental stages. Each project includes a variety of primary source documents. Active projects include, the Valley of the Shadow, Virtual Jamestown, Race and Place: African American Community Histories, and the Eisenhower, Kennedy, Johnson, and Nixon Presidential recordings project. The best known of these projects, the Valley of the Shadow, is an on-line collection of materials relating to two communities before, during, and after the American Civil War. The documents include letters, diaries, newspapers, images, maps, census records, and military records. The site is one of the most heavily visited history related web sites on the web, receiving traffic from students and non-students alike in countries across the world. The Valley of the Shadow is used in numerous K-12 and higher education settings. Students' in these courses analyze newspaper articles, letters, diaries, census records and more in exercises on historical bias, document verification, and statistical analysis. In addition, students use the archive to research topics, issues, and problems from the period.

The lesson titled "Substitution in the Civil War" has been created to give middle and secondary social studies an opportunity to explore primary source materials from the Valley of the Shadow Project at the Virginia Center for Digital History. This web-based lesson contains links to four letters and seven newspaper articles dealing with the issue of substitution in Augusta County, Virginia. During the Civil War soldiers in the South and the North could higher substitutes to carry out their military service. The lesson guides students toward defining and explaining substitution. Students are completely dependent on the primary sources at the Valley of Shadow web site to develop their definition. Consequently, students will construct their own evidence based definition for substitution. Students also have an opportunity in the lesson to use their definition to determining the effect substitution had on the southern war effort. With adaptation by the teacher this lesson can be used an introduction to historical methodology or as a vehicle for teaching about broader issues in the Civil War.

Geographic Information System (GIS)

A Geographic Information System (GIS) is commonly thought of as a computerized system that can turn geographically referenced tabular data sets into maps. It allows the user to query the database and discover relationships. Those new to the concept of GIS may find it clarifying to consider the example of the encyclopedic map transparencies that overlay new information one upon another. A county could be

shown with a transparency rivers, another for roads, for parks, and one with demographic information. An automated GIS would be able to use the tabular data set to produce these "transparencies" and display them on the screen in any thematic order one would choose. In addition, one could use a variety of techniques to analyze this information.

A number of research projects are being conducted in order to consider applications for GIS in the K-12 schools. From research in five North American schools that have successfully integrated GIS, there is strong evidence of teacher collaboration. Because the information system (database) function of a GIS is multi-purpose, its spatial analysis function is an added benefit in interdisciplinary applications. Teachers who collaborated were most often Science teachers, but Geography and Instructional Technology teachers also collaborated on developing GIS options. In the one middle school, a more interdisciplinary project took hold, and data that was gathered in Language Arts classes became data for the GIS application.

Each teacher interviewed discussed the benefits of collaboration, perhaps the most important being the support needed during the steep learning curve of early engagement. Additional perspectives on application, data acquisition, and manipulation of the data were also shared in successful collaborations. As teachers and students learned more about how to use the technology, a synergistic effect of collaborative learning characterized the GIS classrooms.

Web Resources

As the World Wide Web has grown, so have search engines and other methods of locating information on the Internet. The growing amount of information on the Web continually calls for better, more efficient methods to navigate its use. The "Review of Web Sources," located at http://www.citeforum.org/social/resources/web/prof/home.html, aims to address these needs. The information in Review is organized so that users searching for web sites best suited for K-I 2 teachers, or for college methods instructors, or for searching for particular social studies content, or for finding various social studies organizations and conferences, will find what they seek as quickly as possible.

The user may look at a list of all reviewed web sites related to his or her field of social studies interest. Each site is described briefly, with pertinent categories of information described, and with links to the actual site provided. Web surfers interested in various sorts of social studies information may find "Review of Web Sources" to be helpful.

Participation in the Impact Project

Most of the existing Impact materials have been developed by social studies educators at the University of Virginia, University of South Florida, University of Texas-San Antonio, and Western Washington University. Beginning in summer 1999 other members joined the project to field test existing materials and to develop new materials. The materials will also continue to be tested in K-12 classrooms. New members of the Impact social studies team include faculty members from: North Carolina State University, Clinch Valley Community College, Iowa State University, Ohio State University, Rowan University, University of North Carolina, Charlotte, Northern State University, University of Houston, University of Florida, and Virginia Tech. For more information, visit http://www.citeforum.org

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Beyond Primary Sources: A Professional Development Collaboration Designing Technology Integrated Instruction for Supporting K-12 Historical Thinking and Understanding

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Abstract: *Beyond Primary Sources: Using Technology in the K-12 History-Social Science Classroom* provided K-12 California teacher participants with the opportunity to collaborate on the development of instructional materials using technology to support historical thinking and understanding in K-12 students. Participants examined the use of problem-based learning and technology to support their students' development and engaged in a guided inquiry to design instruction focusing on the use of technology and constructivist learning approaches to solve shared instructional problems. Resources such as the State Board of Education Content Standards in History Social Sciences, case studies in history and social science, exercises and theoretical perspectives provided additional guidance. Following the two-day workshop, the participants worked in online collaborative workspaces collaboratively developing their instructional materials. The completed materials are posted on the CH-SSP website (www.sscnet.ucla.edu/ch-ssp) for convenient statewide access.

Background

Traditionally, K-12 teachers are expected to develop instructional materials for their own classroom. Now, teachers often have the additional responsibility of integrating technology into their instruction. However, the integration of technology into current curricula is-non-trivial (Starr, 1996). –The existing instructional methodology must be re-evaluated and adapted to take advantage of the technology's potential as, among other uses, an information source, a communication source or an authoring tool. With little to no training or experience, most teachers are inadequately prepared to develop technology-integrated instructional materials. Because of this, professional development activities for teachers in this area should be a top priority.

Two offices at UCLA have come together to address this concern. The first is the Executive Office of the California History-Social Science Project (CH-SSP), one of nine California Subject Matter Projects (CSMP's). These projects have been mandated by the California State legislature to provide professional development to K-12 teachers statewide. The Executive Office oversees the educational activities of eleven local sites across California. The second is the Office of Technology Projects in Center X, the Graduate School of Education and Information Studies (GSE&IS). This office supports the use of technology for professional development and initiates programs which support K-12 teachers integrating the use of technology into their curriculum. Together, these two offices are offering *Beyond Primary Sources: Using Technology in the K-12 History-Social Science Classroom* to the teachers of the State of California to help meet the need to prepare teachers to develop technology integrated instructional materials.

The Project

Beyond Primary Sources: Using Technology in the K-12 History-Social Science Classroom provides K-12 California teachers with a unique professional development experience. Using both an onsite institute and an online collaborative environment, teacher-participants are both recipients of instruction using technology and designers of instruction which integrates technology. The first institute was held in the Spring of 1999. The 29 participants were selected by the local History Project site directors. The participating teachers ranged from those who had never used technology in the classroom to those who integrated it into their instruction regularly. All participants had attended at least one CH-SSP institute previously. Through both face-to-face and online collaboration, they developed instructional materials which use technology to support historical thinking and understanding in K-12 students. In the two-day onsite institute at UCLA, they examined the use of problem-based learning and technology to support their students' development of historical thinking and understanding. Then, in the three-month online follow-up they continue to work collaboratively to develop instructional materials for their K-12 History classes which reflected their exploration in the institute. Participants were compensated for their hotel, food and travel expenses at UCLA and received a stipend.

The first major goal was to engage participants in guided inquiry to design technology-enhanced instruction that solved shared instructional problems. Resources such as the State Board of Education Content Standards in History Social Sciences, case studies in history and social science, exercises, and theoretical perspectives provided additional guidance. Teachers' questions and concerns about using technology in the history and social science classroom were addressed through the exploration of exemplary teaching and learning in their content area. This guided inquiry is discussed in more detail below.

The second major goal of this project was to explore the use of online collaborative workspaces as a tool both for collaborative work among teachers separated by geographic distance and as a tool for follow up for other professional development institutes. We felt that approaching teacher training in technology using an online environment was appropriate as it has been shown that the most effective technology training for new teachers includes participating in electronic networks (OTA, 1996). For the Institute in Spring, 1999, The

Milken Educators Virtual Workspace (MEVW) was used. The MEVW space allowed participants to use the Internet to create and participate in a collaborative online learning community. Included in the MEVW space, and used in these collaboratives, is a collaborative documents space where participants can post, read, comment on and edit documents, a question and answers space which allows participants to engage in asynchronous discussion; and a chat room, which allows participants to engage in synchronous discussion. MEVW is ceasing operations in December, 1999. For the academy in January, we will be moving to a combination of the Nexus workspace and Blackboard.com. The Nexus workspace was developed and is maintained by the Nexus Project, a State of California K-16 technology initiative. It is conducive to collaborative development of documents. Blackboard.com is a more appropriate space for online synchronous and asynchronous discussion.

The Inquiry Model

Teachers rarely have the opportunity to experience good instruction as learners. As teachers often teach in the same way that they themselves are taught (Day et al., 1990), we believe it is important for professional development to model the teaching that we expect the participants to engage in. In this institute, teacher participants were both recipients (learning how to develop instruction) and developers (developing the instruction for their students) of the same learning model. The model is composed of three elements: the acquisition of high level thinking skills, the optimal use of technology as an instructional tool, and problem based learning as an instructional model.

As recipients, teacher participants engaged in constructivist, problem based inquiry and technology based collaboration to examine their practice. Problem-based inquiry required the teacher participant to identify and solve an "instructional problem" they encountered when teaching historical thinking and understanding. Through collaborative discussion, the participants used technology and problem-based learning to develop instructional solutions to the problem. Participants actively engaged in higher level thinking through continuous reflection on their own design process. They compared their own solutions with those of other participants, providing multiple perspectives and approaches to the problem. These instructional materials require students to engage in higher level thinking (specifically historical thinking and understanding), reflect on their own cognitive processes, solve a problem collaboratively and use technology to support their learning.

As developers, teachers designed instruction using problem-based learning and technology to support the development of higher level thinking skills in students. These instructional materials ask students to engage in higher level thinking, specifically historical thinking and understanding, reflect on their own cognitive processes, solve a problem collaboratively and engage them in the use of technology to support their learning.

Technology and Student Outcomes

This initiative gives teachers an opportunity to use technology to support instruction in a specific way. Exemplary technology integration involves constructivist learning approaches (Jonassen et al., 1999). Teachers have many choices in determining how to use technology to encourage historical thinking and understanding. Students might develop their own instructional software (using authoring software such as HyperStudio) or participate in

international distance learning projects (for instance, the sharing and comparing of town, regional and country histories through email, newsgroups and conferencing software). By solving an instructional problem with technology and problem-based learning, teachers must think about how to integrate technology effectively. This project required teachers to determine how the use of technology in their instruction will help them attain their instructional goals.

The Online Collaborative

The on-line community formed by this initiative consisted of two history teacher facilitators, two educational technology facilitators, and 29 teacher participants. Participants worked in small groups with a facilitator who helped maintain an environment conducive to communication, professional networking and the creation of exemplary instructional materials. Following the two-day workshop, the participants continued to develop their instructional materials as part of this online collaborative. We believe that participant to participant online communication is important as research suggests that knowledgeable teachers positively affects other teachers' attitudes and behaviors about using computers in the classroom (Becker, 1994). There are five different forms of online communication -- chat, original written material, response to written material, participation in the discussion forums, and e-mail. This wide variety of communication activities encouraged participants to form a collaborative community supporting the instructional materials development. These completed materials are posted on the CH-SSP web-site (www.sscnet.ucla.edu/ch-ssp). Seventy percent of the participants produced completed lessons.

We believe this project is an example of the direction professional development will be going in, in the future. The problem-based learning model allows teachers to solve an historical thinking and understanding problems in students by creating technology-integrated instruction. The combination of both offline and online activities enables teacher participants to establish professional relationships in a familiar and comfortable environment and then extend and utilize these relationships in an online environment. Without this online environment, it is difficult to maintain the relationships established in professional development institutes because of geographical and time constraints. This project explores the use of an online collaboration tool for developing and supporting statewide networking of teachers sustained over time.

Outcomes

This institute achieved it's goals moderately well. The guided inquiry process worked well as a discussion tool, but feel short of our expectations when it came time for the teachers to transfer that discussion into the development of a process for developing instructional materials. It also did not carry well into the online environment, although we believe that was due to motivational factors and not the nature of the discussion itself. We believe, and the feedback we received confirms this, that not enough structure was provided for the teachers in going from the discussion to the implementation. This is a difficult step for many teachers. We were committed to this structure being provided by the teachers themselves as opposed to being imposed from a central leadership. However, this did not happen.

The online environment as a community building tool and a collaborative environment was less than satisfactory. This was due to several factors. First, the environment that was used is completely text-based and was unreliable technically. Second, teachers had a difficult time remaining committed to the project once they returned to their schools. Third, many teachers had technical difficulties which were time consuming and difficult to overcome. Fourth, many teachers were relative novices to technology and were not comfortable establishing relationships electronically. For some of the groups, the online environment worked fairly well. For others it was hardly used at all.

Approximately 70% of the participants completed their instructional materials. Of these, about half were satisfactory. Of those that were not, in many cases the integration of technology was not at the level which we hoped it would be. It tended to be a superficial integration and not a use which directly encouraged and supported higher order thinking. A few lessons indicated a lack of understanding of what the product was expected to be.

As a professional development institute, we feel that several changes can be made to improve the participants understanding of technology as an instructional tool, to improve the utilization of the online environment to conduct the professional development and to improve the support for the teachers to move from a strong and informed discussion to the implementation of that discussion in a development context. These changes are discussed in the next section.

Recommendations

This professional development institute will be repeated in January 2000. We have several recommendations. They are as follows:

1) Address the teachers' level of motivation to continue in the online environment.
2) Provide consistent technical support
3) Require school site administrator support.
4) Provide more direction for the development process.
5) Provide a more concrete discussion of technology and its' classroom uses.

There were many difficulties with the professional development institute, some of them centered around participants actively engaging in the online communications. Teachers, once they returned to their original school sites, lost track of the online effort and gradually participated less and less. The stipend offered was small and not of sufficient motivation. We are suggesting that providing participants with a larger stipend or University Extension credit towards salary points may be an important motivational component. Technical support is also essential. Several teachers could not participate because they did not have access to the appropriate technology, or the technology failed them. This ties in directly with school administrator support. We will be requesting that schools provide the technical support necessary for these teachers to participate in the institute in the future. There are several reasons for this. First, this gives the school "buy in" to the project, motivating both the school and the teacher to continue participation. Second, many schools provide the ISP for

the teachers in any case. Technical support is part of that responsibility. This request is not a requirement - the teacher can find other sources of technical support. We can also provide a limited amount. However, we feel that by asking for administrator support and technical support, we involve a greater community in the project and create more motivation to continue participation.

The process for instructional materials development was an issue. We would prefer, encourage and work towards that process being developed by the participants themselves. However, many of the participants requested a more structured process for developing the materials. We do not know if this was because they were using a new environment and felt unsure about how to proceed, or if they would have difficulty developing instructional materials without an imposed process in any environment. In the future we would recommend that direction and additional structure needs to be provided for the development process. We will also be adding an extra day to the initial institute. A significant portion of that time will be spent more directly addressing uses of technology in the K-12 History and Social Science classroom. It is anticipated that teachers will take from that discussion specific ideas about how to use technology in the instructional materials that they will be developing.

Conclusion

In general, a professional development effort using online instructional materials development, in a group, collaborative setting, needs a structure to support it which includes facilitator support for the multiple forms of online communication, technical support, and clear guidelines for the participants process. In addition, participants need a tangible motivation for completing the project, such as salary points or a stipend. These online development projects differ from traditional development projects in that they can be conducted asynchronously and between participants who are at a geographic distance. For the future, we hope that the communities that are formed can continue on, develop further materials and expand to provide online support for other teachers in their subject areas or grade levels.

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Assessing Pre-Service Students' Knowledge In A Social Studies Methods Course Using Digital Resources

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Abstract: This paper is a preliminary report on the findings of a study assessing the processes related to pre-service social studies students' development of knowledge about to teaching history using digital historical resources. A comparison of participants' subject matter knowledge and pedagogical content knowledge uncovered a divergence between what social studies pre-service students know about history and what the know about teaching history.

Introduction

The most significant new issue impacting the construction of knowledge among pre-service social studies students relates to the use of resources on the World Wide Web (Johnson, 1998; Martin, Smart, & Yoemans, 1997). Changes in the development of social studies teacher knowledge attributed to the World Wide Web have been particularly significant within the discipline of history. The application of the World Wide Web has led to dramatic changes in the way historical content is stored, retrieved, and used (Ayers, 1999). Web based digital historical resources are now part of pre-service social studies students' experiences in learning history and learning how to teach history. As such, digital historical resources should be accounted for in new research on the development of social studies' teachers' knowledge.

Shulman (1987) conceptualized teacher knowledge as consisting of seven categories: subject matter content knowledge, pedagogical content knowledge, curriculum content knowledge, general pedagogical knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational ends. The development of subject matter content knowledge and pedagogical content knowledge are an important part of pre-service social studies students' education. The social studies methods course plays a particularly important role in developing pedagogical content knowledge about how to teach using historical documents (Fehn & Koppen, 1998). Since the advent of the World Wide Web instruction in how to teach using historical documents has included digital historical resources.

Very little research has been conducted on the development of pedagogical content knowledge using digital historical resources. There has been some research on the development of pre-service social studies students' subject matter content knowledge (specifically historical thinking), but this research base needs to be expanded (Downey & Levstik, 1991). New research should focus on inquires into the relationship between subject matter content knowledge and the development of pedagogical content knowledge (Adler, 1991). An analysis of pre-service social studies students' subject matter and pedagogical content knowledge and the relationship between the two may illuminate new ways to develop pre-service students' teacher knowledge (Adler, 1991; Wilson, Shulman, & Richert, 1987). New research in this area must take into account the effects of information technology on the creation of new pedagogical content knowledge (Bohen and Davis, 1998). In addition, the relationship between the historical scholarship and education should be considered

The dramatic potential of scholarship produced from digital historical collections has been recognized and to a degree realized by the Virginia Center for Digital History (VCDH) at the University of Virginia. VCDH is the home of the Valley of the Shadow an on-line collection of materials relating to two communities before, during, and after the American Civil War. The collection includes letters, diaries, newspapers, images, maps, census records, and military records. The site is one of the most heavily visited history related web sites, receiving traffic from students and non-students alike in countries across the world (Thomas, 1999). The Valley of the Shadow has been used in numerous K-12 and higher education settings. Galgano (1999) reported

on his use of the site in an undergraduate history methods course. Students' in the course analyzed newspaper articles, letters, and diaries in exercises on historical bias, document verification, and statistical analysis. In addition, students used the archive to research a paper relating to some issue or problem from the period. The author posited that the Valley of the Shadow presents "virtually unlimited research potential" (p.26).

Since pre-service social studies students are expected to learn content by using information technologies, these technologies should be accounted for when researching the development of pedagogical content knowledge. While the role of the information technologies does not need to be the primary focus of an inquiry into development of pedagogical content knowledge, not considering or ignoring it would be unrealistic. The recognition of the place of information technology in the development of pre-service students' pedagogical content knowledge is practical and realistic.

The Study

This research study was concerned with analyzing the development of participants' pedagogical content knowledge of specific historical topics relating to the American Civil War. The rationale for choosing content from the American Civil War related to its relevance. The Civil War was a pivotal event in American history and is taught in secondary American history classes. Documents from the Virginia Center for Digital History's Valley of the Shadow were used. The setting for this research study was a social studies methods course at a large southern public university. This course was conducted over a two semester period. Data was collected from the first semester. During this semester an emphasis was placed on the use of digital primary historical resources.

The participants in this study were enrolled in the social studies methods course described above. The course had nineteen students enrolled. Of these nineteen students twelve participated in this study. All the participants in this study had taken numerous courses in history and were pursuing an undergraduate major in history or had received a four-year degree with a major in history. Participants pursuing an undergraduate major in history had taken three education courses: foundations of education, philosophy of education, and introduction to instructional technology. Participants with a four year degree were enrolled in their first education courses. All participants were enrolled in a general educational methods course as well as the social studies methods course.

This study was qualitative in nature, but did involve the collection of some quantitative data. Data was collected using written assessments of subject matter knowledge, interviews, and observations of the participants' social studies methods course. Data was analyzed using Erickson's (1986) qualitative methodology. The analysis was written in the form of assertions derived from the data and vignettes that supported the assertions. Pilot research related to this project has been conducted. The preliminary findings from this piloting helped to provide clarity for the remaining research.

Subject matter content knowledge relating to history was conceived of as historical understanding and historical reasoning. Participants' historical understanding was measured using the multiple-choice section of the 1988 College Board Advanced Placement (AP) test for history. Actual AP test scores from the 1988 test ranged from 1 to 5. These scores included the multiple choice test and writing test scores. For the purposes of this study participants' multiple choice scores were converted into a 1 to 5 score using results from the 1988 test. Each converted score represented the score made by the largest percentage of test takers on the actual 1988 test. For example, 60.3 percent of all 1988 test takers who scored a 5 on the AP test scored between 71 and 100 on the multiple choice section. Consequently, participants who scored a 71 or higher were given a 5. The remaining four scores ranged as follows, 4 = 56 to 70, 3 = 44 to 55, 2 = 24 to 43, and 1 = 0 to 24. All participants' also completed a writing assignment that was used to measure historical reasoning. This assignment involved participants writing an essay on a question relating to the American Civil War. The question asked students to define substitution and describe its effect on the southern army. Participants were given two documents from the Valley of the Shadow web site. They were also instructed to search the Valley of the Shadow for additional documents. Participants were given a letter from a southern soldier to his brother about the soldier's efforts to obtain a substitute to serve in his place in the army. The second document was a newspaper article detailing Confederate President Jefferson Davis' opposition to substitution.

The analyses of participants' essays consist of four parts.

1. Ratio of support statements to claims - Claims were considered a phrase or statement that put

forward a position that could be argued. Support was considered any phrase or sentence that offered to extend, justify, cite, or explain a claim. It was possible to have more support statements than claims.
2. Evidence of additional research - The participants were given two documents to read before writing their essay. They were also asked to search the Valley of the Shadow for additional documents relating to the question. Each essay was evaluated for evidence that additional documents were consulted.
3. Evidence of document citation - Each essay was checked for citation of the documents used as evidence.
4. Organization - Each essay was checked for organization in terms of introduction and conclusion.

The ratio of support statements to claims was converted to a score between 0 and 2. All other parts of the analysis were scored 0 for not evident and 1 for evident. The total possible score on the historical reasoning as measured by the essay on substitution was 5.

In order to assess the transformation of participants' pedagogical content knowledge an activity was developed in which participants had to learn about some content and then develop an instructional idea related to that content. In this activity participants were given one of three topics to research using the newspaper archives at the Valley of the Shadow. The topics included African culture in America, the abolition of slavery, and political party positions on issues relating to slavery. The participants were asked to search for and read at least one article from the two Franklin County newspapers at the Valley of the Shadow web site. After reading the articles participants were asked to answer two questions relating to their topic and to develop and answer two more questions. They were also asked to think of an instructional idea relating to their topic using the resources at the Valley of the Shadow. The instructional ideas and a summary of participants' subject matter content knowledge were submitted in the form of a message posting to a discussion group. The content and lesson ideas were also discussed during social studies methods class meeting.

Findings

Participants subject matter content knowledge as measured by historical understanding and historical reasoning was well developed (Chart 1). Participants' scores on the AP test ranged from 46 to 71 percent correct. The convert scores ranged from 3 to 5. Scores on the historical reasoning assessment ranged from 1.6 to 5. Ten of the twelve participants scored a 4 or better (above 56) on the AP test. Two participants scored a 3 on the AP test, but scored well on the historical reasoning assessment. Three participants scored below 3 on the historical reasoning assessment. All three of these participants scored 4 on their AP test. Scores on both measures were divided into high and low groups with 2.5 serving as the dividing line. Eleven participants scored in the high region on both historical understanding and historical reasoning. One participant scored in the high region on historical understanding and the low region on historical reasoning. The scores indicated that participants' subject matter content knowledge conceptualized as historical understanding and reasoning was clearly advanced. Participants' pedagogical content knowledge was not as advanced.

Name	Historical understanding (HU) AP test score percent / extrapolated score (of 5)	Historical reasoning (HR) Score (of 5) on Substitution essay	Grouping on HU and HR (HU/NR)
Sarah	71 / 5	3.4	High/High
Jane	69 / 4	3.5	High/High
Jerry	67 / 4	5	High/High
Doug	67 / 4	3.5	High/High
Mandy	67 / 4	2.8	High/High
Noel	65 / 4	1.6	High/Low
Jennifer	65 / 4	3.5	High/High
Stacey	63 / 4	2.8	High/High
Melanie	61 / 4	3.2	High/High
Peter	58 / 4	4	High/High

Erin	49 / 3	4.2	High/High
Emily	46 / 3	4.2	High/High

Chart 1 Participants subject matter content knowledge

Pedagogical content knowledge was intricately tied to subject matter content knowledge. It might be expected that given the context of participants' well developed subject matter knowledge, pedagogical content knowledge would be as well developed. For some participants' this was the case, but the subject matter content knowledge was never fully transformed into pedagogical content knowledge. The manner in which participants' transformed their subject matter content knowledge into pedagogical content knowledge was expressed in varying degrees of completion. Jane most fully transformed her subject matter knowledge into pedagogical knowledge. Doug partially transformed his subject matter knowledge into pedagogical content knowledge. Jerry incompletely transformed his subject matter knowledge into pedagogical content knowledge

Jane

As one of three participants who researched Franklin County newspaper accounts of African culture, Jane noted several discrepancies. While racist and "derogatory" language dominated the Democratic Valley Spirit, Jane found one article in the paper that spoke in positive tones about a black social event. She noted similar discrepancies in the Republican Franklin Repository and Transcript. Although the paper was more likely to use "neutral language" when reporting on African culture, Jane found some articles that "revealed a still-prejudice nation." Overall the general tendencies of the two papers where found to be similar. Jane noted that the two newspapers treated the topic of African culture with equal disdain. "The tendencies of these newspapers were certainly to portray African American culture as threatening and foreign." Jane's understanding of the content was compete but left her feeling tenuous and confused. Referring to an article she found in the Valley Spirit Jane wrote "another article, though, spoke of the entertainment one evening at a church as an evening 'to be remembered'; this positive article certainly confused me." She indicated that the papers reflected similar yet discrepant attitudes about African culture. Jane's subtle subject matter knowledge of contradictions within the newspapers was transformed into a coherent and cleaver pedagogical idea.

Jane's pedagogical or instructional idea was cast around a concern she expressed with the content of the lesson. She felt the resources that she used to learn about the topic would pose problems for high school students. Specifically, she was concerned about the language used in the newspaper articles and a quote attributed to Thomas Jefferson. Jefferson was quoted as saying there were seventeen differences between blacks and whites. Jane was concerned that this quote "could potentially hurt the class' atmosphere." Despite this misgiving she felt the introduction of the quote offered a "learning moment" where she would have to "teach about the difference between Presidents' opinions and their cultural ramifications." These concerns were similar to the sense of contradiction Jane felt when she read newspaper articles about African culture. On one hand she did not want to include certain newspaper accounts for fear of offending some students. At the same time Jane viewed the particularly inflammatory Jefferson article as beneficial. Her sense that the newspaper articles she read did not express a consistent view led her to suggest a debate as an instructional idea. The debate would allow students to deal with what Jane considered a controversial subject matter in an acceptably environment. The pedagogy of debate captured the central elements of contradiction evident in Jane's subject matter content knowledge.

Doug

Doug was one of five participants who researched political party positions on slavery. These five participants answered the following two questions. 1) What was the party position on slavery as expressed in the articles? 2) What was the context of the articles? Doug's understanding of political party positions on slavery was characterized by a view of abolition that was comparative in nature. Doug indicated that the Republican Party was indecisive on abolition while the Democratic Party was completely opposed to abolition. "The Republican Party, as represented by the paper, was cautiously opposed to slavery. Abolition was a touch subject, with Republicans siding on either side of the subject." In contrast to this view Doug stated that the Democratic paper, the Valley Spirit, took a "very anti-abolitionist stance." He further argued that as expressed in the Valley Spirit Democrats believed that "abolition, by giving freedom to slaves, would give the south more

political clout, as freed slaves would now constitute a whole person in terms of population, rather that the 3/5 as in the past." Doug's subject matter content knowledge of political parties' position on slavery was characterized by two organizing factors. First, Doug focused on the term abolition. He referred to the Democrats as being anti-abolitionist. Abolition for Republicans was a "touch subject" with party members holding a variety of positions on the subject. Second, with regard to the Republican Party Doug focused on a contrary view of Civil War politics. He saw the Republican Party as incompletely abolitionist. These subtleties only partly translated into pedagogical content knowledge.

As an instructional idea Doug suggested that students complete a worksheet like the one he had done. He indicated that this type of work could "direct student research." He further stated that "by giving the students an issue to address and some questions to answer, the students have a clear understanding of how to proceed." He suggested that students could synthesize and generalize from their answers. Doug saw the pedagogical strength of the activity in the comparative aspects. "I like the comparative aspects of the assignment, contrasting the Republican and Democratic views." Although this instructional activity allowed for the possibility of differences and similarities being discussed, they was no assurance that students would uncover the range of opinion on abolition that Doug recognized within the Republican party. In fact, by having students compare and contrast Republican and Democratic party positions the lesson facilitated a simple dichotomous consideration of the respective parties' views on slavery. Doug's subject matter content knowledge was much more sophisticated than his pedagogical content knowledge. The transformation of subject matter knowledge into pedagogical content knowledge was impeded by an inability to express the intricacy of his subject matter knowledge in pedagogical terms. The pedagogical terms compare and contrast would not allow for the "spectrum" of positions on slavery that Doug said were represented within the Republican Party. Although the Valley of Shadow may contain resources that would facilitate students understanding the differences between Republicans and Democrats on issues relating to slavery, Doug never indicated how they might be used. Doug approached the lesson as a learner instead of a teacher. He invoked a strategy that may summed up as, if it worked for me it will work or them. Given Doug's status as fourth year student majoring in history at a large university this assumption was highly problematic.

Jerry

Jerry researched newspaper positions on slavery. His subject matter content understanding was expressed during a class discussion conducted after participants searched the Valley of the Shadow for information relating to their questions. "The articles that I found support the fact that neither party, the Republicans or the Democrats supported abolition. The Republican Party was antislavery…I found one article that indicated that they did not like the mixing." After indicating that the antislavery movement was the majority view in the north Jerry implied that this antislavery position was morally inferior to the abolitionist position. He believed that antislavery sentiment did not necessarily translate into notions of equality or integration. He developed an instructional idea that related to the central focus of this content understanding, but incompletely transformed the subject matter into pedagogy.

In Jerry's lesson students would first define the words abolitionist and antislavery. These definitions would be obtained from the Valley of the Shadow or another Internet site. After these terms were defined Jerry wanted students to determine how the two Franklin County newspapers represented the issues of slavery and anti-abolitionism. His instructional direction reflected a concern that students do not understand the meaning of antislavery or abolitionism. By having students define the two terms Jerry thought that his students would have grounds for making the comparison that he made in his content understanding. Jerry expressed that he also wanted his students to examine the differences in practice between abolitionism and anti-slavery. "I would like students to understand that the majority of Northerners held anti-slavery sentiments, rather than abolitionist sentiments." This instructional interest was reflective of the central focus of Jerry's subject matter understanding. When asked to indicate what he thought students should learn in the lesson Jerry said: "I would like for the students to dispel the myth that the North held primarily abolitionist views during the Civil War." This content was not facilitated by the instructional idea. Jerry suggested discussion as a way to get his students to understand what he perceived to be a myth about the abolitionist movement. Although discussion can facilitate an almost infinite number of instructional goals, Jerry never indicated how students would use the resources at the Valley of the Shadow to facilitate this discussion or assist them in understanding the abolitionist myth. The discussion strategy represented an incomplete pedagogy that was presumably dependent on Jerry's ability to direct the discussion.

Conclusions

The implications of this research project relate to the development of pedagogical content knowledge while using digital historical materials in social studies education methods courses. Participants had little trouble in using the Valley of the Shadow to develop their own subject matter content knowledge, but where often unsure about how the site could be used in K-12. Given the impact of technology on the development of teacher knowledge, understanding of how pre-service social studies students' think when using digital historical resources is very timely and significant. Research relating to the transformation of subject matter content knowledge into pedagogical content knowledge using digital historical resources is central to the purpose of social studies education methods courses. In this study even though participants had a sophisticated level of historical content knowledge when using digital resources in a broadly studied area such as the American Civil War, they struggled to transform that subject matter knowledge into pedagogical content knowledge. To resolve this problem social pre-service students must be given the time and resources necessary to develop their pedagogical content knowledge.

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Collaborative dialogue: A web-based, multimedia case study shared among geographically disparate social studies educators

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Abstract: This study combines the use of a web-based multimedia case study and threaded discussion groups in an attempt to bridge the gap between theory and practice via dialogue among geographically distant preservice teachers, inservice teachers and university faculty members. The paradigm for this study is interpretive inquiry and we employ Erickson's (1986) method of analytic induction to formulate empirical assertions. Preliminary assertions relate to instructional strategies that facilitate collaborative case-based teaching and learning among students in geographically disparate locations and relate to the kinds of knowledge constructed and interactions observed via such dialogue. Final results will be available by the SITE 2000 meeting in San Diego.

Introduction

A wealth of literature reveals that completion of teacher education courses does not necessarily result in the ability to teach (Cochran-Smith, 1991; Feiman-Nemser & Buchmann, 1987; Knowles, Cole, & Presswood, 1994; Lanier & Little, 1986; National Commission on Teaching and America's Future, 1996). Bridging the gap between theory and practice has been a challenge for teacher education programs for many decades. John Dewey (1965) encouraged teacher education programs to prepare teachers to reflect upon theoretical issues and their relationship to practical classroom application. Nearly twenty years later, Zeichner (1983)called for development of reflective teachers who critically analyze classroom situations. Recently, Cooper and McNergney (1995, p. 2) claimed "...the problem is not that programs are too theoretical, but that theory has not been related to real circumstances to help prospective teachers interpret what is happening and to guide their actions."

Case-based learning originated in business and law schools (Christensen, 1987) and has recently been used in teacher education in an attempt to bridge the gap between theory and practice (Bliss & Mazur, 1996; Cooper & McNergney, 1995). Benefits of applying cases to teacher education include (1) development of critical analysis and problem solving skills, (2) opportunities for reflective practice, (3) analysis and decision-making in complex situations, (4) active learning, and (5) creation of a community of learners (Merseth, 1991). As we head into the twentieth century, technological advances have made it possible to improve traditional case-based learning with multimedia features that enhance authenticity and active learning. For example, technology allows us to go beyond the traditional one-dimensional text based case study to include features such as audio and video clips. Technological advances have also made it possible to extend the learning community beyond the walls of traditional teacher education courses (Bliss & Mazur, 1996; Schrum, 1991). Preservice teacher education learning communities are being redefined to include preservice teachers from geographically disparate locations, experienced classroom teachers, and university instructors. This study will combine the use of a web-based multimedia case study and threaded discussion groups in an attempt to bridge the gap between theory and practice via dialogue among geographically distant preservice teachers, inservice teachers and university faculty members.

The case study was written by a team including inservice teachers, university faculty members and doctoral students with the goal of creating opportunities for students to analyze and reflect upon real-world classroom issues (Merseth, 1996) such as classroom discipline, classroom organization, parental communication, and integration of technology. Educational technology faculty members and doctoral students worked with the case study team to transform the case into a web-based, multimedia format that includes images, audio and video files and pop-up text windows. The case features a first year social studies teacher who is struggling to design a meaningful project that will not only introduce her eighth grade students to the Bill of Rights, but will also encourage them to investigate the continuing significance of these essential freedoms. (http://www.citeforum.org/social/case/casestudies/reflections/home.html)

The participants in this study will communicate via a Usenet newsgroup. A Usenet newsgroup is an electronic community typically organized around a specific theme or topic, and is displayed in a way that reflects the threaded conversation structure. The mechanism for mirroring the newsgroup with remote sites is a part of the Network News Transfer Protocol (NNTP) that is implemented by Usenet server software. The University of Virginia and the University of Florida have arranged to exchange the newsgroup between the two universities. This distributed model alleviates excessive connection delays since the data is available on a server at each site. Participants in the newsgroups discussions include preservice teachers, inservice teachers, and university faculty members.

Purpose of Study

Social studies teacher education programs have a responsibility to "build ongoing and stimulating collaborative links among social studies educators" (Armento, 1996, p.497). Likewise, teacher education programs have a responsibility to prepare prospective teachers to know and apply educational theory (Cooper & McNergney, 1995) so that professional knowledge is considered when making classroom decisions (Schon, 1987). We are attempting to expand the learning community of preservice social studies teachers at two Research I universities by presenting them with a multimedia case study that will serve as the focus of their online dialogue. The purpose of this research is to study the development of a cohort of social studies educators who expand their own learning community by engaging in professional discourse with colleagues in geographically disparate locations.

Paradigm and Methodology

The paradigm for this study is interpretive inquiry. Interpretive inquiry was developed under the thesis that "human discourse and action could not be analyzed with the methods of natural and physical (Miles & Huberman, 1994, p. 8). We selected this paradigm because we wish to explore the interactions in the on-line learning community from the perspective of individual and collaborative student experiences.

We will employ an interpretivist research strategy (Erickson, 1986). Specifically, we will employ Erickson's analytic induction (Erickson, 1986)approach to data analysis that centers on the formulation of empirical assertions that are confirmed or disconfirmed by a search for empirical warrants within the data. Validity will be established via carefully attention to the "five major types of evidentiary inadequacy" (Erickson, 1986, p. 149) and triangulation (Lincoln & Guba, 1985).

A variety of strategies will be used for collecting data. The primary data source will be transcripts from the threaded discussion group. Additional data sources will include class face-to-face discussion transcripts, purposefully selected student interviews, student reflections, and weekly instructor reflective journals.

Results

The data for this study is currently being analyzed and we anticipate that the study will be complete by the SITE 2000 meeting in San Diego. Preliminary assertions relate to instructional strategies that facilitate collaborative case-based teaching and learning among students in geographically disparate locations and relate to the kinds of knowledge constructed and interactions observed via such dialogue.

Results from this study will provide a platform for continued research addressing (1) the isolationistic tendencies of teacher education programs, (2) mechanisms for bridging educational theory and practice, and (3) preparation of reflective preservice teachers who are prepared to utilize collaborative technologies for professional development during their induction years and beyond.

Educational Significance

Many studies related to the use of alternative communication and collaborative technologies are not grounded in solid research methodology but are merely anecdotal accounts (Blanton, Moorman, & Trathen, 1998). This study is grounded in the interpretive paradigm (Miles & Huberman, 1994) and implements analytic induction (Erickson, 1986) in an attempt to shed light on important issues related to on-line collaborative learning environments including but not limited to: effective instructional strategies, the types of the knowledge constructed, and the nature of interaction within such environments.

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Interdisciplinary Applications for Geographic Information Systems

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Abstract: Automated Geographic Information Systems are capable of creating layered maps from a tabular data set and further, of allowing the user to analyze the information. This paper describes five North American schools that have successfully integrated GIS and have shown evidence of the value of teacher collaboration. The spatial analysis function of the database strongly supports interdisciplinary applications. Because of this, interdisciplinary projects between science and technology classes, history, science, language arts and technology classes can be coordinated using a combination of GIS and other applications such as word processing, database or spreadsheet information, power point or web page applications.

In recent years, a number of reports indicated a general geographic illiteracy among students in the United States. This illiteracy, coupled with the increase of communication technologies which demand greater global awareness, naturally caused a great deal of concern for parents and educators. These concerns led to a reevaluation of the way geography is taught in the American classroom.

One response to these studies was the National Geography Standards, prepared by the Geography Education Standards Project in 1994. "Geography is composed of three interrelated and inseparable components: subject matter, skills, and perspectives... All three - subject matter, skills, and perspectives - are necessary to being geographically informed" (Geography Education Standards Project, 1994, p.30). In order to more adequately develop geographic skills, an environment that encourages this development needs to be created. The Standards also emphasize the potential role of Geographic Information Systems (GIS), a computerized spatial analysis tool, in meeting this educational challenge. With the availability of new powerful personal computers, it appears the use of this technology is now a reasonable possibility for the average classroom. GIS, therefore, appears to be poised to become a powerful tool in the development of geographic skills. Significantly for educators, GIS also appears to fit in well with the constructivist environment that many classroom teachers are seeking. The focus of this paper will center on the development of interdisciplinary applications for GIS in K-12 and higher education classrooms.

Definition

Since the 1980's, GIS has been rapidly expanding throughout the world. Those seeking to analyze data spatially have found in it a tremendous technological aid. The United States Geological Survey (USGS) describes GIS as a "system capable of assembling, storing, manipulating, and displaying geographically referenced information" (USGS, 1992). This information has a spatial component, and so, a map can be produced from the data set. The power of GIS is displayed in its ability to turn this data into layered referenced maps and then query through those layers allowing the analyst to see relationships.

Those new to the concept of GIS may find it clarifying to consider the example of the encyclopedic map transparencies that overlay new information one upon another. An overhead with several transparencies laid upon it is another good example. If a teacher were to teach about the five themes of geography using an overhead, they might use five transparencies. A town could be shown with a transparency for each theme - place, location, human environmental interaction, region, and movement. An automated GIS would be able to use the tabular data set to produce these "transparencies" and display them on the screen in any thematic order one would choose. In addition, one could use a variety of techniques to analyze this information.

Applications

From research in five North American schools that have successfully integrated GIS, there is strong evidence of the value of teacher collaboration. Because the information system (database) function of a GIS is multi-purpose, its spatial analysis function is an added benefit in interdisciplinary applications. In a database or spreadsheet, if there is a "geocoded" field such as a street address or coordinates of latitude and longitude, the data can be displayed in a map format. Interdisciplinary projects between science and technology classes, history, science, language arts and technology classes can be coordinated using a combination of GIS and other applications such as word processing, database or spreadsheet information, power point or web page applications.

Teachers who collaborated on developing GIS options were most often Science teachers, Instructional Technology teachers, or Geography teachers. The Geography team was a Canadian pair. In Canada, Geography is taught as a major subject throughout the K-12 curriculum. In all of the US schools, at least one teacher was a Science teacher, and some teams were both Science teachers (Alibrandi 1997). In the one middle school, a more interdisciplinary project took hold, and data that was gathered in Language Arts classes became data for the GIS application. In the middle school studied, all but a math teacher participated in the interdisciplinary project.

Each teacher interviewed discussed the benefits of collaboration, perhaps the most important being the support needed during the steep learning curve of early engagement of GIS. Additional perspectives on application, data acquisition, and manipulation of the data were also shared in successful collaborations. As teachers and students learned more about how to use GIS technology, a synergistic effect of collaborative learning characterized the GIS classrooms. These teachers were not afraid to have students develop their own interests and inquiries. When those inquiries moved beyond the teachers' current capabilities, the teachers engaged community partners, other teachers, or technical assistants to guide their learning.

In each case, GIS use spread somewhat laterally across curricula and made new and more sophisticated projects possible. In the next section, I introduce five schools that have integrated GIS into various curricular applications. In each case, there was collaboration. In most cases, there was in-school collaboration and partnership with a community partner. In addition, in most cases, there was an *actual* field component as well as a *virtual* application. As we develop avenues for GIS use in classrooms, the integration of field and community work will greatly enhance the mutual benefits to schools and communities as there is great potential for capacity-building as a result of these collaborations.

Five Cases:

Baymouth High School

Baymouth (a pseudonym), located in a seaside community in New England, the project was an after-school environmental community service project. Baymouth is the only high school in a 60-square mile, town; the historic county seat. Students met weekly after school to gather water quality data for an ongoing study of a small source-to-sea river that had suffered degradation from channeling, municipal, private, agricultural and golf course withdrawals, encroaching

development, and high densities of nesting waterfowl. Students worked at streamside, taking weekly samples and conducting physical, chemical, and biological tests at four locations on the river in fall and spring. During winter, students built a database of their findings using the streamside locations as the "geo-coded" points to link (fields in the database) to existing database information and GIS maps from the town's GIS department.
This was a partnership project funded by a state community service organization for capacity-building between school and local government, NPO's, and local businesses. Well-developed GIS information at the town and county levels supported the student-generated data. Two teachers in the Science department; one who had developed an Instructional Technology lab for student use, facilitated the project at the school. Neither teacher had been trained in GIS use prior to the project, but both saw its value for environmental science. The project had been funded through a state Community Service Learning grant administered by the non-profit land trust partner (Alibrandi, 1998). Students were responsible for presenting their findings and participated in a locally sponsored "River Day" event and at a state-wide conference for environmental community service.

Delany Magnet Middle School

Delany is a 'magnet' Middle School for "Academically Gifted and Talented" students in a city in the south east. The school is located in a historically Black community, and the students participating in the GIS electives came from the student body at large. At Delany (a pseudonym), the teacher team was a combination of a Science and an Instructional Technology teacher who collaborated on developing a GIS elective. One teacher had participated in a one-week In-service teacher training course in GIS and water quality and hazardous waste.

The students came from 6th to 8th grades. Most of the students interviewed had participated in more than one quarter of the elective course entitled "Satellites, Computers and Mapping" (Thompson & Hagevik: URL). The teachers had developed the GIS course as an elective, and found that students wanted to continue to develop GIS skills. The course has evolved with teacher and student interest for several quarters.

Farr Tech

Farr Tech (a pseudonym), another 'magnet' school for Science and Technology located in a major city in the Great Lakes region, draws students from the greater metropolitan area. The teacher is a highly respected innovator and GIS technician, and has reached out to community business and educational partners. The teacher had instituted GIS in the context of his science courses, and had been teaching with GIS for three years. The student interviews took place during a Saturday class; a partnership project in which a local business representative interested in training and hiring young technology-proficient workers, collaborated in GIS instruction with the teacher. The class met in a nearby community college computer lab of perhaps thirty computers and a projection screen. The predominantly African American students volunteered randomly to be interviewed.

It is important to note here, that three of the five schools featured are 'magnet' schools. The integration of this technology in classroom settings in the technology's early years was far more complex than a "plug and play" software of application. Since the pioneering work of the teachers featured at Farr Tech and DaVinci, the software for GIS has become more accessible, simpler to operate, and more ubiquitous in both government and commercial settings. The students in the Saturday class came from 10th through 12th grades, and were interviewed during the weekly 3-hour session they attended voluntarily. The entire course extended over a 16-week semester, meeting every Saturday morning.

The problems being addressed were resource location problems; where to locate child care facilities, transportation routes for a food bank, redesigning school districts for equity and neighborhood integrity. The teacher has gone on to develop a city-wide system of school facilities management using student assessors and GIS data managers and mappers.

DaVinci High School for Science and Technology

DaVinci is one of the premier magnet high schools for science and technology in the nation. Located near the nation's capitol, the county is home to the US Geological Survey headquarters. If any school should pioneer GIS, DaVinci should, and has. Jan was one of the nation's first teachers to introduce GIS to the high school curriculum. She had been working to integrate the technology for going on four years. During that period, the software applications had undergone phenomenal change, and significant work has gone into developing more accessible software applications to attract teachers and school libraries to include GIS as an instructional technology.

Jan works with a partner teacher who conducts field studies in geology and hydrology. During my visit, which was year three for the teachers, Jan was feeling that this year had been the most successful. The course was a double major "capstone" senior course designed to integrate science and technology in an original research problem. The community partner was a GIS specialist from the USGS who was interested in partnering to have students solve a real problem looking at the relationship between impervious surfaces and drainage. Students compared maps and satellite images of their region over time. In the process, they provided a service of research by "ground truthing" the satellite image data.

Each pixel of the satellite image represents an actual area on the ground, but the satellite image is not photographic; it is generated in response to heat reflected at the earth's surface. Checking the value of specific pixels of the satellite image required that students "ground truth" its value by visiting the exact location on the ground and mapping whether there was tree cover, asphalt, open land, or what have you.. With their USGS partner, the teachers and students developed an error matrix to verify the predictive accuracy of the satellite image. Then their analysis of change in impervious surface (roads, parking lots, roogftops, etc.) could be conducted with greater confidence.

I visited the school near school year's end, while the seniors were scrambling to complete their components for an upcoming presentation at the county's impressive auditorium. Students were compiling data, refining reports, and constructing power point presentations. Jan and her partner, a Geology teaaher allowed some of the students to be interviewed even in this extremely busy time. Three weeks later, I returned to see their presentations where very knowledgeable audience members quizzed them on their procedures. The students reported that, among their other findings, of over fifty gauging stations positioned throughout the county's river basins, only three had reliable, consistent data usable for their study. This the students reported in a county that houses many of the nation's elected officials. With confidence, competence, assurance and candor, they responded to pointed questions from the audience. They were soundly applauded, and conversations ensued after the presentation much as in a professional scientific meeting or hearing.

The Starr School

Innovative teachers Frank and Max teach in a private boys' school in a Canadian city. I was fortunate to visit any school in a nation where geography is taught in equal amounts to history in the British tradition, and where GIS was first developed. I found the teachers utterly willing to experiment and to allow me full access to their classroom as they carried on with their lessons and their humor-filled school days during my visit.

In a corner of the classroom, I met with randomly available individual students who took time out from their team-mates (they were working in pairs on specific problems) to complete drawing tasks and answer questions. To a man, each student described GIS as a tool for "problem-solving." They weren't being coached to say this, but had apparently internalized the perspective. It was a refreshingly informal and friendly atmosphere; not stuffy in the least, but the teachers were quick to aside that "just because they're in private school doesn't mean that each boy is a genius; kids are kids."

The GIS classroom was equipped with perhaps twenty computers, most of which were working and networked to a single printer. Students were using GIS to address problems such as transportation for a bid to attract the Olympics, resource location problems to plan for equitable access by neighborhood

groups, and developing maps for worldwide web access. The Geomatics course was a capstone course built upon a strong base of geography classes. The teachers had co-authored a workbook for the course (Taylor & Nicolucci 1999) and were developing standards for use by Canadian schools intending to offer such a course.

In all of these cases, the schools have developed products that have yielded benefit to their communities either through reports, maps, or worldwide web pages. Many of the students in these classes will move directly into summer employment where their newly acquired GIS skills are desperately needed. The potential for school/community partnership through collaborative GIS projects is perhaps the most promising direction for the next milennium.

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A Digital Humanities Resource and Website for Learning

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Abstract: This paper presents a discussion of the final component of the Learning with ISLA (Information System for Los Angeles) project, the development of a website. This website compliments the educational and teaching components of a larger project which is developing an advanced method of organizing and searching primary research materials in the humanities (photographs, manuscripts, records, texts, newspapers, documents, maps, etc.). The Learning with ISLA web-site supports the development of ISLA-based lesson plans, provides access to complimentary resources, provides links to actual ISLA resources, and provides a vehicle for dissemination of information about the project. Included in the paper is a discussion of the process used to develop the web-site, and the means by which students and teachers interactively submit materials to the site. Also provided is a description of other website characteristics.

Background

It is a generally held notion that it is the area of the humanities that is the least liable to provide students with Internet-based lessons and robust Internet materials. In an approach to address this situation a multidisciplinary team began work under a grant from the National Endowment for the Humanities (NEH) and other funding agencies to develop an advanced method of searching primary research materials in the humanities and incorporating them into teaching. ISLA, the Information System for Los Angeles, provides a "regional meta-collection" to digitally unite information by creating a "virtual library" of photographs, manuscripts, records, texts, newspapers, documents, maps etc., from various partnering collections. The ISLA database is designed to facilitate teaching and research related to the development of the Southern California metropolitan area. ISLA is currently searched by keyword, time period, or format with an enhanced version of ISLA under development which is projected to support maps, spatial searching, along with the addition of time-keyword-format structured retrieval of information. The ISLA system has been described in previous reports, including the project overview (Kazlauskas, Ethington, Wegner, Hunt, 1997), the digitizing effort (Kazlauskas, 1999), and the general training effort (Kazlauskas, 1999). This paper will describe the final component of the project, the Learning with ISLA website, which provides access to the ongoing outcomes of this project.

The Education Component

Throughout the project there has been interest in the integration of ISLA into the classroom. ISLA is particularly suited to assist in developing information literacy skills and the fostering of participation and critical thinking skills. A faculty member and several doctoral students in Education provided training sessions for school administrators and teachers, for a group of local teachers involved in an in-service program, and for students in a pre-service course in computer competency and curriculum integration. Individuals and groups from these training sessions have developed lesson plans for their specific K-12 curriculum interest level. These lesson plans have become a part of the Learning with ISLA website. The Learning with ISLA web-site is broad in scope in that it supports the development of lesson plans, provides access to complimentary resources, as well as provides links to the actual ISLA resources. The following describes the process of developing this website, and the means by which students and teachers interactively submit materials to the site, and provides a description of other website characteristics.

Learning with ISLA Website Development

The ISLA website, which is a component of the grant "Learning With ISLA", was developed so that educators and students in K-12 and post-secondary classes can use the Internet to access an array of lesson plans which taps into the rich ISLA archival source of digital materials for teaching, learning, and research. The development of this website was also seen as the most efficient and cost effective method to allow for universal access for the submission of individual lesson plans by educators.

Two ideologies in our design, construction, and implementation of this web-site served as guidelines. First, we wanted to provide the viewing audience with clear, concise, and unambiguous categories of information to avoid overloading the site with extraneous and confusing information; secondly, we wanted the website to be user friendly and compatible with different browsers and Internet bandwidth connections.

In order to accomplish these goals, several website design principles were adhered to throughout the design process. We constructed the site to be a comprehensive resource of ISLA lesson plans and at the same time to provide accurate and up-to-date information. The simplicity of the website interface emphasized "clarity over coolness" where hyperlink pathways took precedence over superfluous images and animation. These concepts allow the users to easily navigate through the site and locate necessary information.

The length of time required to load useful information was another important design principle to consider. Page file size was kept to a minimum by using images and other web page enhancements sparingly; this had the effect of decreasing download time or "wait time" to the client's computer.

Multiple links to the same page increased the "discovery success" of visitors browsing for useful information. Text labels and anchors were kept consistent throughout the entire site to avoid misleading and confusing visitors. For example, clicking on the link "Lesson Plan" anywhere in the site would always take the visitor to that particular page. The same menus appear on all pages in the same locations to facilitate clear and logical navigability.

Website Layout and Components

The layout of the Learning with ISLA website is based on a simplified hierarchical arrangement of pages containing information. The first-tier or the Main Menu is comprised of six sections: Home, Lesson Plans, Supporting Links, About ISLA, Go to ISLA, and Contact Us. These six main sections may have a second-tier, or possibly a third-tier branching from them. The following provides a brief description of the contents for each of the six main sections as well as their corresponding sections, or tiers. The general physical layout of all pages within the website is consistent, with the Main Menu on the top of the page containing the six main sections and a corresponding navigation bar at the bottom of each page. Side menu bars were added to aid in browsing specific content within that particular page or linking to others pages within or outside the site.

Home

The Home page is the obvious initial starting point for visitors to the "Learning with ISLA" website, and it has four main headings. The first heading, Learning with ISLA, provides the reader with a description of the grant and its three principal components. The second heading, Introduction, gives an overview of the ISLA (Information System for Los Angeles), the digital research resource of Los Angeles materials held in a very large, University-based archive at USC. Heading three, Overview of Current System Under Development gives a description of the ISLA interface and how it is used to search and retrieve materials from the 5,000 items located in USC's Integrated Digital Archive (IDA) database. And lastly, heading four, Credits and Acknowledgements, acknowledges the generous support provided by various organizations and universities such as the U. S. National Endowment for the Humanities, the RCL Foundation, the USC Office of the University Provost, the Southern California Studies Center, and the USC University Library.

Lesson Plans

The Lesson Plans page is the main gateway or starting point for educators looking for ISLA lesson plans to use in classrooms. This section also contains instructions for educators on how to submit their own ISLA lesson plan for inclusion into the lesson plan archive. The Lesson Plan section consists of a secondary menu whose main headings are Overview, Lesson Plans' Archives, Submit a Lesson, and Lesson Plan Links.

The Overview page provides the visitor with information on how the individual lesson plans are categorized in the archive. These categorizations are based upon possible examples of how educators would use the ISLA site in the classroom. There are currently five categories of ISLA lesson plans: Art and Architecture, Ethnic Studies, Geography, History, and Social Studies.

Art and Architecture learning objectives include developing an understanding of historical architectural styles and their creators' intended meanings. Student learning tasks may include identifying a similar style in different types of constructions and determining a period of unidentified constructions based upon style of architecture. Additionally, students may be able to classify different architectural styles based upon common features that make a style unique to a particular culture, designer or era.

The Ethnic Studies category contains lesson plans which allow students to examine different ethnic groups during historical periods and gain insight into the modes of livelihood practiced by ethnic groups in various historical times. Other learning activities include having students search the ISLA database for selected neighborhoods and note evidence of ethnic settlement and ways of life as well as observe the impact a certain ethnic group has had on the development of Los Angeles and its surrounding areas.

Geography and map reading involve students in understanding and working with cardinal orientation, scale, proximity, and interpreting map symbols. The learning tasks required of the students include orientation of unmarked aerial photos, correlation of topography with cartography, and comparisons of regional maps in space, time, and by category.

The History category of ISLA lesson plans assists in guiding students to understand more about the nature of the changes within regions over time, and across regions, while offering pictorial clues which may be used to provide hypothetical explanations for those differences. ISLA also has a wealth of historical documents archived which students can examine for historical written data about a particular time period in the history of Los Angeles.

Social Studies' lesson plans have students working with the concepts of social categorization and elementary comparative statistics, which may provide an understanding of the settlement patterns of regions and ethnic groups in the Los Angeles area. Student learning activities may include having students investigate different regions of the city and construct a changing demographic profile of that neighborhood at different points in time through examination of different socioeconomic variables.

The Lesson Plans' Archives page is a listing of the unique lesson plans which have been submitted website by teachers. Lesson plans are listed under one of five general categories as described in Overview. The title for each lesson plan is a hyperlink and clicking on it will display that particular lesson for viewing or printing. All ISLA lesson plans are structured according to the

following main headings: title of lesson plan, author's name, email address of author, subject category, grade level, school site, duration, materials, a brief description of the lesson plan, learning objectives and goals, technology objectives, procedures and student assessment activities.

The Submit a Lesson page gives information to authors interested in submitting a lesson plan based on the ISLA system to the collection. Potential authors are reminded that all submissions will be subjected to an evaluation process and, if accepted, will be published in the collection under one of five main categories. Authors are also presented with a USC/ISLA rights statement explaining that authors must grant USC/ISLA the unreserved right to edit lessons as necessary. If authors agree they click on the "I Agree!" link which takes them to the ISLA Lesson Plan Submission Form. The ISLA Lesson Plan Submission Form page is designed to allow for easy submission of lesson plans by authors. Form fields are used which correspond to the lesson plans main headings such as title, authors name, subject category, grade level, learning objectives and so on. All submitting authors need to do is type in the requested information in each field. Once all requested information has been entered into the lesson plan form, the button "Submit Your Lesson Plan" is then clicked, sending it to the ISLA website team for review, editing and posting to the website.

The last link on the Lesson Plans secondary menu is Lesson Plans Links. The Lesson Plans Links page is a listing of useful and interesting links to other lesson plan resources. Links are listed under one of the five main lesson plan categories. For example, Art and Architecture has links to the ERIC Art and Architecture and Education World Art and Architecture Lessons websites. Current links are routinely checked by the ISLA webmaster for accuracy; in addition, new lesson plan links are continually being added to the page.

Supporting Links

The Supporting Links page provides links to learning and educational resources that complement and enhance the ISLA lesson plans. This page categorizes resources under one of five main headings: NEH, California, Los Angeles, Curriculum Guidelines, and Other Resources.

The NEH-National Endowment for the Humanities heading has a link to EDSITEment; this site brings together the best of the humanities on the web. The EDSITEment page is continually growing with a collection of the most valuable online resources for teaching English, history, art history, and foreign languages. EDSITEment is a joint project of the National Endowment for the Humanities (NEH), the Council of the Great City Schools, MCI WorldCom, and the National Trust for the Humanities.

The California heading has a link to "The Challenge: A Standards-Based School District Reform Initiative" website. This site contains California school curriculum standards and frameworks for the language arts, mathematics, history-social science, science, health education, physical education, visual and performing arts, foreign language, applied learning, service learning, and career preparation.

Other useful resources on the Supporting Links page include links to public art, history, and geography of the Greater Los Angeles region. The "Public Art in Downtown LA" is a website that documents public and civic art works and monuments, as well as some turn of the century architectural buildings. "History-LA" is a site containing numerous links related to the history of Los Angeles and the website uses animations to illustrate the physical processes of rivers where students can explore case studies and trail a river from source to ocean to differentiate patterns, features, and landforms.

About ISLA

The About ISLA page provides links to and overviews of ISLA and the IDA, USC's Integrated Digital Archive. ISLA is the current time-space-time-keyword structured digital database. It is provided free-of-charge for the purpose of unrestricted public access, research, and teaching. ISLA is a "regional meta-collection," which means that it is composed of collections owned and housed by many different regional institutions. ISLA will be available soon over the Internet using the IDA interface and database system. Using the Internet maximizes exposure of and access to the many collections integrated by the ISLA system. IDA is a software system conceived, designed and written at the University of Southern California for the purpose of creating and managing very large digital library collections of primary

research materials in heterogeneous formats. IDA is a space-time-keyword-format structured search-and-retrieval system, with special value to regional archival collections. Through it, users will be able to search and retrieve different collections of archival objects (photographs, texts, quantitative data, or audio-visual files), plus the authoritative cataloging "metadata," by searching specific space, times, or keywords.

Go to ISLA

The Go to ISLA page provides information about, and instructions on how, to access both IDA-LA and ISLA digital archives. The IDA-LA database is currently available on the web-based Homer, which is one of USC's online catalogs. The database includes 3,990 photographs from the California Historical Society, Dunbar, Hearst, and Whittington collections; 88 historic documents, including ordinances and petitions, from the City Archives' Untitled Record Series; and the full text of 33 USC theses on Los Angeles. The Go to ISLA page provides a direct link to USC's Homer online catalogs and the Digital Media page with a link to IDA-LA.

ISLA will provide a "regional meta-collection" intended to digitally unite and provide public access to information owned and housed by many different regional institutions. ISLA will be a "virtual library" of photographs, manuscripts, records, texts, newspapers, documents, maps, etc., from various partnering collections. The ISLA database is designed to facilitate teaching and research related to the development of the Southern California metropolitan area. The ISLA site is still in development, but a link to a description of the prototype and "screen shots" is provided on the Go to ISLA page.

Contact Us

The Contact Us page provides email links to, and information about key people involved in the ISLA Lesson Plans project and ISLA. This page also has email links to the website development team for help questions, comments, and feedback about the ISLA Lesson Plans website.

Conclusion

In essence, ISLA/IDA is an ambitious project that is still under development. There are some current technical obstacles that when solved, will set a precedent in technology and revolutionize the way documents and images are stored and retrieved for public use. As a teaching tool, no doubt, ISLA currently offers the basis for a lesson in computer use and technology as well as extremely interesting and valuable content for lessons in a variety of settings. When it is offered in its full version, it will offer an unparalleled Internet application for use in schools globally.

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INTEGRATING COMPUTER TECHNOLOGY INTO SOCIAL STUDIES CLASSROOM

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Abstract: One effective way to actively involve students in the activities of problem solving, critical thinking and decision making is to incorporate technology into social studies classroom. The technology does offer teachers the opportunity to place children in open ended student centered investigations, and to shift from their traditional instructor role to mentor and co-learner.

This study describes the computer software that is developed in social studies curriculum for second grade primary school students and highlights some principles of behavioral, cognitive and constructivist theory that are applied into the design of the courseware

Introduction

As we move into the 21 St century, technology has grown in schools so much that is now a vital part of our children s education. Technology is very important to our students and teachers. Integrating technology into the teaching activities is the most productive way for teachers to expand the learning levels of students. Teachers at all grade levels should keep up with the expanding technology while maintaining a learning environment for the students.

Social studies education remains dominated by tradition and instruction remains primarily teacher centered, with lecturing, reading text, completing questions, and taking tests. Reform efforts in the social studies have stressed a need to change the manner in which social studies has been taught and learned. One effective way to actively involve students in the activities of problem solving, critical thinking and decision-making is to incorporate technology into social classroom.

Computer technology has not been in wide use in social studies classrooms in Turkey. There is also a shortage of computer software in this field. We need software programs to teach study skills, to organize information, to arrange and graph the knowledge. Recently there is an ongoing funded project in the Department of Computer and Instructional Technology at College of Education, Karadeniz Technical University, Trabzon, Turkey about developing courseware in social studies field. The aim of the project is to increase the teacher knowledge about technology and its use in K-12 schools.

This paper describes the completed part of the software developed and highlights some principles of behavioral, cognitive and constructivist theory that are applied into the design of the courseware.

Multimedia Courseware

The History of Turkish Republic and Ataturk was chosen as a subject for this multimedia courseware. The courseware has been prepared by using Macromedia s authorware 4.0 and can be used both as a Windows.EXE file or a shockwave file for distribution over the Internet.

After interviewing teachers about History of Turkish Republic and Ataturk subject some learning problems were identified. According to teachers, this subject contains a lot of information about historical events and dates. Students are having difficulty remembering those events by chronicle order and they often get confused about dates. To overcome these problems, some learning activities were planed. Principals of

behaviorism, human information processing theory, and constructivism were applied to instructional design of this courseware.

What makes good instruction is not the medium. It is the instructional method that guides the way the medium is used. In order to produce effective courseware, the author must be aware of the techniques of instructional design and learning theories (Clark, 1995). In keeping with the theories, the way that Behaviorists, Cognitivists, and Constructivists are depicted by each other tends toward the extremes. The three are not mutually exclusive. However, there are certainly more and less appropriate times to apply the ideas from each camp. What is important is that, whatever theories or ideas we apply that they do the most to enhance the learning possibilities in the given environment and particular domain. Also, there are more and less appropriate uses for Behaviorist, Cognitivist, and Constructivist theories of learning. People are not machines and do not live isolation from the real world. Neither can students be left entirely on their own to haphazardly find/not find what is important to grasp in a particular learning situation. Guidance is still needed.

Applying Behaviorist Theory

Performance objectives can be attributed directly to operant conditioning that has probably had a great impact on educational practice within the past thirty years than any other single model of human learning (Ormrod, 1990). At the beginning of the courseware s design, important knowledge for elementary third level students is identified and goals of the instruction are translated into performance objectives that are sufficiently specific and detailed to show progress toward the goals. The reason for eventually stating all objectives in terms of performance is to be able to measure student performance to determine when the objectives have been reached. To check the results of student learning during the progress of a lesson multiple of choice-test items have been prepared and placed after every information screen. Such a check made it possible to detect any misunderstandings the student may have and to remediate them before continuing. After two incorrect attempts the programs took the students back to the related information screen.

According to behavioral psychology what ever the fundamental nature of the learning process, experience or practice in a new situation has no effect- learning will not occur- unless practice is reinforced (Clark, 1995). Reinforces are messages or other actions that encourage a response to be repeated. In the present software the two types of reinforce, positive and negative are used to inform students about the correctness of the answer. When response is correct, a short statement affirming this is made. This is done with a single word, such as good or correct and with encouraging words, such as you are doing great job! and with an interesting picture or animation and sound. To incorrect responses, simple and direct answers are used. Fig. 1 is an example for question screens.

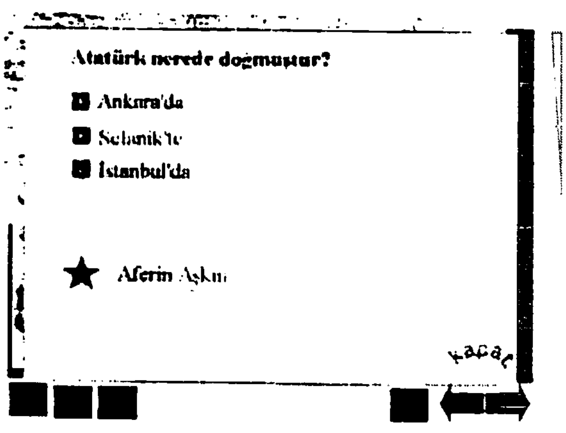

Figure 1. Question Screen

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Applying Cognitivist Theory

In Cognitivist theory, learning a piece of information does not guarantee that the information will be remembered later on. Retrieving information from long-term memory is sometimes easy and automatic, at other times slow and strenuous, and at still other times virtually impossible. Frequently used information tents to be remembered without conscious effort. Things are more easily retrieved when long-term memory is organized (Ormrod, 1990).

The information that is presented in the courseware organized and overlapped with what students already know. The following is the table of contents in its main menu:

1- Ataturk s Life
2- Turkish Republic and Social Reforms
3- Our National Festivals
4- Games

The courseware contains text, animation, scanned pictures, audio and video files all of which of course help to clarify the knowledge and to direct the attention of students to the lesson.

According to cognitive psychology working memory is the main work area for though, the conscious center of the brain. But its storage capacity is limited. Because the limited capacity of working memory is rapidly overwhelmed when lots of new information is presented, it s crucial to provide frequent opportunities to use or practice the information in working memory. More frequently rehearsal items are better remembered than less frequently rehearsed ones. Rehearsal through which the information better understand and made more meaningful does facilitate storage in long-term memory (Clark, 1995). In the present software, after the presentation of each new idea or chunk of information too many practicing opportunities are provided. Three different games are included into the courseware and placed in its main menu. Games are designed to teach important dates in the history of Turkish Republic and Ataturk. The first game includes some dates and pictures. Here students are allowed to drag dates to the related pictures. After dragging the date to the right picture, dates snap on the center of the pictures. In the case of incorrect trails, dates go back to its first initial position. Students receive feedback after every attempt that they made. The second game included pictures of some important historical events between 1880 and 1940 and history band. Pictures of events are displayed on the screen by chronicle order and students click on the history band to mark its occurrence date. The third game is about completing an incomplete sentence. Students are allowed to complete sentences about historical events by putting the right date in an appropriate place. Fig. 2 shows the first game s screen.

To reinforce a message dual encoding through the use of concrete words, text, graphics and sound was added to courseware. Visual images can be stored quickly and retained over long periods of time. For this reason, visual aids were used to provide beneficial supplement to verbally presented information. Color, arrows, shading and sound were used to direct learner s attention to important parts of the message.

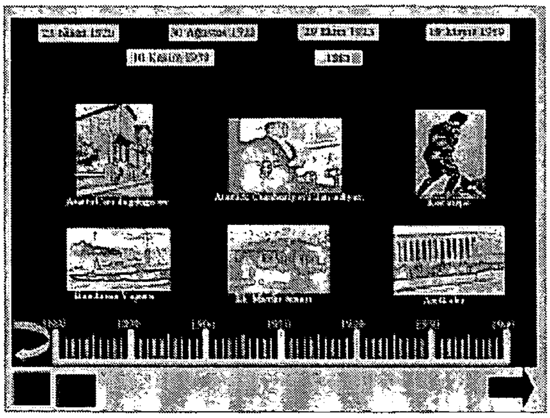

Figure 2. A screen from the first game

Applying Constructivist Theory

According to constructivism, students come into a classroom with their own experiences and a cognitive structure based on those experiences. These preconceived structures are valid, invalid or incomplete. The learner will reformulate his/her existing structures only if new information or experiences are connected to knowledge already in memory. Inferences, elaborations and relationships between old perceptions and new ideas must be personally drawn by the student in order for the new idea to become an integrated, useful part of his/her memory (Caprio, 1994).

Model of constructivist teaching (Wheatley, 1991) have three components: tasks, groups, and sharing. The model is a simple one to follow. In preparation for a class a teacher selects a tasks which have a high probability of being problematical for students-tasks which may cause students to find a problem. Secondly, the students work on these tasks in small groups. During the time the teacher attempts to convey collaborative work as a goal. Finally, the class is convened as a whole for a time of sharing.

To implement a constructivist format into developed courseware some procedures for teachers are organized in teachers handbook. Teacher s handbook that is accompanied by courseware includes guidelines for teacher and methodologies for creating a constructivist classroom. Teacher s handbook has been based on projects, authentic tasks, and real world contexts. Classroom projects are designed with a shift from whole-class to small-group instruction, from individual to tutorial instruction, from lecture to coaching, from summative tests to performance assessment and from isolation to cooperative learning. One of the classroom activities was to select a task that is problematical for students and breaking students into small groups to work on this task. Teacher is suggested to structure a lesson in the following format:

1- Engage student interest on a topic that has a broad concept.
2- Ask open-ended questions that probe the students preconceptions on the topic.
3- Present some information or data that does not fit with their existing understanding.
4- Have students break into small groups to formulate their own hypotheses and experiments that will reconcile their previous understanding with the discrepant information. (The role of the teacher during the small group interaction time was to circulate around the classroom to be a resource or to ask probing questions that aid the students in coming to an understanding of the principle being studied.)
5- Let students work on developed courseware and take tests to determine learning difficulties.
6- Encourage the use of alternative sources for information while doing their projects.

Developed courseware has been suggested to be a learning material for students while working on problematical tasks. Tools button has been created into courseware to help students in their projects. By pressing Tools button students are allowed to select some pictures and write what they know about this picture. After reflecting their ideas on the computer screen students are allowed to print their work. By doing this, the students have an active participation in the shaping and augmenting of their learning.

After sufficient time for experimentation, the small groups share their ideas, conclusions and projects with the rest of class.

Conclusions

Social studies teachers are slow to integrate computers into their teaching. This is partially due to the limited amount of social studies software. However, the most meaningful learning takes place when students interact with concrete materials. Students have greater understanding when experiences are meaningful and manipulable. The computer environment offers equal, perhaps even greater control and flexibility to students.

As a developers of computer courseware, we need to be aware of our beliefs about how people learn and we need to select method consistent with those beliefs, fit the needs of the learner, and match the purpose of the learning. Because what makes good instruction is not the medium. It is the instructional method that guides the way the medium is used. In order to produce effective courseware, the author must be aware of the learning theories and their instructional applications.

This study describes the computer software that is developed in social studies curriculum for second grade primary school students and highlights some principles of behavioral, cognitive and constructivist theory that are applied into the design of the courseware

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Hypergroups for Social Studies Teachers:
A Critical Issues Dialog for Technology Integration

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Abstract: This paper provides a case study of the use of online discussion in the social studies program area at the University of Houston. Online discussion was integrated as a tool for reflection, continued dialog, and to facilitate the development of a community of learners. The goal is to model a constructivist focus for transforming social education to include powerful approaches that are meaningful, integrative, value-based, challenging, and active.

Introduction

Successfully integrating technology in social studies classrooms is a vital issue facing social studies educators. Unfortunately and all too often, problems occur when social studies teachers are presented the new technology, expected to implement it, then left to battle alone with their own issues regarding effective integration. Nevertheless, technology skills are now essential for social studies teachers and students.

This article provides a case study of social studies pre-service and in-service teachers' conversations via on-line web discussion groups called hypergroups. The conversations began in Spring 1999 when hypergroups were established as part of the Social Studies program area at the University of Houston. Although the hypergroups were established as part of course work in Social Studies Methods, Current Literature in Social Studies, and Technology in Social Studies, social studies teachers who have engaged in social studies education at the university over the past two years were also made aware of the on-line discussion group. Topics and themes ran the entire spectrum within social studies education, although technology issues definitely emerged as one priority theme during discussions. This article provides an overview of the project and summary, analysis and implications of the discussion responses.

In social studies, technology is often used as an add-on, available when the "real work" is finished, or as a reward for good behavior. These occurrences are due in part to the assumption by administrators and teachers that the training needed to implement technology effectively is too extensive and too technological or, on the other end of the spectrum, that the training can be done with one long and usually unproductive in-service session quickly forgotten as the year progresses. A false over-reliability or even blind acceptance of technology in schools also causes these issues.

Education has become a massive process for producing passive minds (Sizer, 1992). This is especially true historically in social studies education due in part to the use of teacher-dominated curriculum and instruction, textbooks, worksheets, and tests (NCSS, 1994). Another contributor to the problem is the tendency to focus on coverage of content over quality of learning, which has often pushed teachers to utilize the more traditional methods of teaching. Thankfully there are educators who go beyond traditional strategies and try to make social studies powerful and meaningful by embracing new and innovative ways of teaching.

Many well established teachers ask why they should use technology in social studies when there are successful methods already being used within their classroom? The issues presented in this paper focus on making social studies a more powerful and meaningful experience through technology integration in hopes of meeting students learning goals and meeting the needs of facilitating a critical and active citizenry. What society demands our children be able to do when they leave the educational system is much different from what it was as few as ten years ago. They must be proficient in using technology and understand the implications of its use in the future as well as how it has effected us in the past. Social studies teachers must modify the old style of teaching to fit the

new way of learning. Social studies is not just about covering content; it is about analyzing content and developing social skills and attitudes, all with a critical thinking and problem solving focus.

Technology also has the ability to make learning exciting and worthwhile, allowing students to interact with the computer as well as other students while observing and acquiring the most current information on places they would otherwise never experience. We, as educators sometimes fall into a trap of anesthetizing the students...[There's] not enough stimulus (Sizer, 1992). Implementing technology can wake up those sleeping students as well as promote a motivation to learn independently. We focus too much on extrinsic motivation to ensure learning; perhaps technology integration can facilitate a movement toward more intrinsic motivation. This should be the goal of every social studies teacher and can be developed and fostered quite effortlessly in a technological classroom.

The role of technology in social studies teaching and learning can be much more meaningful and powerful. If we are truly interested in promoting a social studies that goes beyond traditional transmission to a more transformative knowledge, skills, and attitude development that facilitates an informed and active citizenry, then technology must play a more central role. Many of the excuses that pervade successful social studies technology application including content coverage, time, availability, training, and traditional praxis should be addressed. There really is no excuse if we keep in mind the ultimate goals of social studies education.

Theory and Foundations

Online discussion is relatively new in pedagogical praxis. Only in the last few years has there been even minimal research and literature regarding issues, trends and effective learning in online discussion. There is even less research in the merging of online discussion and social studies education. Perhaps a key issue is ensuring effective learning through online discussion. Jonassen states that there are four paramount attributes of constructivism that facilitate an effective learning environment including: (1) providing opportunities to foster personal construction of knowledge; (2) setting an appropriate context for learning; (3) facilitating collaboration amongst learners; and (4) facilitating learning and collaboration through conversation (1995).

Savery and Duffey (1995) suggest the integration of problem-based learning (PBL) in order to encourage collaboration. This strategy, whether integrated in technology or more traditional learning environments, necessitates active engagement, metacognition, and social negotiation. Tied to these essential components is the integration of democratic and critical approaches to learning (Weisser, 1997).

Issues dealing with learning via technology (online discussion) suggest developing a constant awareness regarding dialog, discussion, and discourse as we hope to establish collaborative learning communities. Research suggests that online discussion can encourage otherwise silent students to participate, can promote the ideal of serious dialog regarding comments, can facilitate discussion on issues and themes that are unlikely to be approached effectively in classrooms, and can facilitate the development of collaborative learning community (Weisser, 1997; Parkyn, 1999; Swartz and Hatcher, 1996). Parkyn (1999) suggests specific pragmatic details vital for effective online discussion including detailed instructions and expectations, monitoring, etiquette, and equal involvement of all (including the instructor).

Within a social studies framework, an online discussion must focus on knowledge, skills, and attitudes related to social education. It must also address the components of powerful social studies teaching and learning including approaches that are meaningful, integrative, value-based, challenging, and active. The ultimate goal might be the transformation of social education to a student-centered, problem-based, critical analysis focus (White, 1999).

Hypergroups

Hypergroups are a web-based discussion tool established at the University of Houston for any professor wanting to facilitate online discussion outside of class. While the great majority of hypergroups are extensions of in-class activities, many were also established as central components to online specific courses.

The design for hypergroups lists courses alphabetically. Once students enter the site, they can scroll to the appropriate course number. Many of the specific hypergroups are password protected. The interface lists the course title, options for interacting, description of the course, and owner (professor). Options for engaging in hypergroup discussion include posting new threads or topics, replying to previously posted comments, joining the discussion, looking through the listings of postings, and viewing the names of the members of the specific hypergroup. Other options include viewing the postings by thread, names, or chronology.

A limitation to hypergroups has been its administration and coordination as a doctoral student who has left the university developed hypergroups. Informational technology faculty and support staff have made an attempt to continue the implementation and administering, although it was recently decided to purchase a packaged program called Web Boards to take the place of hypergroups.

The Project

The social studies program area at the University of Houston has meaningful technology integration as a primary goal. Most students enter the professional development component of their program having either life-experience and / or at least one course in informational technology. The courses that encompass this project include Elementary Social Studies Methods, Secondary Social Studies Methods, Current Literature in Social Studies, and Integrating Technology in Social Studies.

In all of the courses hypergroups were used for a variety of applications. The instructor introduced hypergroups toward the end of the first class meeting in conjunction with a technology in social studies project suggested as a project for each course. Negotiated technology assignments for each course included readings on integrating technology, problem-solving scenarios, software evaluations and applications, web quests and web site evaluations, course-specific technology applications, and hypergroups.

Hypergroups were introduced in a lab situation whereby all students could access the site. The instructor then demonstrated the organization and potential applications for hypergroups with each class then negotiating expectations for their application. Generally agreed upon expectations include a minimum number of postings and / or replies to postings, hypergroup etiquette, reflections on class projects, issues, and discussions, sharing of resources and completed projects, and facilitating the development, rights and responsibilities of a community of learners. The instructor generally stresses that the course hypergroup discussions be restricted to themes and issues (and their application) related to social studies education and schooling in general.

Once the expectations are agreed upon, the instructor posts a message to initiate discussion. The instructor participates equally in the discussions although makes a general posting approximately every other week to facilitate the flow. Students are given the option to respond. Students seem to do well in participating in their own threaded discussions, however. There is a synthesis posting required after the last class meeting. In the synthesis students are encouraged to comment on highlights from the course (both in class and online), suggest additional issues and themes, and offer final ideas for application.

Postings

Initial Posting from Instructor (titled Hello and Introduction)
"Hello Folks! The purpose of this group is to facilitate discussion outside of class. Themes and topics might include issues and trends in social studies, transformative curriculum, instruction, and assessment in social studies, sharing of ideas and posting questions, and general reflection on class activities. Please take some time each week to post to this discussion group and be sure to use the exact (same) name each time you post. Here's fodder for our first comments and reflection: What are the most vital issues and concerns in social studies today - what are possible solutions? How can the use of meaningful literature address these issues?A primary goal is to enable meaningful dialog outside of our class, so let's make this a priority when responding."

Sample Replies from Students

"One of the most important issues in SS today is the idea of getting students to understand that history is not a puzzle to be solved, that what is a "right" answer today may be disproved tomorrow.Students should be more concerned with thinking about history as opposed to wondering if they have the answer "right." I think standardized testing is particularly crippling to the idea that students need to think about historical events and make their own connections and decide for themselves if a "factoid" is indeed correct or just an idea twisted to fit a particular
ideology. End of sermon."

"I think the first issue we should address in social studies is the issue of relevance. Students are not interested in social studies because they do not see any relevant connection to their own experiences. I'm worried about kids not learning their connections to the past and to each other. I guess that pertains to the tenet that SS instruction should be meaningful. If the curriculum doesn't show us our connectedness - how our actions affect and influence each other now and in the future - how can we think that we're preparing our kids to succeed?"

"I guess I believe that SS is a part of our everyday lives. I'm assuming we have all felt like we have been left out or treated rudely/unfairly at some point in our lives. This all comes back to how and when people were taught proper and meaningful social skills. I feel that one of the most important things we can model and get through to our students is the courtesy and compassion for each and every person we come into contact with on a daily basis. It shouldn't matter who is around or how busy you are, there should always be that gesture of courtesy to each individual. From this frame of thinking, you can expand on it in almost any direction. It ties into anything you want to discuss such as emotions, reactions
to these emotions, whether they are appropriate or inappropriate, taking into consideration differences between all of us and how important those differences are, etc. This list could go on for awhile. But my point is that if there is something we really need and want to get through to our students, there are fun and successful ways of doing it so that they benefit the most."

Second Posting (titled new comments and issues)
I am very impressed with the comments and issues presented here and in class...lots of thoughtful ideas...Let's keep this going by commenting on each others postings, reflections on class activities and themes, elementary social studies, etc... Perhaps we can share issues/ideas with planning for the theme
presentations, other projects, and discussions in class. Please discuss, comment, ask, challenge regarding schooling, k - 12 social studies, curriculum issues, instruction issues...themes and topics in class, etc... What about a thematic, in-depth, and issues-centered approach to k - 12 social studies???

Sample Student Replies
"Obviously motivation and inspiration dies in many people, or we wouldn't be talking about it. I think it's hard to pinpoint specific reasons for this. It happens the same way a lawyer suddenly finds himself practicing the kind of law he said he would never do when he was 25. The important thing is that we can talk about it, we know it's happening and even more important we know that it can and will happen to many of us. We all say it won't, but just look around, there are teachers in every school, down every hall that have lost the inspiration and probably couldn't tell you why they still do what they do. They are the ones that teach by the text, follow the norms of the administration, never rock the boat. What is so frightening is that there are no easy answers, each one of us is different. I think we have to find our own answer within ourselves."

"I think that one of our main jobs as educators is to teach students how to think and how to problem solve. Children of all ages need to be taught these skills. Far too many times, children are told rather than asked how to solve a problem. I think we would be surprised with their responses as well as who responded. For me, the key is to present interesting problems with multiple solutions. Allow the students to investigate and communicate their solution. If we give them more space to explore and to solve problems, they will learn how to do it and do it well. Every student needs to feel that they are thinkers and that their minds are powerful tools that only they can use. It is our job to stimulate and motivate them to use them!"

"I always was interested in the topic of Social Studies, but was never taught in a way that really allowed me to think. We were always given the facts, situations and problems and then tested on them. I was never asked to think in depth about the issues or to try and come up with solutions. I really believe that it is important to involve students and help them understand the situation at hand. Ultimately they should be asked to think of possible solutions. This allows children to relate to the problems and see the critical importance to the issues by learning how these problems can be solved. If we want to have an impact on children, we have to involve them in engaging activities that allow them to discover the importance of what is being taught. Ultimately, we have to teach them these skills to be successful in the real world."

Third Posting (titled additional big issues and questions)
Additional Issues/Questions to ponder perhaps:

- Despite passion, excitement, and creativity often demonstrated in pre-service teacher education, the great majority of social studies teachers eventually buy into the system and become much like their elementary social studies teachers. Why is this? Is there anything we can do to counter this?
- We constantly state that social studies is more than coverage of information (skills and values development for example), yet content for the sake of content (and very basic low level knowledge) remains the very dominant focus in social studies. why is this? Is there anything we can do to counter this? Should we?
- We preach citizenship and democracy, yet schools and classrooms are among the most autocratic and often disempowering places. Why is this? Is there anything we can do to counter this?
- With the increasing focus on accountability, efficiency, and essentialism, where is the focus on the children? Shouldn't his be what we are all about? Shouldn't we be outraged at the idea that all children should fit a certain mold?
- Other possibilities...Is the real purpose of social studies education in this country the perpetuation of the status quo and inculcation of "the American way?" We can talk about the hard issues in forums like this, but can we really make a difference "in the trenches?" What are specific ideas that can help us all continue/maintain the passion and idealism day to day throughout our teaching careers? Why shouldn't social studies be about social reconstruction and transformation?

Sample Student Replies
"I think you are asking the tough questions that no one really wants to answer, that is those that have lost what first inspired them. And that I think is the answer. Even though countless hours of hard work and preparation are put forth to enter the classroom what happens then? I think that so many teachers enter with high expectations and eager hearts, but find that what awaits them is a brick wall. After pounding away at it alone for a while they forget the reason they started to tear it down in the first place. With no support for their efforts they become persuaded by those on the sideline to put their "weapons" away and follow the mass. Why not? It's easier this way, it's just a job- and the administration wants test scores, content, so why not give it to them. If it makes my life easier and my superiors happy then it must be the right way. But it's not, we all know that. But the big question is this- Most teachers felt it wasn't the right way to go when they started or they wouldn't have entered this profession to begin with. This is a profession about making an impact, not following the middle road. So what do we do about the loss of heart and soul in our work? We all say it won't happen to us, but it's happening everyday to teachers around us, the question is what makes us different? I think we know that in our hearts. We must surround ourselves with people who have that inspiration also(even if it's just one person that we see in class on Tuesday night), we have to remind ourselves daily that the struggle is so hard because it's worth it. When we realize that nothing else matters and suddenly doing what you know is right in the classroom isn't so difficult after all."

"All of these questions are inter - related. The all- encompassing answer could be summed up in one word: TRADITION. Most teachers buy into the old system of teaching because it is what most of their peers do in the schools. Let's face it, it is the easiest way to teach also. There is no challenge to cracking the book open and lecturing...Countering this will take a lot of dedicated, caring teachers to set a new norm- a norm that involves imaginative, creative lesson plans and implementation. I would say that a school board could reprimand and remove any teachers that are too "old school", but that would lead to way too much controversy. So, the answer is to set a new precedent as new educators.Again, the reason social studies is basically taught at a lower level is

because it has been the easiest thing to do in the classroom over the years. As long as kids scrape by and pass the exam, administrators could care less that social studies may not promote critical thinking. I think that social studies should be presented at a higher level, one that not only tells the students who, what, when, where, why and how, but also promotes them to ask: "So what is the importance and relevance to toady?" As educators, we can only go one step at a time and offer lessons to our classes that go beyond just mundane details. Schools are autocratic and disempowering because administrators may be afraid that offering the students too much freedom of expression or leeway will lead to undesirable results. The thinking is that if the "automatons" gain freedom, that chaos and anarchy will occur. In some cases it is hard to let every student speak his mind, and in some cases, certain freedoms should limited, such as being able to wear clothing with references to alcohol, drugs and sex. That is not to say these things cannot be discussed, because they should be. There is not enough focus on the children because the focus is on the paycheck. Most teachers I know live only for that special day every two weeks that swells their bank accounts. That is wrong. It
is also absurd to think that all children fit one mold. As educators, we need to see that every student is different and have something to offer each and every one of them. In physical education, we are taught to make lesson plans that include students of all levels simultaneously. I believe academic classes should follow this approach as well. Of course with every suggestion made on this board, it will not be easy and it will take time, but it can be done."

Final Instructor Posting (titled final thoughts / synthesis)
How about some synthesis and final reflections regarding issues and ideas discussed via this hypergroup/listserv... Perhaps we could also suggest web sites, books, lesson ideas, and other resources that "really make a difference" and that might push us toward a more "enlightened" approach to social education.

Students generally revisited issues that had been discussed in class or via hypergroups during the synthesis. The threads that received the most postings / replies surfaced (as indicated earlier) again in the synthesis component. Particular final issues include the need for continued support once they are "real" social studies teachers, how to survive in schools that have an essentialist focus and stress accountability, access to technology, and transformative issues for social education. Students also used the synthesis for posting additional references, resources, and web sites.

Student Initiated Threads / Postings

Students were strongly encouraged to post their own topics, themes and issues as the semester progressed and not to rely on replying to the instructor's comments. A variety of comments, issues, and themes emerged as students posted their own topics and themes. These generally initiated a much richer ongoing discussion, but were often linked with other postings. Considerable dialog emerged with various student-initiated postings. Examples of themes, topics and issues follow:

Approaching controversial issues
Standardized testing
Indoctrination
Diversity / Culture
School violence
Status of social studies
Elementary social studies issues
Lack of social studies knowledge
Technology issues
Social studies curriculum

Classroom management
- Traditional approaches
- Pop culture
- Gender

Values education
Public vs private
Teacher education
Censorship
- Rights / responsibilities

Social studies instruction

The threads that received the most comments dealt with the status of social studies, public vs private schools, culture and diversity, controversy, pop culture, and indoctrination and values. At a few points students ignored the issue of etiquette and engaged in very heated discussions on these very powerful and controversial themes and topics. Participants did an excellent job in managing their colleagues and redirecting to the purpose of the hypergroups.

Conclusions

Students generally were very positive regarding the use of hypergroups and the actual discussions in the hypergroups. The hypergroups were enhanced as a result of traditional class discussion and projects although many additional issues, themes, and comments were provided via hypergroups that only received lip service (if that) in class activities and discussions. Student replies to instructor postings seemed very frank and actually very challenging to traditional thought. Students in fact, often stated that the questions posed, format itself, and general classroom environment welcomed critical analysis and challenging commentary. Students also indicated in the synthesis that hypergroups facilitated the development of a community of learners.

As a result of the project, the social studies program area will continue with online discussion integration in courses through the new format entitled Web Board. Other developments include offering online courses for social education and providing opportunities for real time chat. Issues that must be addressed regarding hypergroups and other online discussion activities include access to and troubleshooting regarding technology issues, appropriate online discussion etiquette, and facilitating the components of powerful social studies teaching and learning. Other issues include constant monitoring and involvement by the entire learning community (instructor and students), encouragement regarding individual postings and replies to postings, including controversial, challenging, and open-ended questions by all, and encouragement regarding postings of references and resources and developing opportunities for real time chats.

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Methods Course Connections: Transforming Social Studies via Technology Integration

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As the new Millennium dawns, opportunities abound for the inclusion of meaningful technology use in elementary schools. Modern computers are less expensive, more powerful, and have more versatility than those that were available a decade ago. Current technology allows the contemporary computer user to interact with software and to engage in information retrieval on the World Wide Web (Harris, 1998).

At the same time, many Internet locations allow the social studies educator to access web sites that bring history to life through the use of primary sources and "virtual" visits to historic locations. Now students can go online to collect current data from the United States Census Bureau (1999) or follow the activities of the 106th Congress or the passage of a bill through the legislative process at the Thomas (1999) web address. The National Council of Social Studies (NCSS, 1999) web location allows teachers to access the NCSS Standards(1994) and to link with Internet locations to access supporting information for each standard.

Until recently, traditional elementary social studies instruction focused on facts and the transmittal of information by teachers to students with the aid of resources such as a textbook, map, and globe. The power of today's technology provides the opportunity to shift social studies instruction to allow the student to capture, manipulate, and retrieve information in new ways (Rose & Fernlund, 1997; White, 1997). This contemporary revision of social studies instruction definition would have to include the addition of software, video, and Internet access.

As we enter the new millennium, shifting social studies instruction from teacher talk, memorization of facts, and textbooks to a social constructivist approach with the teacher as a facilitator encourages students to process multiple data sources as they utilize the power of technology and the resources of the Internet to construct their own knowledge (Rice & Wilson, 1999). Preservice teachers can plan and develop social studies units of instruction that include exploration of primary resources, comparison of cultures with international pen pals, and virtual field trips to locations far from the elementary classroom.

In the fall semester 1999, two social studies methods professors conducted a survey to determine the technology use of preservice teachers in four sections of social studies for the elementary child. One section of the course was taught concurrently with an instructional technology for teaching course; the other three sections were taught prior to taking the instructional technology for teaching course in the curriculum. As a course requirement, each methods professor required students to utilize the Internet for resources for an integrated unit of elementary social studies instruction.

Study

The purpose of the study was to examine the level of technology integration in the student's development of a social studies unit of instruction. In addition the study examined the effect of whether being enrolled in the technology class at the same time as the social studies class had any effect on the degree of technology integration in the unit of instruction.

The sample population consisted of 89 students at a major southeastern university, accepted into upper division status in elementary education, who were enrolled in an elementary social studies methods course. Section I was concurrently enrolled in a technology class in addition to the elementary social studies methods. Sections II, III, and IV were enrolled in elementary social studies methods and are not enrolled in the technology course until the following semester.

The survey instrument [Appendix I] asked students to self-report their class rank, previous/present enrollment in a technology course required by the major, and the degree of technology use they employed to complete a class project in the elementary social studies methods course.

Results

All students indicated the use of the Internet for resources for the unit. As assignments are required to be word processed, all students indicated use of word processing. As Email is advocated as a

means of communication with professors at this institution, Email received high utilization in the survey. It is likely that the first three items received higher use due to the requirements of the course.

Current Use of Technology

	Section I	Section II	Section III	Section IV
1. Internet Resources for Unit	22	25	17	25
2. Email	21	22	11	21
3. Word processing	22	25	17	25
4. Creating worksheets	11	23	14	24
5. Computer assisted instruction	4	3	2	4
6. Chat Rooms	11	4	3	5
7. International pen pals	1	0	0	5
8. Problem Solving Software	0	0	0	0
9. Simulations	5	3	3	5
10. Source for Primary Sources	7	12	4	5
11. Databases				
12. PowerPoint				
13. HyperStudio				

Conclusion

Students incorporated technology as required but rarely went beyond course requirements in the elementary social studies methods course. The section concurrently enrolled in the technology and elementary social studies methods showed no greater integration of technology in their units of instruction than students who had not taken the course.

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Appendix I

Survey

- I am currently enrolled in Senior I. Yes No
- I am currently enrolled in EDTC 4001. Yes No
- I use technology in the following ways. Circle the appropriate items:

1. Internet Resources for Unit
2. Email

3. Word processing
4. Creating worksheets
5. Computer assisted
   instruction
6. Chat Rooms
7. International pen pals
8. Problem Solving Software
9. Simulations
10. Source for Primary Sources
11. Databases
12. PowerPoint
13. HyperStudio
14. Other

TECHNOLOGY DIFFUSION

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A central issue for technology educators is examining and facilitating the process whereby instructional uses of technology become integrated into the educational system. Although massive investments of federal, state and local funds have gone into providing technology infrastructure for schools, there is growing concern that technology is not being used effectively in the classroom. Recent Office of Technology Assessment, National Council for Accreditation of Teacher Education, and Milken Family Foundation reports, draw on nationwide studies conducted in the United States to conclude that teachers' use of technology currently lags far behind its availability. The federal Preparing Tomorrows Teachers to use Technology (PTTT) grant program has provided hundreds of millions of dollars to help rectify this problem and support projects aimed at helping educators be more effective in integrating technology into their instruction. The papers in this section provide a valuable resource for those of us who are interested in supporting the technology diffusion process. The first six papers are research reports on the adoption and integration into K-12 classrooms. The next four papers address efforts to infuse a technology emphasis throughout teacher education programs. The following five papers provide descriptions of collaborative partnerships between universities and K-12 schools—followed by five reports of professional development models. The next five papers examine the use of the Internet-based learning environments. The final three papers give insights into the role of technology directors and educational technology plans, with the final paper providing a description of a unique consortium housed at the Miami Museum of Science.

The first set of papers provide a rich examination of the technology diffusion process in K-12 schools. Mize and Gibbons conducted extensive case studies in three schools and identified four factors that are important for successful instructional integration of technology—a consistent "vision" of integration, effective leadership, regular staff development, and a low teacher turn over rate. Hall and Mantz examined middle schools in North Carolina to establish their "technological readiness" and the extent to which they have integrated instructional uses of technology. Findings indicate that there is a wide range of readiness in the schools examined and, although considerable planning has occurred, there has been little training for teachers or impact on schools. The Sherry, Billig, Tavalin and Gibson paper describes the development and evaluation of a five stage Integrated Technology Adoption and Diffusion Model which draws on Activity and Systems Theory. Lan, He, Ouyang, Zhonghai and Bao provide an international perspective on technology integration in their examination of a Shanghai secondary school. They focus on the teacher professional development model and the role of students in supporting the process. Beasley addresses a specific issue associated with teachers' reluctance to embrace instructional technology—reliance on traditional texts. She concludes that teachers continue to rely on texts because of "classroom insecurities, accountability issues and technological insecurities, availability, and assistance. In the final paper in this group, Marcovitz and Hamza used case studies of three elementary school classrooms to examine ways that students supported their teachers in using technology in the classroom. They identified both positive and negative factors associated with having students assume technology support roles.

The second group of papers describe efforts to diffuse technology components throughout university teacher education programs. Strudler, Heflich and Anderson present their model for widespread infusion of technology throughout the teacher preparation program which was funded through a PTTT grant. The four major components include inservice workshops for university and K-12 school personnel, one-on-one support, minigrants for technology-based modules in methods courses, and expanded opportunities for students to apply technology in courses and field experiences. Pan provides a discussion of why previous attempts at technology integration have not been successful and offers four initiatives aimed at overcoming these obstacles. Renne explores the evolution of a teacher certification program as technology becomes a focus and gives an example of how she was able to integrate technology, math, and pedagogical issues. The Isaak and Ward paper concludes this section with a description of an elementary teacher education program in which technology

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was diffused into all aspects of the curriculum including science, language arts, math, music and art. A series of projects were described including collaborative assignments that crossed courses and involved new students working with students who were further along in the program.

The five papers that follow report university/K-12 collaborative partnerships. Abate describes a project in which master K-12 teachers are assigned to help university teacher educators integrate technology into their courses at five different universities. In her pilot study, McGee documented the experiences of volunteers among preservice teachers enrolled in required technology courses as they mentored K-12 teachers about technology. Another collaborative project, described by Wentworth and her colleagues, examines the effects of three professional development seminars from the perspective of various participants-a district technology coordinator, a state Internet specialist, a K-12 teacher, and a university faculty member. Wong and Smith focus on the collaborative work of one university and six local school districts to establish a consortium that seeks to identify common educational problems, including the integration of technology, and develop and implement appropriate professional development opportunities. Finally, Stephen and Evans describe the development of learning communities among inservice and preservice teachers and university faculty at an elementary math, science, and technology magnet school program.

The next three papers offer further discussion of models for professional development with technology. Pronk describes an innovative teacher training course set up as a profession-oriented learning center for University faculty and students and elementary teachers. Krieger and her colleagues tell about one school district's staff development efforts that develop and support teachers' use of technology. Cole describes another professional development model based on a partnership of teachers in which all of the participants implement the joint project in their respective classrooms.

One commonality among several papers is the use of the internet to enhance learning environments. Abate and Seung document efforts in designing an Internet site that supports technology integration in preservice teacher education. Hines and Downing also address issues in web development, focusing on the potential of intra- and inter-disciplinary collaboration in the process of building a virtual community. Sisk and Gardner describe the Learning in Electronic Environments course that aims to provide the opportunity for business advisors and other practitioners to explore the potential of electronic delivery systems. Finally, Wright explores the application of best practices in online learning and other educational uses of information technology.

The final group of papers address some important issues in technology diffusion. Brownell and Brownell examine the role of technology directors in the development of successful institutional leadership regarding technology. They use complexity theory to analyze case studies of two technology directors and examine the effectiveness of this pivotal change agent role. Breithaupt addresses the development and implementation of educational technology plans with a specific focus on systematic evaluation. In the final paper in this section, Pollock describes a PTTT catalyst grant developed around a partnership including the Miami Musuem of Science, University of Miami, the Smithsonian Institution, NASA, and the Florida Department of Education. Based on a training-the-trainers model, the project will develop materials, provide digital resources, prepare training teams, provide support for teams, and disseminate their model throughout the Southeastern United States.

The papers in this section represent insightful analyses of the technology diffusion process and exciting and innovative approaches to integrating technology into the educational system. It provides an excellent resource for all of us who are striving to improve the use of technology in education.

More than Inventory: Effective Integration of Instructional Technology to Support Student Learning in K-12 Schools

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Abstract: This paper is a report of three case studies considering the instructional uses of technology in public school classrooms. A level of technological proficiency was determined for each school that participated in the research through the use of a series of surveys, teacher interviews, and observation. Once a level of proficiency was determined for each case, specific strategies used at each school to promote technology integration were evaluated. Data collected and analyzed for each case indicated that strategies for strong technology integration must address three specific areas; the schools vision of integration, the leadership at each school, and the training method used for staff development. Results indicated that public schools that addressed all three areas adequately were able to achieve a higher level of technology integration, with improved acceptance and attitudes towards technology in everyday use by both teachers and students.

Introduction

State and national agencies regularly reference technology integration as a real need if public schools are to be considered technologically proficient as they move into the next century. However, the specifics of how to effectively integrate technology into the K-12 curriculum are still largely undetermined. The confusion about how to effectively integrate technology may come from a basic misunderstanding about what the term technology integration means. If one was to ask teachers what technology integration is, many different answers would most likely be received. Although technology integration is considered a real need, a cohesive understanding about what technology integration is, does not currently exist.

Predominately schools use one of two methods to place computer technology in front of students. The first method follows the instrumentalist view. This view sees technology merely as a tool or instrument to be used by teachers and students for teaching and learning. Research from this view has been involved in developing better human-computer interfaces, improving graphics, and making software tools more efficient, rather than in better pedagogical techniques (Jih, 1996). Haas (1996) states however, that this view of technology places: "…teachers and scholars in a subordinate position to technology, removing them from the realm of technology development and critique and setting them in positions to be merely receivers of technology."

Since the use of technological tools will be an important skill once students enter the work place, schools cannot discount this need. However, schools that have tried to follow this view completely have found difficulty in doing so. Two problems develop from the total acceptance of the instrumentalist view. First, this view supports the belief that the quality of a student's work is dependent upon the quality of the tool. This perpetuates what is known as the *latest is the greatest syndrome*, where schools constantly fight the financial battle of trying to have the latest technological innovations so that students will hopefully produce the best work. Financial constraints hinder K-12 schools from updating their technological

resources at a speed equivalent to that of the development of these resources. Secondly, schools following this view typically make the teaching of skills their primary instructional method. It is felt that if students learn the menus and features of particular software, they will be able to use these skills in the work place. Industry however, indicates that they are dissatisfied with the quality of students entering the work place. Although students appear to have spent a great deal of time with various software, they do not seem to know when and how to apply their software skills to work related problems.

The second method of integration comes from the transparent view of technology which sees various technology as being basically immaterial. Schools that follow this view tend to place whatever technology is available in either labs or in classrooms and then expect teachers to find some place for it in the curriculum. Since the technology is immaterial, whether or not a teacher chooses to use the technology in their classroom or in their teaching is simply a matter of choice. This view removes the need for schools to have the latest technology, but creates the problem of justifying the existence of technology that is often out of date and inadequate to the school community. This view also perpetuates the belief of teachers that they are integrating technology as long as they add it onto their teaching at various times throughout the school year.

As with the instrumentalist view, administrators also have problems in the evaluation of their technology programs. Since this view does not see the technology as being an essential part of the learning environment, outcomes attributed to the use of technology in the classroom are very hard to establish and measure. Another problem with this view is that teachers who are highly motivated to use computer technology in their classrooms must rely largely on trial and error methods for finding a place for technology in their teaching day (Picciano, 1998). Simon's (1990) word *satisficing* applies well to this situation. Teachers commonly must accept a technology that, although it satisfies the situation, it causes the teacher to sacrifice an optimal solution to an instructional problem. Myhre (1998), argues however, that most teachers are not highly motivated to use computer technology in their classrooms. Instead, teachers find it difficult to find a place in their teaching practice for computer technologies at all. In a study evaluating the use of technology by both pre-service and in-service teachers, participants indicated that much of the software did not meet their instructional needs. In order to use available existing software, the teacher was required to mold their pedagogical practice around the technology. When this occurs, technology becomes the focus of the learning, not a component to enhance learning.

This study looks at schools considered to be technologically proficient by current standards and then works to determine trends and strategies that K-12 schools should consider in order to successfully integrate computer technology into the teaching environment.

The Study

This is a first report of a continuing study which seeks to identify trends in technology integration among K-12 schools considered to be technologically proficient. In this study, individual public schools in the Texas panhandle were identified as having a high commitment to the integration of technology through a series of visits to schools to identify those that not only had a high degree of technology hardware and software, but also had committed a substantial amount of the teaching day to the integration of technology. To help identify schools as being technologically proficient, current Department of Education guidelines for the evaluation of technology programs were used (USDOED, 1998). The Department of Education guidelines stated that a school should have appropriate hardware and software resources in order for technology integration to take place. Using the USDOED survey instruments as a guide, three schools were selected as cases for this report. Two of the schools were in small rural locations and one was in a more urban location.

The first step for identifying technological trends was to develop a theoretical perspective from which to guide each case study. This perspective was used as a lens through which the series of interviews and surveys used for data collection could be viewed. Current literature indicates that technology integration should be more than simply having hardware and software available for teachers and students to use. The literature illustrates that there should be a blend between the common methods of technology use in schools instead of taking either method to its extreme (Haas, 1996). Therefore, this study views integration as the matching of appropriate technology to a particular educational task in order to solve instructional problems. This matching of technology to task should not occur only during "computer time," but instead should be a continuous process throughout the class day. Technology should not be added on as an additional teaching

area, but instead should be used much like a pencil, to enhance the learning experience each day in many different content areas.

Once this perspective was developed from the literature, survey and interview instruments were developed to collect data and identify themes that would help mark principle issues of integration in the case schools. Two principle types of data collection were used in this study. One was the use of a survey to identify demographic information, teacher perceptions about technology integration, integration strategies, leadership, and staff development. Further, the survey instrument contained an index of instructional use, developed to help identify the true degree of integration being accomplished by each school. The survey instrument was developed by the researchers and then submitted to a panel of peers for suggestions on improvements and identification of problem questions. Once comments were received back from the panel, a second version of the instrument was produced which incorporated the feedback from the panel. The second version of the instrument was then administered to a pilot group of teachers for evaluation and suggestions. After incorporating changes identified after the pilot administration of the survey, a final version of the instrument was produced for use in the study.

The second type of data collection was done though the use of interviews of both teachers and administrators at each school studied. Again using the literature as a guide, interview scripts were developed that followed for each interview. Each of the interviewers received training in the use of the scripts and were asked to follow the scripts exactly as they conducted their interviews with teachers and administrators. Observational data was also collected by the researchers so that a better understanding of the context for the survey and interview data could be achieved.

After the data was collected, an analysis of the data yielded the following results.

Results

The analysis of survey data pertaining to demographics yielded the following results. The age range for teachers in the cases studied showed a very even distribution between teachers in the various age groupings used. Teachers 21-30 years of age represented 29% of the teachers surveyed. Teachers 31-40 years of age represented 24% of the teachers surveyed. Teachers 41-50 years of age represented 25% of the teachers surveyed. And teachers 51-60 years of age represented 20% of the teachers surveyed. Teachers in the 61+ years of age were the only age range not representing an fairly equal distribution coming in with only 2% of the teachers surveyed in this age range.

In the schools studied, the years of experience represented by both new and more experienced teachers also were evenly distributed. Years of experience represented by the teachers were closely correlated with the age of teachers at the case schools, indicating a stable faculty at each school, with a very low turn over rate.

Previous research has indicated that teachers, especially in older age ranges, tend to have a very low self-perception about their technology skills. Research has also indicated that females tend to have a lower self-perception than males relating to their use of technology. However, the teachers in this study indicated that they felt that their technology skills were high. 55% of the teachers surveyed indicated that they had high technology abilities with 16% of the teachers indicating that they had average technology abilities. 29% of the teachers indicated that they felt that they had low technology abilities. Nearly all the teachers at the schools were female with only two teachers and one principal being male.

The results of the instructional use index and the individual teacher interviews yielded the following themes that emerged as key factors in the integration of technology in these schools.

Theme 1: Integration Strategy. The strategies used by individual teachers were very diverse. However, the main focus indicated that teachers must have a clear vision of an integration strategy in order for integration to occur. Teachers who did not have a clear view of integration for their teaching situation tended to feel very frustrated. The most common comment made by teachers that did not have a clear view of integration and consequently did not have a strong integration strategy, was that they did not have enough time to add the integration of technology on top of everything else that they were to teach each day. These teachers felt that they should be released from teaching all subjects or from having to integrate technology. Time repeatedly was indicated as a factor that must be dealt with if technology integration was to occur.

Theme 2: Leadership. Another theme that developed throughout the three case schools studied was the theme of leadership. Leadership was seen as more than just mandates given by administrators instructing teachers to integrate technology. Further, leadership had to be more than simply providing hardware, software, and technical support. Although having these resources was seen as highly important, the administrators involvement in the integration process was seen as a key factor in moving a school towards proficient technology integration. Examples given were where administrators were seen improving their own technology abilities through the attendance of staff development with classroom teachers, using technology in daily administrative and communication task, and allowing teachers time to experiment with new teaching methods utilizing technology.

Theme 3: Staff Development. The third theme focused upon staff development. In these schools, technology related staff development was regularly scheduled for all teachers. Teachers normally have an average of 5-6 opportunities per month in which they can choose to participate. These regularly scheduled training opportunities not only help keep the teachers aware of the need to improve their technology integration practice, but also help teachers keep up with the ever changing face of technology. Further, as teachers have a higher exposure to technology integration methods, self perception about their ability to use technology also increases. As a teacher's self-perception increases, so does their motivation to use technology in their classroom.

Theme 4: Teacher Turn Over Rate. The last theme found in the current data collection was the theme of teacher turn over rate. In the schools that seemed to have a high degree of technology integration, there was also a high degree of stability among faculty. The three cases identified as being technology proficient all had the trend of having a very low teacher turn over rate. This trend was reflected in the demographic information with regard to age and years of experience. It would seem that teachers in a stable work environment were more accepting of trying new teaching strategies in their classrooms. In less stable environments teachers may tend to revert back to standard teaching strategies such as using standard textbooks and worksheet materials.

Discussion

As seen in this report, there are several factors that can influence the effective integration of technology into the classroom. The four primary themes that emerged all warrant much discussion and will likely evolve as this research continues. However, trends between the different cases studied so far can still be seen.

Integration strategies are a primary concern to any school wanting to effectively integrate computer technology into the teaching environment. A school must have a clear vision of its integration strategies and this vision must be appropriately communicated to all members of the school community. Schools typically still follow either the view of using computers as tools or instruments for teaching or they view the technology as being transparent. It may be that a more balanced approach to technology integration is needed. An approach in which the technology is not integrated by adding it on top of other teaching activities that a teacher conducts throughout the day, but instead, one where the technology is seamlessly integrated in all content areas. By seamlessly integrating technology into all areas of the curriculum, issues of time will be minimized since the technology is not additional to the existing curriculum, but is an integral part of the curriculum.

Leadership is also an important factor in that it cannot be approached from a punitive posture. Administrators must themselves have a clear vision of technology integration for their school and then effectively communicate that vision to their teachers. This communication does not appear to be best when it comes in the form of mandates, but instead should be communicated by example. Allowing teachers an opportunity to try new teaching methods utilizing technology is essential. This may mean that administrators may have to accept that not all of the methods that teachers may try will be successful for a given school. However, this must be seen as an evolutionary process needed if technological proficiency and integration is to be achieved in a given school.

Strong staff development is essential for the technologically proficient school. To achieve the integration of technology, teachers must be exposed and trained in a variety of methods for integrating

technology into their classrooms. It would appear that staff development is most successful when scheduled regularly with multiple opportunities for attendance. There is also a consideration of the type of staff development utilized. Schools can either try teaching skills, and then expect teachers to understand how to use their new skills, or they can teach methods of integration that help meet teaching objectives. Some combination of both may be most appropriate for most schools.

Lastly, maintaining a low teacher turn over rate may be a strong indicator of schools that may be ready for the integration of technology. If teachers are to try new teaching methods and use new technology, they must feel they work in a stable environment. Teachers working in schools that have low teacher turn over rates may be more receptive to technology integration.

As with any organization, schools have a variety of factors that can influence the use of technology. This study has been an attempt to begin looking at some of the trends and factors that can indicate integration of technology in today's schools. It should be noted that this is an on-going study that is far from complete. However, as schools continue to advance utilizing technology in their educational settings, many trends and ideas are sure to continue to emerge.

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MIDDLE SCHOOL TECHNOLOGY INTEGRATION STUDY

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Abstract: This paper is a report on the development and findings of an on-going study being conducted on middle schools in rural eastern North Carolina. An analysis of the technological readiness of each school is being followed with a program to offer school leaders a technology design and teacher training that will work in their schools. Findings indicate wide disparity in readiness and a great deal of planning with little deployment of technology and meaningful training for teachers.

Introduction

Eastern North Carolina is a very rural area with a lack of resources to provide the technology necessary to level the playing field vis-à-vis more progressive areas of the state and country. Consequently, middle schools are not equipped and school leaders and teachers are not trained to use modern technology and integrate it into their curricula. Teachers continue to teach using outmoded, if often effective, methods. New methods include an emphasis on data searches using Boolean logic and a keen evaluation of the data extracted. One might term this integration of technology into classroom learning an emphasis on "keywording" rather than "keyboarding." The point is to adopt technology as a tool for learning rather than viewing it as a subject to be learned, i.e., to align the curriculum using technology.

The Study

This study is focused on establishing the level of technological readiness in 126 middle schools in eastern North Carolina and creating a model of school technology. This includes identifying the proper equipment, software and resources needed, as well as developing a costing and training model for school leaders and teachers to make new technology integral to the learning process through curriculum alignment.

Review of the Literature

Previous studies and discussions with practicing public school leaders and teachers have indicated several seemingly intractable obstacles when attempting technological initiatives in classrooms. Yerrick and Hoving (1999) reported that few teachers use technology in the classroom because of insufficient training, perceptions of social support, perceptions of lack of control of specific initiatives, and teachers' own attitudes toward technology and individual projects. Additionally, public school teachers have indicated that access to equipment and insufficient staff development are major obstacles. Staff development initiatives are often seen as one-time phenomena, with little or no follow-up.

Many studies have focused on one or more of these problems. The most oft cited are clearly procurement and proper provision of technology, training in its use, teachers' attitudes concerning the technology in specific settings and perceptions of support for technology related initiatives.

The leveling of the technological playing field is a main thrust of West Middle School in Lawrence, Kansas (Lowe & Vespested 1999). A study presently being conducted focuses on student leadership, professional development for teachers, and curricular integration. These are the most important aspects of any program designed to change the learning process from being teacher centered to being learner centered. At West Middle School this is

being pursued aggressively in order for the students to meet desired exit outcomes. Funding for this comes from grants and local businesses.

The World Wide Web is becoming and important tool in classrooms across the country. The Web offers a distinct advantage to students over textbooks and stationary libraries. First, the information on the Web is current. Various news and other agencies post events and information as they happen. Also, one may find many differing viewpoints about any subject on the Web. Textbooks have a distinct disadvantage of containing predigested ideas and biases, presented as fact (Windschitl and Irby 1999). In preparing teachers for instruction, it is important that we inculcate the true nature of the internet into their knowledge bases and have them demonstrate a mastery of its use in the classroom. To accomplish this it is important to train prospective and practicing school leaders and teachers how to use text, audio, video, graphics and hyperlinks to incorporate into their lesson plans (Smith, Martin and Lloyd, 1999).

There is no question that the goal must be for every student to have access to a PC. This is a critical component to "leveling the playing field" for all. Students are the ultimate knowledge workers (Gates 1999). Without the proper tools, students are being programmed for failure. Our teachers are working in an environment tantamount to *planned failure*. PCs change the equation by helping make the transition away from traditional approaches to the learning experience (Gates 1999). They enable exploration, experimentation, and collaboration in a self-directed way. Teachers then orchestrate these experiences. Parents are apprised of students' accomplishments using the technology available.

Curriculum alignment is a topic of discussion in today's environment of accountability. In order to align curricula with societal expectations, one must understand the various curricular components. Glatthorn has contributed to this understanding by identifying eight types of curricula. The first he identifies is the **hidden curriculum**, e.g., the allotment of time to subjects. The more time allotted, the value students attach. Second is the **excluded curriculum**, that which is simply not taught. He cites the study of dialects as an example of an important exclusion. Third is the **recommended curriculum**; that which experts in the field believe should be taught. Fourth is the **written curriculum**, i.e., state standards, district, school and teacher developed notions of what should be taught. Fifth, Glatthorn identifies the **supported curriculum**, i.e., textbooks, software, etc., which supports the written and recommended curricula. Number six is the **tested curriculum**. This incorporates those educational ideas, facts and concepts to be tested and will reflect on the teacher, the school, the system and the state. Seventh is the **taught curriculum**, i.e., what teachers actually teach, and finally, Glatthorn identifies the **learned curriculum** or what students actually know after having experienced a specific course of study (Glatthorn 1999).

Glatthorn recognizes that only some of these curriculum types must be directly aligned. Others are, at least to some extent, only peripheral to the learning process. Important alignment areas are hidden/taught, written/recommended, excluded/written, supported/written, tested/learned, and taught/learned (Glatthorn 1999). A major component of this study will be assessment of the sufficiency of technology to the task of aligning these curricula.

Wraga cautions those who would use curriculum alignment that the practice results in low level instruction (Wraga 1999). It is important that any new pedagogical strategies using technology not resort to "skill-drill" exercises. The goal is to facilitate student immersion into the subject matter.

It is worth listing some of the Wall Street Journal's **Hard Lessons on Computers in Schools**. They offer cogent guidelines for integration of technology in the teaching/learning process. They are:

- Computer labs are lousy places for computers. They need to be in classrooms.
- Struggling students often get more out of computers than higher performers.
- Most teachers still haven't been trained on how to use computers in class.
- School systems must plan computer use carefully.
- Computers are tools, not subjects. They need to be integrated into the lessons of other subjects.
- Kids flourish when everyone has a computer.
- Hand-me-down machines are not good enough for school use. (Gates 1999)

Methodology

A questionnaire analyzing technological readiness in eastern North Carolina middle schools has been developed and sent to school leaders at 126 middle schools. Results are reported below.

A technology and costing model has been designed and will be used to bring each participating school to the same technological level for the study. Those not having the resources to equip the entire school can "scale down" the model so that those classrooms participating will have the proper equipment for the study. The model is attachment 1 of this paper.

Schools have been selected for the pilot portion of this study based on their answers to the readiness questionnaire, their willingness to participate, and their abilities to deploy the proper technology. These pilots are being conducted using eighth grade English Literature teachers, students and state standards. Information on the progress of pilots is becoming available now.

Students in participating classrooms are being pre-tested using a non-confidential writing prompt used as an example on the NCDPI web page. This prompt is similar to one used to assess writing competency at the end of the seventh grade year. Teachers will be trained to integrate technology into their classes by aligning these curricula according to the Glatthorn categories discussed in the literature. Students will be post-tested at the end of the spring 2000 semester using the same instrument. Results will be available in early summer.

A control group will be given the same pre and post-tests, with more traditional interventions, for comparison.

All essays written as a result of the prompt will be scored using the criteria developed by NCDPI.

Findings

Each questionnaire was reviewed and the following preliminary findings have been determined:

- Most middle schools in eastern North Carolina have technology plans in place (See Table 1)
- Many but not all of these plans include a component designed to provide training in the use of technology (See Table 2)
- Most schools have the majority of their computers in labs (See Table 3)
- Most schools have a few (2-3) computers in actual classrooms (See Table 3)
- Computers are used for some, very limited, individualized instruction (See Table 4)
- A majority of teachers in eastern North Carolina middle schools have access to email and some use it to correspond with parents, other teachers, administrators, etc. (See Table 5)
- A majority of eastern North Carolina middle schools have web sites (see Table 6)
- There is an approximate student/computer ratio of 5/1 in middle schools in eastern North Carolina (See Table 7)

Tables

82.15

Table 1: Reported Percentage of Eastern North Carolina Middle Schools with Technology Plan in Place

78.57

Table 2: Reported Percentage of Eastern North Carolina Middle Schools with a Comprehensive Plan for Training Teachers in the Use of Technology

Percentage in Labs Only	Percentage with Computers Deployed Mostly in Labs	Percentage with Majority of Computers Deployed in Classrooms
14.28	**85.72**	**0.00**

Table 3: Reported Deployment of Computers in Eastern North Carolina Middle Schools

None	Some	Much Individualized Instruction Using Computers
17.85	82.15	0.00

Table 4: Reported Amount of Individualized Instruction Using Computers in Eastern North Carolina Middle Schools

Percent with No Interaction	Percent Interacting Among Teachers and Administrators	Percent Interacting Among Teachers, Administrators and Parents
39.2	18.0	42.8

Table 5: Reported Amount of Computerized Interaction Among Teachers, Administrators and Parents

60.8

Table 6: Reported Percentage of Eastern North Carolina Middle School Web Sites Maintained

Mean Ratio	Median Ratio	Modal Ratio	Range
5.7/1	5/1	4.76/1	2.29/1 – 200/1

Table 7: Reported Student/Computer Ratio in Eastern North Carolina Middle Schools

Figures

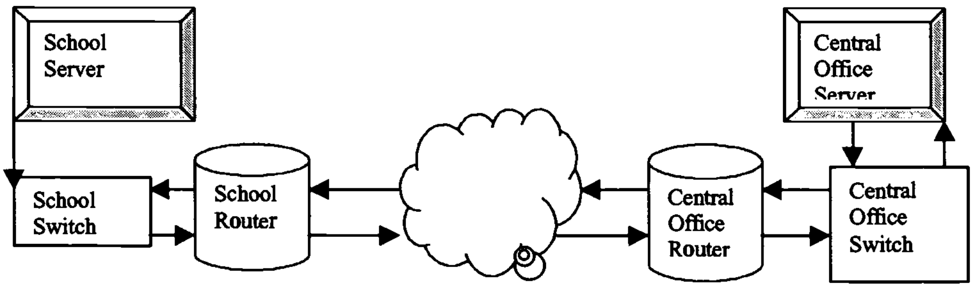

Figure 1: Technology model for middle schools and central offices

Cost Item (for 500 student school) (Assuming 20% of computers already available)	One-time Ed. Discount	One-time E-Rate	On-going Ed. Discount	On-going E-Rate
Computers Needed (Appropriately Equipped)	$ 600,000	$ 600,000	$ 250,000	$ 250,000
Wiring	$ 125,000	$ 62,500	$ 0	$ 0
Server	$ 12,500	$ 6,250	$ 0	$ 0
Switch(s)	$ 12,500	$ 6,250	$ 0	$ 0
Router	$ 20,000	$ 10,000	$ 0	$ 0
ISP	$ 90,000	$ 45,000	$ 90,000	$ 45,000
Phone Company	$ 2,500	$ 1,250	$ 2,500	$ 1,250
LAN Administrator	$ 40,000	$ 40,000	$ 40,000	$ 40,000
Total	**$ 902,500**	**$ 771,250**	**$ 382,500**	**$ 336,250**

(Approximately $675 per student per year with E-Rate)

Figure 2: Costing model for middle schools

Cost Item (for 20 person central office)	One-time Ed. Discount	One-time E-Rate	On-going Ed. Discount	On-going E-Rate
Wiring	$ 5,000	$ 2,500	$ 0	$ 0
Server	$ 12,500	$ 6,250	$ 0	$ 0
Switch(s)	$ 2,500	$ 1,250	$ 0	$ 0
Router	$ 20,000	$ 10,000	$ 0	$ 0
ISP	$ 2,400	$ 1,200	$ 90,000	$ 1,200
Phone Company	$ 2,500	$ 1,250	$ 2,500	$ 1,250
LAN Administrator	$ 40,000	$ 40,000	$ 40,000	$ 40,000
Total	**$ 84,900**	**$ 62,450**	**$ 132,500**	**$ 42,450**

Figure 3: Costing model for central offices

Principal/Assistant Principal and Teacher training will be designed using writing prompts similar to those used by NCDPI to test students at the end of the seventh grade.

1. The trainer will assist the participants in downloading text examples of primary and secondary sources for use as part of a sufficient number of lesson plans to cover one semester in an eighth grade Language Arts class. The participant will review and work with the trainer to establish a viable base of information to begin the lessons.
2. Audio tools will be used to demonstrate their effectiveness to the participant. Some will be from sources external to the internet and others will be downloaded from cyberspace.
3. Graphics from the internet and other sources will be integrated into lesson plans.
4. Hyperlinks to pertinent data will be developed for use.
5. Discussion between the trainer and the participant will shape the lesson plans into something useful and comfortable to the participant.

The next step in the study will be to actually integrate the lesson plans into the classroom. Using the lesson plans as guides, the participating teacher, with guidance and input from school leaders, will (throughout the semester):

1. Introduce new concepts using the internet, where appropriate.
2. Promote discussions using the internet, where appropriate.
3. Give assignments requiring use of the internet.
4. Use the World Wide Web for presentations by the teacher and students.
5. Use email discussion lists.
6. Determine student mastery on a periodic basis.

Figure 4: Middle School Technology Training Model for School Leaders and Eighth Grade Language Arts

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NEW INSIGHTS ON TECHNOLOGY ADOPTION IN COMMUNITIES OF LEARNERS

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Abstract: This paper presents an alternative, nonlinear view of technology adoption among teachers participating in The WEB Project, a Technology Innovation Challenge Grant. It is based on a number of new theories including Activity and Systems Theory, and upon previous evaluations of large scale educational technology programs by RMC Research Corporation, notably the Boulder Valley Internet Project.

With the current emphasis on presentation, communication, and WEB technologies in all settings--K-12, higher education, corporate training, and online learning networks--effective design of learning environments is a large concern. However, the adoption, implementation, institutionalization, and other aspects of technology are often given less emphasis than they deserve.

We know that the Internet affects student learning, but the research is still ongoing about how members of learning communities adopt technology and telecommunications and use them to enrich teaching and learning. As we studied the formation of online communities of learners and the integration of technology in middle and high schools in the state of Vermont, we found that Rogers' (1995) *Diffusion of Innovations* framework and Hall and Hord's (1987) *Concerns-Based Adoption Model* (CBAM) did not adequately describe the systemic process in which technological, individual, organizational, and pedagogical factors interact throughout the life span of an instructional technology program. However, these models form the conceptual framework for many new studies of innovations, such as Dooley's holistic framework for the diffusion of educational technologies (Dooley 1999).

Our purpose in this paper is to explore an alternative view based on a number of new theories, including activity and systems theory. We then present a dynamic model based on a case study of The WEB Project, a Technology Innovation Challenge Grant that is entering its fifth and final year of implementation.

Background

In 1962, Everett Rogers published the first edition of *Diffusion of Innovations*. In this seminal work, an innovation was conceived of as an *object* with five perceived attributes--relative advantage, compatibility, complexity, trialability, and observability--that help one to explain its rate of adoption. The decision by a user to adopt or reject the innovation is an *event*--a point in a linear process--with time as an independent variable. The process of adoption consists of a series of actions and choices over time, based on internal factors within a social system. Rogers' diffusion studies addressed innovations such as new types of grain, water purification systems, and birth control clinics in underdeveloped countries.

Change in Schools (Hall & Hord 1987), based on the pioneering work of Frances Fuller, brought about a psychological shift from properties of an innovation to the concerns of its users. It also refocused the role of a change agent from a promoter to a facilitator. In the Concerns Based Adoption Model (CBAM) of Hall and Hord, users pass from self concerns, through task concerns, to impact concerns as they become more experienced with the use of the innovation. Like *Diffusion of Innovations*, the CBAM model is also linear in nature.

As we applied these models to the adoption and diffusion of technology into classrooms in Vermont, we found that they did not fit well. Innovations such as the Internet, the WWW, and online learning

technologies are not static (Batty et al. 1999). In fact, they evolve faster than traditional research studies can deal with them. Moreover, the first stage of adoption is gaining knowledge about the innovation. For interactive technologies, this is a continuous learning process for all users, be they novices or experts.

Having observed teachers and students in The WEB Project cooperating schools for the past three years, we found that the adoption, implementation, and institutionalization process of technology-based active learning in the arts, social sciences, language arts, and humanities, is simply not linear. Teachers are co-learners and co-explorers with their technologically-savvy students. The community of learners, supported by The WEB Project's electronic network, evolves in expertise in a dynamic, systemic fashion as the technology acts as a "carrier of practices" for all of its members.

As a result, we need to look for alternative views that can explain:

- The explosive growth of the Internet and the learning communities that it supports;
- The realities of federally funded instructional technology programs;
- Multiple levels of scale, both individual and group;
- The use of interactive learning tools in an intentional context; and
- The cyclical nature of the change process.

Developing An Integrated Technology Adoption and Diffusion Model

Through our evaluations of several educational technology initiatives, especially the Boulder Valley Internet Project (Sherry, Lawyer-Brook, & Black 1997; Sherry 1997), we found that teachers generally go through four distinct stages as they develop expertise with the Internet and the World Wide Web. Our *Integrated Technology Adoption and Diffusion Model* (Sherry 1998; Sherry 1999) describes a learning/adoption trajectory -- i.e., a cyclical process in which teachers evolve from learners (teacher-trainees) to adopters of educational technology, to co-learners/co-explorers with their students in the classroom, and finally, to a reaffirmation/rejection decision. It is at this fourth stage that teachers decide whether the use of telecommunications to enhance teaching and learning is working for them; contributing to their self-efficacy as teachers; compatible with their personal vision of learning; and worth the time and effort that they have put into mastering a new set of skills. The Learning/Adoption Trajectory is presented in Figure 1.

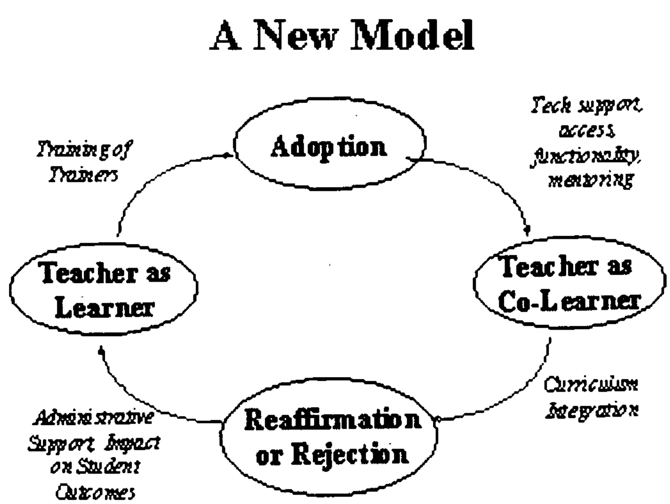

Figure 1: The Learning/Adoption Trajectory (Adapted from Sherry 1999)

In this research-based model, the reaffirmers go on to build capacity within their school and among their fellow teachers as they assist their colleagues with troubleshooting equipment, give inservice sessions at their schools, serve on technology planning committees, and become the new round of peer trainers and change agents for their colleagues. If they move to another school, they continue operating at this level, thereby adding a portability dimension to their skills. This is the point that is characterized by Rogers (1995) as confirmation-seeking; it is where reinvention of the innovation may take place. Similarly, Hall and Hord (1987) have observed refocusing activities on the part of users as they shift their concerns from task management to the impact of the innovation on all users within the educational system.

At each of these four stages, there are professional development strategies that work. For example, training may be more appropriate once an "advertising campaign" is in place that informs teachers, parents, and administrators about student successes and promising educational practices using technology in the classroom. Learning communities can also be more easily formed at later stages. In addition, many professional development "sessions" are necessarily embedded within the school day since needs may be immediate. Teachers may turn to each other, to students, or to online help for immediate assistance.

Further Evolution of the Technology Adoption Model: The WEB Project

Based on three years of evaluation of The WEB Project (http://www.webproject.org), a Technology Innovation Challenge Grant in Vermont, we found that the learning/adoption trajectory model was validated (Sherry, Billig & Perry 1999). Data for the 1998-99 academic year for The WEB Project were gathered from interviews, focus groups, and classroom observations that took place during site visits to participating schools; surveys of students, teachers, and administrators; participant observations at the *Making Connections Summer Institute* and the *Basin Harbor Retreat* during the summer of 1999; and an analysis of artifacts such as teacher and project publications and compact discs, threaded discussions, and student projects posted on The WEB Exchange, the project's website. A cross-case analysis was performed between participating sites to identify general trends, and data were analyzed to ascertain the early impact of the project as a whole on student performance.

The WEB Project stresses using online conversation for improving student products and performances in the arts and humanities, and engaging in dialogue about works of literature and current events. Along with the student/teacher forums, there are a number of forums that connect participating teachers, mentors, resident artists and musicians, members of participating initiatives such as the MIDI Project, the ARTT Project, and the Vermont Center for the Book, and other experts, in a community of learners. Through these online conversations, teachers shared ideas, common interests and concerns, and strategies for solving complex problems of practice, and they exchanged messages of mutual support for one another. As a result, The WEB Project ecology spanned the classroom, the school, and the community-at-large, rather than being limited to a specific district or set of classrooms.

As instructional technology continues to evolve and to pervade educational institutions, our model, too, is evolving. When trends in the cross-case analysis of The WEB Project were compared with the original model of the Learning/Adoption Trajectory (see Figure 1), it became clear that participants in The WEB Project had progressed beyond *the teacher as co-learner* and *teacher as reaffirmer/rejecter* stages. The traditional role of the teacher was being restructured. Professional networks of participating teachers were expanding, and teachers were sharing their ideas beyond the bounds of their schools and districts. Teachers were creating and sharing standards and rubrics rather than simply following them. At some cooperating schools, teachers began to institute trainer-of-trainers programs at their schools or among their online learning networks, using students and peers as assistants and co-trainers. At another school, the role of a teacher was restructured so that she could serve as a mentor for other teachers across the project.

Thus, in contrast with findings from earlier instructional technology projects, a fifth stage must be added to the model as it applies to The WEB Project: *teacher as leader*. It is at this point that the system really starts to build capacity. Moreover, this is the stage at which the local community expands beyond its initial bounds to encompass a wider community, linked through an electronic learning network to the environment in which it is situated.

The leadership of The WEB Project was facilitative at this stage. They made the critical decision to link this innovation with others taking place within the state, building on successes of existing initiatives like the MIDI Project, the ARTT project, and the Vermont Center for the Book, and leveraging resources of other participating schools and cooperating initiatives. Support from many sources was garnered, not only from the Vermont Department of Education and administrators throughout the state, but also through the community. Practitioners such as artists and musicians were cultivated and provided constructive feedback to students. Communities were involved in technology based projects at many schools. Administrators were kept informed of all progress and requirements for participation.

The project also built on the educational vision for the state as a whole, specifically on the state standards and the Vital Results. The vision for the project was kept in the forefront of all participants' thinking and represented a shared idea of what everyone wanted to accomplish. Communication was regular and effective. The leadership also remained persistent in their efforts despite occasional criticism and difficulties encountered at the cooperating schools.

Interpreting Observed Effects

It is at the *teacher as leader* stage that we must break away from linear models and start looking at more dynamic models such as:

- the "unfreezing-change-freezing" process described by Schein (1996);
- the circular change model of Havelock and Zlotolow (1997);
- the balancing and reinforcing loops described by Senge (1990); and
- the interaction of users, tools, agency, and the community of users described by Engestrom's (1996) Activity Theory framework.

In Schein's (1996) view, from the perspective of the user, members of a learning organization begin to "unfreeze" their perceptions as their experiences with an innovation fail to match their preconceived notions; go through a change and refocusing process; and then "refreeze" their concepts to match their current experiences. The WEB Project, however, never got caught up in this "refreezing" process. Instead, the project co-directors, teachers, mentors, and students all became quite good at soliciting feedback and using it for continuous improvement.

In contrast with Schein's user-centered framework, Havelock and Zlotolow (1997) focus on the role of the change facilitators as they move a system through six stages of planned change, beginning and ending with care and concern for all clients within both the local and larger community. As in Senge's (1990) view of systems theory, Havelock and Zlotolow note that the bigger the change, the bigger the forces acting against it. To counteract this, multiple channels of diffusion are needed, which can carry a shared vision throughout the entire community. This is exactly what was happening with the leadership of The WEB Project.

Engestrom's (1996) Activity Theory integrates the individual users, their intentional uses of the tools of technology, their desired outcomes, and the community of users with its norms, conventions, and social structure into a framework in which a change to any part of this system ripples through the entire system, affecting each and every component and user. In this vein, The WEB Project eliminated nearly all internal boundaries so that communication was seamless; staff and consultants could easily be accessed; and communication flowed regularly and smoothly. Participants collaborated, solved problems jointly, suggested solutions as appropriate, modeled exemplary behavior for their colleagues, and explored the root causes of problems and their contexts before suggesting a solution.

Table 1 presents the developmental stages of the teachers in the five stages of the newly revised learning/adoption trajectory, together with effective strategies for professional development.

Developmental Stage	Effective Strategies
Stage 1. Teacher as Learner. In this information-gathering stage, teachers learn the knowledge and skills necessary for performing instructional tasks using technology.	Time for training; demonstrations of promising practices; ongoing professional development by peers rather than one-shot workshops by outside experts; inservice sessions that stress the alignment of technology with curriculum and standards.
Stage 2. Teacher as Adopter. In this stage, teachers progress through stages of personal and task management concern as they experiment with the technology, begin to try it out in their classrooms, and share their experiences with their peers.	Online resources, helpdesks, and other forms of readily accessible technical support; mechanisms to deal with technical problems as they arise; in-building technical specialists; other technology-savvy teachers who can mentor new users and provide them with care and comfort as well as information; open lab workshops at school sites to solve specific technical problems.
Stage 3. Teacher as Co-Learner. In this stage, teachers focus on developing a clear relationship between technology and the curriculum, rather than concentrating on task management aspects.	Workshops and online resources with strategies for enhancing instruction and integrating technology into the curriculum; collegial sharing of standards integration; exemplary products and assessment ideas; use of students as informal technical assistants.
Stage 4. Teacher as Reaffirmer or Rejecter. In this stage, teachers develop a greater awareness of intermediate learning outcomes and begin to create new ways to observe and assess impact on student products and performances, and to disseminate exemplary student work to a larger audience.	Administrative support; an incentive system that is valued by adopting teachers; awareness of intermediate learning outcomes such as increased time on task, lower absenteeism, greater student engagement, and increased metacognitive skills; evidence of impact on student products and performances; dissemination of exemplary student work.
Stage 5. Teacher as Leader. In this stage, experienced teachers expand their roles to become action researchers who carefully observe their practice, collect data, share the improvements in practice with peers, and teach new members. Their skills become portable.	Incentives for co-teaching onsite workshops; release time and other semi-permanent role changes to allow peer coaching and outside consulting; support from an outside network of teacher-leaders; structured time for leading in-house discussions and workshops; transfer of skills if teacher goes to another school.

Table 1: Effective Strategies for the Five Stages in the Revised Learning/Adoption Trajectory

In The WEB Project, the various strategies listed above served as facilitators for the teachers as they became more familiar and comfortable with the use of technology for teaching and learning. The particular factors that facilitated adoption varied, depending upon the stage of implementation. For example, the types of professional development and support needs changed over time as teachers became more comfortable. Onsite support became less important than online support. Similarly, curriculum integration was difficult at first as teachers struggled to learn technical skills, but then became more important in making long term decisions about adoption.

Organizational factors also played key roles. Administrative support and availability of time to experiment and develop lessons or units and rubrics for assessment influenced adoption and integration, as did the sheer accessibility of equipment. Technology plans and support within the school and the larger community also served as significant facilitators.

Lessons Learned

It appears that the amount of each of the strategies listed in Table 1 influences student impact and project sustainability, as well. In general, technology planning tends to emphasize the strategies that are appropriate for the first two stages. However, as teachers mature into co-learners and reaffirmers, and as

their students begin to develop technological expertise as well, new strategies must be added to the traditional type of professional development afforded by schools and districts.

Site-based teams or online learning networks must have a coherent, consistent vision that forges a strong connection between technology training, curriculum integration, and student performance assessment. Additionally, there must be a visible and valued incentive system in place for the project to go to scale (Elmore 1996). Although it is not necessary for the principal to be a technology leader, it is essential that his/her support be visible, that it represent a mandate for professional development in instructional technology, and that it be backed up with resources and organizational arrangements to provide sufficient time for training, practice, and authentic assessment of student products and performances.

The most important lesson to remember is this: in large scale instructional technology programs, one must consider the total context of learning activities, including all people in the community (teachers, students, resident experts, administrators, and involved parents) who are using rapidly evolving technological tools to accomplish their intended purposes. It is through community participation, not simply through individual agency or perceptions, that the total identity of the system is shaped and sustained.

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Technology Infusion in A Chinese Middle School: A Comparative Perspective

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Abstract: The success of Chinese secondary schools in preparing students for academic excellence is often discussed by educators in the West. However, there has been little research or in-depth analysis of the Chinese comprehensive educational process and the continuous growth philosophy and strategy of its curriculum, teachers, and staff in the maintenance of students and the institution. In this study, the authors report their investigation of one of the leading secondary schools in China's most sophisticated city, Shanghai, in the daunting task of technology infusion. Major focuses of the study are: Models of professional development for teachers and how they enlist the help of their students. The authors believe that Chinese experience may have relevance for American schools. While China started well behind American schools in access to and use of information technology, it is impressive how rapidly it has been able to mobilize and train teachers to infuse technology.

Introduction

Learning about technology and learning to integrate it in meaningful ways into teaching and learning is a daunting task. What models of professional development really work to help

teachers with this challenge? How can teachers help themselves? How can teachers enlist the help of their students? In the United States, despite the recognized need for teachers to use and teach new technologies, a large percentage of teachers remain under prepared to exploit technology in classrooms ((Perischitte, Tharp, & Caffarella; 1999; ISTE, 1999). Reengineering pedagogy represents a profound paradigm shift that is well advanced in the U.S. economy and culture. While China started well behind American schools in access to and use of information technology, it is impressive how rapidly it has been able to mobilize and train teachers to infuse technology into the secondary education curriculum.

The success of Chinese secondary schools (called "middle schools" in china that cover grades 7-12) in preparing students for academic excellence for university and life beyond is often discussed by the educators in the west. But there has been little research or in-depth analysis of the Chinese comprehensive educational process, or the continuous growth philosophy and strategy of its curriculum, teachers, and staff in the maintenance of students and the institution. In this paper, the authors report their investigation of one of the leading middle schools in one of China's most sophisticated cities, Shanghai. The authors, three of whom are currently professors in U.S. universities and two are senior educators in Qibao Middle School, Shanghai, China, are the product of such "middle schools" in Shanghai in the mid 60s and 70s. Through this study, the authors suggest relevant experiences and examples for schools in the United States.

Qibao Middle School

QiBao Middle School in Shanghai was founded in 1947. According to the 1996-2000 QiBao Middle School Five-Year Development Plan, the school's aims were to become a national model for secondary schools through the implementation of a comprehensive curriculum. The goals of the school included producing well-rounded graduates and continuous professional and personal growth of its employees. The school strives to make a positive impact on the entire nation while serving Shanghai and the south region of China, promoting academic excellence, cultural interaction, and domestic and international diversity. There is an emphasis on continuous improvement and self-perfection. The school's leadership realizes that one of the important means by which these goals can be reached is through the effective use of modern education technology.

Technology Infrastructure

Qibao Middle School has developed its technology infrastructure, which includes a computer network for instruction and administration and an audio/video network for instruction only. Qibao's well-developed technology infrastructure has enabled comprehensive and interactive instruction with data formats in text, pictures, images, sound, and animation, using technologies from network, computer, VCD player, and multimedia projectors, and enhanced the quality of instructional management in Qibao.

Technology Competence and Training for Faculty and Staff

Unlike the American system, where the emphasis of technology training often focuses on students, in Chinese secondary schools, technology training is also mandated for teachers, staff, and the administrative personnel. In order to provide meaningful and relevant technology training, the School developed standards and set timelines for various constituents, with the focus on three groups: middle level administrators, clerical staff, and young and middle aged faculty (age 45 or below).

Middle Level Administrators include senior academic and administrative personnel (e.g., dean of academic affairs, dean for administrative affairs, bursar, etc.). Training activities for middle level administrators are designed to improve their ability to use information technology to optimize their leadership and management roles. Clerical Staff include secretaries and data entry personnel. Traditionally, secretaries are required to be proficient in typing Chinese. With today's computer technology, they must learn keyboarding and computer typing skills to type Chinese characters using a conventional English alphabet keyboard.

Young and Middle-Aged Faculty are teachers under the age of 45. Seventy-eight percent (78%) of Qibao's teachers fall into this group. They form the backbone for instruction. The objectives for this group's training are accomplished in two units. The first unit covers:

- basic knowledge and familiarity of Internet and Intranet;
- Internet information search and access;
- use of multimedia courseware on the Internet;
- software download from the Internet;
- familiarity with features of multimedia software;
- use of commercial multimedia software;
- use of Internet browsers and e-mail; and
- use of campus network to make comments and suggestions regarding and to the management of the school.

The second unit covers more advanced techniques, e.g., the design and development of multimedia courseware using PowerPoint and FangZhen Author, a multimedia authoring system in Chinese platform developed by Beijing University in China. It also covers the use of word processing and network safety and security issues.

The method of learning for this group is a combination of self-study and group training. The first unit takes thirty hours. Well-organized workshops are scheduled several times every term for teachers to go through the training. Everyone in this group is required to master the skills stipulated in the first unit. The second unit also takes thirty hours. At present time, two to three teachers who are more experienced in technology are selected from each program area to participate in the unit two training, which requires more advanced skills. Thus, a cross-discipline faculty group with more advanced technology skills is formed in the school. Members of the group can provide support to each other in the development of multimedia courseware.

Technology Expectations and Activities for Students

In addition to computer courses with graduated difficulty, teachers are designated to

direct after school programs for students to ensure the quality of technology infusion. The following are some examples.

Student Journalism Group. Former student groups in broadcasting, newspaper, and photography were combined to form the Student Journalism Group. This group combines computer technology with photography, video taping, interview, and broadcasting to report the school events and news from faculty, staff, and students.

Student Computer Club. This club has several groups: programming, multimedia, network, database, and maintenance. Members of the Student Computer Club are a leading force in the school's effort to apply modern educational technology. They participate in the development of multimedia courseware, providing faculty with technical mentoring and assistance, and relieve them from tedious data entry routines. Club members also contribute to the management of the campus networks which connect all classrooms and offices, assist the school in entering large amounts of data into its databases, and in the communication with outside agencies through the use of networks, e.g., information exchange, locate, access, and retrieve information.

The Multimedia Computer Lab opens to students twice a week during the day. Students can use their own multimedia software in the lab, or use school's multimedia software collection that covers almost all subject areas. The General Purpose Computer Lab also opens twice a week for students to study the use of computers. It is required of all students to take at least 80 hours of hands-on computer instruction each year, and to use computers at least one hour each week during their free time. The computer labs that use a simulated Internet environment is managed and operated by students. The labs that have direct connection to the Internet are open to all students during the noon hours and in the evening. There is no limitation for students to use labs and classrooms with direct Internet connection.

QiBao Research Association for Modern Educational Technology

The purpose of the Association is for teachers to learn advanced and effective modern educational technology and methodology. Some of Association's interests include: How to use modern educational technology to enhance the quality of education? How to increase the efficiency of instruction? How to provide quality education effectively? And What is the relationship between technology and education? Members of the Association believe that these questions and tasks should be studied along with the characteristics of QiBao's faculty and student body, the technology facility, specific instructional needs, and the focus of each academic program.

The Impact of Technology in QiBao

Modern information technology has played an important role in the realization of the school's goals for the new millennium. The strategy and its technology have empowered and inspired QiBao faculty and students in their daily exchange among themselves, with educational organizations, and others in and out of China. It has assisted teachers and parents in their communications. And most importantly, there have been positive changes in student learning both

qualitatively and quantitatively.

Multimedia Courseware Contests

In order to further promote teachers' use of modern educational technology in their instruction, and continue the exploration of innovative ideas to solve instructional problems, the school held several multimedia courseware contests to recognize the leaders in technology infusion. The criteria for contests focus on the pedagogical soundness of the courseware. Awards were given at ceremonies attended by faculty and students of the school, as well as the head of Shanghai Education Commission, chief of district education bureaus, and principals of key high schools.

Summary of Qibao's Practice

Developing state-of-the-art infrastructure and goals that are realistic and relevant to school's mission, providing systematic and organized training for all employees, involving students in implementing technology, focusing on curriculum infusion, using policy reinforcement, these practices communicate a clear message to everyone at Qibao that technology is important. Qibao now has a technology infused curriculum. A critical mass that is sufficient to sustain technology infusion has been formed. Most importantly, Qibao has reached its goal of becoming a national model of middle schools, producing well-rounded graduates and enabling continuous professional and personal growth of its employees. Qibao is ready for a new paradigm.

Conclusions

Some educators in the United States may unlikely think about learning technology infusion from China - or anywhere else. National cultures, traditions, and institutional characteristics heavily influence educational practices. But it is always useful to focus on best principles. If we understand why certain practices work and what distinguishes them fundamentally from other practices, we will be able to identify the underlying principles involved. That universal idea can then be transported and applied to local context.

It is a fact that both China and the United States are concerned about the quality of education, acknowledge the power of technology as a means for education reform, and both focus on developing faculty capacity for technology infusion. At Qibao, as in many other schools in China, technology is presented as a necessary tool to achieve the instructional goals established by the mission of the school, instead of a peripheral skill which may be well understood by those who implement technology and attend the computer labs, but little understood and sometimes resented by those who "have" to accept it as additional skills to be acquired.

Qibao places significant emphasis on training its teachers beyond the basic level of technology competence. Teachers are trained to develop software to use in their own teaching, and software development is across curriculum. This approach makes sense because such software programs are more likely to be applicable in teaching, and teachers are more likely to use

the material they have developed.

In the United States and China, there are significant differences in the policy formulation and administrative process. The obvious emphasis of the traditional "top-down" model of policy formulation in Qibao is in contrast with the clearly visible "bottom-up" influences found in most American educational systems. The authors believe that cultural change in institutions requires grass-root initiatives as well as policy reinforcement. Grass-root initiatives may provide the fertile soil for institutional change, but to sustain the change and provide a foundation for a paradigm shift, grass-root initiatives alone are not sufficient. Policy is required to define and reinforce a positive change.

At Qibao, training to master and use technology appear to be well-organized, contents are carefully planned, and training is provided to all school employees. Everyone is expected to support the comprehensive school mission. These directed undertakings have produced impressive outcomes. Organized training and utilization required of all employees, from top administrators to clerical staff, obviously helped reach the critical mass of technology users essential to a paradigm shift in QiBao.

To the American educational culture, it may seem an overwhelming demand to require the participation in training, passing of exams and timelines with promotion consequences. It is not hard to imagine resistance and some resentment from everyone: teachers, administrators, and clerical staff. But we don't have to look beyond the American experience to find examples of rigorous professional requirements. A number of professions in the United States have licensing examinations for initial entry and for continuous professional certification, e.g., medicine, engineering, accounting, etc. Why not education? Why not teachers?

The authors found that Qibao is very effective in enlisting help from students in technology infusion. Some American schools are doing the same, but more schools need to develop strategies to involve students in technology activities, and to foster an environment where learning in technology as well as in other subjects is a reciprocal process between teachers and students.

The authors believe that some of Qibao's experiences discussed in this study are unique to the China situation and may be advantageous only in that particular environment. It is likely, for example, that there are more restrictions on accessing and distributing Internet information. Yet, for quite different reasons, they may have relevance for American schools.

Note: Part of the same study has been accepted by T.H.E. Journal and will appear in the February 2000 issue.

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Modeled Lesson Plan Study and Demonstration on Using the Class Text as a Secondary Source

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Abstract: This paper addresses the use of technology resources in the classroom, placing the classroom text as a secondary resource for learning. The ideas are based on the reluctance of classroom teachers to let go of the text on a lesson to lesson context, as they attempt to integrate technology in their lesson plans. Teachers are provided with technology workshops and knowledge, but are not necessarily applying the learned knowledge in the classroom setting. The study concluded that teachers rely heavily on the class text for various reasons, including teacher classroom insecurities, accountability issues, and technological insecurities, availability, and assistance.

Introduction

Educators and particularly school administrators are perplexed by the amount of time, effort, training, and money spent on the integration of technology in the classroom, and the lack of integration resulting from these efforts. Administrators are under pressure from local, state, and federal policies and demands requesting technology-proficient graduates. These demands stem from local employers and state standard course of study objectives, to mandated goals from Congress. For example, the Improving America's Schools Act of 1994, reflected the nation's long-range plan for educational technology. The U.S. Secretary of Education stated the following goals for all students, teachers, and classrooms across America:

1. All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway.
2. All teachers and students will have modern multimedia computers in their classrooms.
3. Every classroom will be connected on the information superhighway.
4. Effective software and on-line learning resources will be an integral part of every school's curriculum. (Riley 1996)

In the attempt to respond to these goals and the current needs of students, local school systems have requested money and justified their budgets by spending funds on computer hardware, software, and teacher training and staff development (Office of Technology 1995). This study evolved from the perplexity of school leaders and administrators as they were convinced that technology goals had been met through the provision of hardware, software, and teacher training. Why were the classroom teachers still not integrating technology throughout their lessons and program of study? After all, research reports that teachers with more training with the many uses of the computer were more apt to integrate the curriculum across all areas of study through the use of the computer as a classroom tool (Becker 1992). Three conclusions were obtained through staff development discourse and teacher survey data. First, teachers expressed the need for the security found in textbooks, reflecting comfortable, traditional didactic activities, teaching methods and techniques. Ironically, both novice and veteran teachers responded to insecurities in the classroom environment. Second, teachers are under local, state, and national pressures regarding accountability expectations. Technology proficiency skills remain a threat to teachers who already have a full plate of duties and expectations on a daily basis. Third, teachers reported a lack of confidence in the

application process and use of technological hardware, along with the lack of personnel assistance and support.

The Study

The study originated from a formation of elementary and middle school teachers who had previous training in classroom technology proficiency. The purpose of the staff development and training was twofold in that it encompassed both additional technology integration and the exploration of reasons for the lack of technology in the classroom, following the previous training. Approximately thirty-five classroom teachers participated in the training. All of the participants had received prior training and involvement in the uses of the computer, proficiency in word processing and other programs, exposure to various software programs, and internet access and practice. Very few of the participants were actually using these skills in the classroom setting or in their planning process. "At the heart of a good technology education program is a teacher who displays enthusiasm for the content, the students, and the school. Unfortunately, the supply of energetic, creative, and people-oriented teachers is declining" (Seymour 1993, p. 15). Why were these enthusiastic teachers who care about the content, the students, and the school not becoming active enthusiasts in this particular arena, involving the integration of technology in the classroom environment? Even though the understanding existed that educational technology is defined as a tool that may vary from school to school and teacher to teacher (Dockterman 1998), and these teachers had the computer hardware, software, and training needed to succeed, they were not applying the technological knowledge in the classroom.

Various topics and training exercises were part of the study, including group discussions, hands-on application, and a modeled lesson plan demonstrating ways to integrate technology through a slide display, internet links, software programs, and the scanning of objectives, questions, and literature related to the intended science topic. The goal was to demonstrate ways in which technology can align itself with competency goals, lead to constructivist principles and away from simply teaching in familiar didactic methods, motivate students, integrate subjects across the spectrum, and place the class text as a secondary resource for learning.

Data was collected through time on task discourse and subsequent surveys. These same teachers are included in a follow-up training and mentoring process intended to enhance the growth and seamless transition of staff development technology skills to student/teacher classroom involvement, throughout this current school year.

Findings

An overwhelming response from teachers of all grade levels and subjects, including novice and veteran teachers, was the reluctance to place the textbook as a secondary source of material used in the classroom. Responses varied from the reliance on the authors' subject knowledge, to the security of holding a book and letting students read from the identical text before them. Research demonstrates that most novice and/or preservice teachers envision schooling and learning that is grounded in didactic instructional methods, entering on the efficient transfer of knowledge to students and the replication of basic skills (Duffy & Jonassen 1992). Veteran teachers tend to rely on traditional beliefs about schooling and are reluctant to engage in cognitive restructuring to create conceptual change, such as integrating technology in the classroom. "Conceptual change requires a high degree of engagement, considerable effort, and intellectual commitment on the part of the learner. Individuals who are interested in the topic, or have some stake in the outcome, will often be more willing to engage in conceptual change" (Niederhauser, Salem, & Fields 1999, p. 156). The majority of the participants were reluctant to adjust themselves and their strong, traditional teaching methodology to conceptual changes.

A second outcome reflected the fact that teachers experience daily stress and pressure from all areas, and additional knowledge and expectations, such as classroom technology, appears to be another conflicting duty and element added to a teacher's busy day. Emphasis on accountability issues, specifically state and federal competencies and end-of-grade testing creates daily stress, and these participants viewed

technology integration as something extra to have to teach and to evaluate, rather than as a vehicle to encourage and enhance the learning process.

The last component of the study reflected the need that teachers have regarding the readiness of trained personnel to assist the setup and working condition of equipment. Due to daily time conflicts and lack of technological knowledge, teachers were reluctant to attempt a new method in the classroom, unless they felt confident that all equipment was ready and working and support was available, if needed.

Conclusions

In order to address the first component regarding the reluctance of teachers to place the textbook as a secondary classroom resource, an understanding of conceptual change and the need for both didactic and constructivist teaching activities, requires a response, along with definitions. "Didactic instruction is grounded in the objectivist notion that reality exists independently of the individual and that the purpose of instructions is to transmit knowledge about that reality to students. An underlying assumption is that all students in the group will develop knowledge that is identical to the expert's knowledge and that of other learners in the group. Observable outcomes are the hallmark of evaluation" (Niederhauser, Salem, & Fields 1999, p. 160). The teachers involved in this study felt comfortable in the stable, strong environment of didactic teaching practices using a textbook to convey and support these teaching methods. "Constructivists challenge the objectivist assumption that knowledge can be directly transferred to individuals. Students and teachers work together in a community of learners to challenge and support each other through the learning process (Niederhauser, Salem, & Fields 1999, p. 162). Even though technology can be integrated in both didactic and constructivist activities, and teachers can determine how technology gets implemented in the classroom, learners tend to assume more responsibility for learning through the constructivist approach. The participants in this study conveyed a certain amount of uncertainty and lack of confidence in abandoning certain didactic activities. Through this process, conceptual change becomes a factor, as teachers adapt. According to Dole and Sinatra (1998), specific criteria has to exists to promote conceptual change including active and engaging participation, influencing factors from existing conceptions, learner motivation, and the promotion of change through social and contextual factors. Each of these elements was addressed in this study. Teachers were involved through active, engaging, hands-on activities and encouraged to return to the classroom for implementation of the technology learned. Through the modeled lesson plan, teachers were to compare existing conceptions with new constructivist views and methodology, as they hopefully experienced ways to enhance learning through technological integration. Learner motivation was approached through Bandura's (1980) perceptions on self-efficacy, or the impression one has of one's self. Motivation is an outcome of a good match between an individual's self-efficacy and one's capabilities, and in order to obtain this match, one has to learn to utilize subskills successfully. The teachers in this study were encouraged to feel good about their capabilities in the classroom, and to rely on technology through a constructivist approach. Last, social factors were addressed through the staff development process and if implemented, through the nature of a true constructivist classroom teaching approach.

The staff development for teachers in this study stressed the feasibility of aligning state and national curriculum goals with technology in the classroom. The demonstrated lesson plan began with the preplanning stage, involved in creating an effective lesson plan. Specific goals and objectives were stated and related directly to the technological plan. The desired goal was to demonstrate that teaching objectives, course related requirements, and end-of-grade test questions do not necessarily have to be taught via the textbook. A wide variety of sources are available to teachers, and many of these demonstrate and enhance student motivation, participation, individual student challenges, and effective teaching methods.

The last component involving lack of technology support and personnel is perhaps, an area that school administrators should view as a real employee need in our schools, unless we expect all teachers to also become experts in computer hardware capabilities. This idea does not seem practical or feasible. My opinion is that if we expect classroom teachers to grasp and implement new methods of teaching through changing their current viewpoints and long-standing methods, then they are entitled to receive and have available the support and personnel needed to follow through with these new approaches and changes.

The overall findings of this study were positive, as local administrators viewed the reasons for the reluctance to change and implement technology. The surveys indicated extremely high teacher responses

regarding the staff development itself. Interestingly, continued support, staff development, and follow through is in place, as further information is gathered on the outcomes and long-term effects of the teacher training and staff development.

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Supporting Technology in Elementary Classrooms: The Roles of Students

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Abstract: In this paper, the authors explore the roles students play in support of technology in elementary classrooms. The primary role of students in the classroom is not support, but teachers need to take advantage of every opportunity for support. Support takes many forms. The authors classify the ways in which students were found to support technology in the classroom, taking advantage of students' expertise to help the teacher and other students. In some cases, students' efforts provided positive benefits to the teacher and other students, and in other cases, the students' efforts caused more problems than they solved.

Introduction

Support for technology in schools comes from a variety of sources. One area that is often overlooked is the support that teachers get from their students. While students' primary purpose is not to give support to teachers, students do support teachers in a variety of ways that can be beneficial to the teachers, other students, and the students providing the support. Some of the support that students give is small help, such as answering a question for another student or the teacher, who is stuck in a program. However, students can give more extensive help when they are paired up with other students for the express purpose of helping them.

When the computer is used in a laboratory setting the teacher cannot be with every student, and when the computer is in the classroom as one activity among several (such as for science centers), the teacher cannot direct all the activities at the same time. Knowledgeable students can fill the gap in informal ways, such as answering questions as they arise, and in more formal ways, such as being assigned to teach other students.

While students helping other students can be useful to both the student being helped and the helper, it can be problematic as well. Students do not always know how to give adequate help to their peers. Sometimes the helper just wants to play with the computer, ignoring the needs of the other students, and sometimes the helper does the work himself while the one being helped just sits and watches. Students are always close at hand, but they are not always there to be helpers, and they do not always know how to help.

The case study presented in this paper looked at a public elementary school in the Midwest, focusing on three teachers for parts of two school years (all of the names in this paper are pseudonyms):

Sarah	a teacher who has been using computers in her classroom for a few years
Cindy	a teacher who has been using computers in her classroom for about a year
Jennifer	a teacher who has just started using computers in her classroom this year

While these three teachers do not cover the entire range of computer use in schools, this variation provided understanding of support from the perspectives of three teachers who seem to be at different places on Hall and Hord's (1987) levels of use and stages of concern scales. All three of the teachers taught both 3rd and 4th grades. Jennifer taught only 4th grade during the first school year of the study, and she taught only 3rd grade during the second school year of the study. Sarah and Cindy taught mixed 3rd/4th grade classes. Each of the three classrooms had one color Macintosh LC II or LC III computer, and all the computers were attached to the school's local area network, which is attached to the Internet.

Research Methodology: Ethnography, Case Study and Situated-Evaluation

This paper is based on a larger study which combined methods of ethnography, case study, and situated-evaluation (Marcovitz, 1996), incorporating interpretations of the experiences of the participants to build an understanding of what was observed and how it relates to support for innovation. In parts of two school years, the investigator spent several hours each week at an elementary school observing classes, talking informally to teachers, interviewing teachers, and attending school and district Technology Committee meetings. The study was an exploration of the culture of the school, how technology fit into that culture, and how various members of the school supported technology.

The qualitative methodology was shaped by situated-evaluation (Bruce, 1993). In situated-evaluation, innovations are viewed as part of existing situations. Instead of viewing the innovation, or support in the case of this study, as a separate entity, it is part of the existing social system.

> In reality, the innovation is but one small addition to a complex social system. Instead of seeing it as the primary instrument of change, it is better to see it as a tool that is incorporated into ongoing processes of change. (Bruce, 1993, p. 17)

Situated-evaluation is an important way to look at support because it helps us understand why support does not always meet its objectives. A situated-evaluation approach might find that the support was inadequate because the designers of the support did not account for the contexts and constraints of the situation, or it might bring about a better understanding of how the situation and the support interact to provide different, not necessarily better or worse, support than what was originally intended.

Research Procedures

In this ethnographic study, new models for support were developed by looking closely at support for technology and the use of technology in three 3rd and 4th grade classes. Most of the investigator's time was spent with these three classes and their teachers: Sarah, Jennifer, and Cindy. Data was collected from four sources: interviews of teachers, informal conversations, observations of classes, and observations of meetings.

Interviews provided the opportunity to discuss some of the issues in detail. Each of the main participants was interviewed at least twice to explore topics in depth. Informal conversations allowed the opportunity to discuss issues as they arose, keep informed about events, and maintain an ongoing relationship with the informants. These took place regularly throughout the study, often during recess or other class breaks. Observation of classes provided the opportunity to observe the teachers' issues and needs in action and observe students in their various roles, on average once per week. Other classes using the computer laboratory were also observed. Meetings on the school and district level gave the investigator the opportunity to observe teachers interacting with each other, discussing their needs, and in some cases, acting on their needs.

Detailed notes were taken during observations. These notes were expanded each day. Notes were analyzed and coded for emergent themes and patterns. The importance of various kinds of support—including student support, student teacher support (Marcovitz, in press a), and computer coordinators (Marcovitz, in press b)—emerged from this analysis, and this led to the categories of student support described below.

Categories of Student Support

The multiple observations of students giving support were analyzed, and the following categories emerged: playing; sharing; reading; small help; becoming expert; teaching; and other. Reading, small help, and teaching involve direct support from a student to either a student or a teacher. Sharing and becoming expert involve indirect support that students give. Playing includes times that the elementary students offered support in order to play.

Playing

Elementary students spend a lot of time playing, and many of them like to play on the computer. Often they offer help as an attempt to gain more time on the computer, not to help.

> After a couple of minutes, the [Macintosh] LCIII group quit, and Jason got onto the LCIII and started playing with the EcoExplorer. He played with the simulator trying to keep the plant alive for a couple of minutes. Then he went to the song composition section. He couldn't figure out how to make a song. He needed to drag the sounds from a menu on the left into his workspace on the right for them to be added to his composition. He was just clicking on them (not dragging them) so the sound would play, but it was not added to the composition.
>
> Frank came over and said, "Let's play the game." Jason still wanted to make a song. "How do you make a song?" Frank said, "I'll show you," and he took the mouse and said, "after we play the game." (Fieldnotes, Cindy's classroom, May 11, 1993)

The computer was new to many students, and it was an attractive toy. This was not discouraged because the games (such as EcoExplorer, MathBlaster, Where in the World Is Carmen Sandiego?, InnerBody Works, and The Incredible Machine) were selected for their presumed educational value. However, in the context of students helping students, playing could be problematic when one student was looking for help, and the helper was looking to play with the computer.

The computer also served as a great source of distraction to many students, such as Marcus:

> Marcus came over several times. He tried to help them with several things. Cindy [the teacher] called him away to do spelling, but he stayed by the computer to give them more advice. Cindy called him again, "Marcus, this is the third time." He went with her. But Cindy went back to her desk for a minute, and Marcus went back to the computer. (Fieldnotes, Cindy's classroom, February 28, 1994)

Marcus liked to avoid his other classwork by going over to the computer and trying to help others.

Sharing

Sometimes students offer support by sharing their experiences with the rest of the class. For example:

> Sarah [the teacher] had all the kids gather in a circle. She said that one of the kids (Ken) had run into some problems, and she wanted to talk about it and show what he did to solve the problem. He had created his stack, but he wasn't able to get a new card or a new stack or a new field. He described the problem, Sarah explained what he was saying. Sally (a volunteer with Sarah's after-school class) showed them how to get around the problem. (Fieldnotes, Sarah's after-school program, October 26, 1993)

One of Sarah's students had run into a problem that she thought others might encounter. After they solved the problem, Sarah had the student share the solution with the class. Whether it was the teacher, the volunteer, or the student who solved the problem was unclear, but the student was actively involved with presenting the solution.

This was part of Sarah's after-school class in which she worked with 3rd grade students on a HyperCard project. Overall, no one had a lot of experience with HyperCard so the class spent a lot of time exploring and learning about it. In this exploratory environment, sharing was important—including students sharing with each other and the teacher, and the teacher sharing with the students.

Reading

Many of the computer activities involved a great deal of reading. As 3rd and/or 4th grade teachers, Sarah, Cindy, and Jennifer had students at a variety of levels of reading, including some who had a great deal of trouble reading instructions on the computer.

> At 10:06 a.m., Sarah started talking to the class about Oregon Trail. She assigned partners to some of the slower readers. (Fieldnotes, Sarah's class at the university computer laboratory, September 23, 1993)

> Cindy said they were about ready to get started, and the kids started to head to the computers. She stopped them and was mildly upset. When they settled back into their seats, she reviewed how to get to the tutorial, and she assigned partners to some of the slower readers. (Fieldnotes, Cindy's class at the university computer laboratory, September 30, 1993)

In some situations, the teacher or another adult (volunteer, student teacher) helped some of the slower students with the reading, but this can be draining on the adults' time. As in these examples, some teachers have found that pairing slower readers with faster readers allows the adults to spend more time with other problems. These examples are from laboratory situations, but this kind of support can be very effective in the classroom as well. Often the teacher is working with a group of students and can not spend the time to work with a student on the computer.

Small Help

Small help refers to the small ways that students help other students or the teacher, usually by answering a question or showing how to do something on the computer. Students working on the computer will often get stuck with a problem. Other students are always around, some of whom know the solution to the problem.

> One student didn't know how to change the names in the party [in the game Oregon Trail]. The volunteer did not know either. The parent said, "She made it turn red. How did she do that?" A kid at the next computer showed them how to do it. (Fieldnotes, Nora's class at the university computer laboratory, September 28, 1993)

> One of the options for erasing [in KidPix] is the firecracker. Jennifer tried to show them this option, but she couldn't get it to work. She clicked on the eraser on the left, and then she clicked on the firecracker on the bottom, but nothing happened. She didn't realize that once she selected the firecracker tool, she had to click on the screen to get it to erase. One of the kids pointed this out to her, and she said "Oh, yeah", and then showed it to the rest of the class. (Fieldnotes, Jennifer's class at the university computer laboratory, October 20, 1993)

Often students become experts or at least knowledgeable helpers and can answer small questions. Although none were observed in these classes, many times students become technical experts, answering questions about configuring software and setting up equipment (matters beyond help with how to play an educational game). Students with expertise at all levels can be very helpful due to their proximity; they are very close to the situation where help is needed and, in some cases, even closer than the teacher.

Small help has its drawbacks as well. Elementary students are often more interested in playing than helping, and they might use offers of small help to get onto the computer. An additional drawback is that children are not trained as helpers or teachers, and when they are given the opportunity, they often give the answer or do the work for someone rather than giving hints or explaining how it should be done.

> Brad came over and said that he had won the game. He asked if they had. They said they were close. They asked him where the antidote was. He wouldn't tell them. He gave them hints. They tried again to find it and couldn't. Finally, Brad agreed to do it for them, and they let him sit down (at first they just wanted him to tell them). (Fieldnotes, Cindy's classroom, May 11, 1993)

> They were having a lot of trouble solving the first puzzle. They went to get help from Tim. Tim came over and did the puzzle for them. (Fieldnotes, Cindy's classroom, February 28, 1994)

Small help can be beneficial when the students answer simple questions and help others to get past roadblocks, but it can be a problem when they do the work for other students.

Becoming Expert

During the 1993-94 school year, Sarah worked with several students in an after-school program to train them how to use HyperCard. The students she trained were 3rd graders from her class and Cindy's class. The goal of the program was for these students to become proficient enough in HyperCard so they could train others the following year. The 3rd graders would be 4th graders the following year and still in the Sarah and Cindy's classes.

Sarah made an investment in her students and the use of HyperCard as an integral part of her curriculum. Many of the other types of support that students offered were almost "free" to the teachers, requiring little or no effort on their part beyond creating an environment in which students were free to help others. Having the students become experts required a significant investment in time on Sarah's part. Sarah had been inspired by other projects in her classroom and discussions with others about the effectiveness of HyperCard in her program. She lacked the expertise in HyperCard and a core of experts to help in her class. Sarah got connected with Sally, a university student, to help her for a short time, but she needed a continuing core of experts, which she created from her students.

Teaching

After becoming experts, students were enlisted to teach other students. HyperCard is a fairly complex program that requires a great deal of training, but other programs require a smaller amount of training, and students could easily learn the program and be used to train other students. Cindy did this with The Incredible Machine, a game that explores the construction of simple machines.

> I have a child in my room who bought it for home, and two of Sarah's children came in and trained two of mine, and then we went from there, 'cause she did it first. And then we matched up kids who now taught everybody in the class. We had a lot of collaboration and peer work (Cindy, interview, May 2, 1994)

As with small help, Cindy took advantage of the proximity of experts: her students. She might not have had the time to teach all her students how to use The Incredible Machine without the help of her students. Having a core of experts, at close proximity, to teach others is difficult without using students for support.

Other

The categories of student support listed above were the most prominent ones observed, but students helped in a variety of other less specific ways. Teachers got support from the ability of students to learn the technology on their own. This helped the teachers spend time on other things and not worry about the students learning the technology.

> She said she is not worried about support for Lego Logo. She said the kids are doing well and can mostly learn it themselves. Though she admitted that it might get complicated. (Fieldnotes, discussion with Sarah about Lego Logo, February 15, 1994)

Teachers got support by learning with the students.

> At 10:49 a.m., two boys (who I think had played before) started a full game [of SimAnt]. Cindy asked if she could sit with them. "You see, I'm learning along with you guys." (Fieldnotes, Cindy's class at the university computer laboratory, September 30, 1993)

In earlier categories, students gave support by answering questions (small help) and teaching other students. Teachers also got support from knowing that students who could answer questions were around, whether or not they actually did anything.

> At 10:20 a.m., she started talking about Oregon Trail. She asked how many had played before. Nine raised their hands. She said that they could ask the kids who had played before or [the student teacher] or herself for help. (Fieldnotes, Virginia's class at the university computer laboratory, October 7, 1993)

All of these other forms of support relied on the proximity of students, mostly to be where the teacher was not or could not be.

Discussion

In terms of support received by the teacher, the most significant categories of support are becoming expert, teaching, and other. These were most significant because the teachers were able to change their curricula in ways that might not have otherwise been possible.

In becoming expert, the teacher was relying on the proximity of a core of experts. The support was not added on later but was an integral part of the development of the curriculum.

Teaching was the logical step after becoming expert and part of the process of developing the curriculum. Student support was necessary to implement the teachers' ideas.

The other category was significant because it relied on the students to be helpers. The actual support given was not necessarily more than small help, but the reliance of the teacher on that help made it important.

The reading category can be critical to the students who have trouble reading. Without this kind of support, the teacher or other adults would have to spend more time with the poor readers. Otherwise, the issue of equity among students could become a major problem for the teacher. Allowing students to help each other with reading allows all students access to the computer.

Small help is the most common form of support. Except in the cases where the teacher relies upon it, this kind of support does not have a major impact on the classroom. It is helpful and, because it is so common, it appears to be the most significant, but the students giving this kind of support are often not credible helpers and not relevant to the needs of the teacher or the student being helped. Playing can be viewed as small help taken to the least relevant extreme, where one student is offering support merely for the opportunity to play.

The instances of sharing observed were not significant in and of themselves, but they helped to create an atmosphere that encouraged helping others.

Proximity is the key to student support in the classroom because students are always present. This is most significant when a core of experts is formed, always available to help.

Proximity and a feeling of credibility toward the student allow the teacher more flexibility to create student support to do what she feels is relevant (such as HyperCard in Sarah's class). The student support is relevant because it is created by the teacher to be relevant. When students have their own agendas (such as playing and wanting to do things for others), their support becomes less relevant and thus less supportive.

As teachers view students as credible supporters/experts, the support and the curriculum can be expanded in more than simple ways. Small help is useful, but Cindy's addition of The Incredible Machine was more useful and made possible by her relying on her students. Sarah took it one step further by relying on her students to help her implement a major addition to her curriculum with HyperCard.

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PROJECT THREAD: TECHNOLOGY HELPING RESTRUCTURE EDUCATIONAL ACCESS AND DELIVERY

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Abstract: This paper describes Project THREAD, an initiative funded by the U.S. Office of Education through its Preparing Tomorrow's Teachers to Use Technology grant program. The project's overarching goal is to build the capacity of individuals and institutional structures to support the infusion of technology throughout UNLV's teacher preparation program. This will be done through: (a) a series of inservice workshops for university faculty, administrators, field supervisors and mentor teachers; (b) one-on-one follow-up support provided by project staff and advanced undergraduate students; (c) a "mini-grant" program in collaboration with the UNLV's Teaching and Learning Center to support the development of technology-based modules for teacher education courses; and (d) expanded opportunities for students to apply technology in their courses and field experiences. Overall, Project THREAD seeks to implement a systematic planning model and move from "pockets" of technology integration toward widespread infusion throughout UNLV's teacher preparation program.

Introduction

Project THREAD (Technology: Helping Restructure Educational Access and Delivery) is based on the belief that for technology to truly impact education, it should be woven throughout the fabric of students' learning experiences--an integral part of the design. As thread connects the component parts of a garment or tapestry, so too can technology help connect learning experiences across assignments, classes, or subject areas. For this goal to be realized, however, teachers must be prepared to apply a range of learning technologies in a variety of ways. Clearly, the level of preparation required to do this goes well beyond what can be accomplished in an introductory educational technology course. Project THREAD, therefore, proposes to weave together a mixture of new and existing learning opportunities to prepare preservice teachers for tomorrow's technology-rich classrooms.

The consortium for this project includes the University of Nevada, Las Vegas (UNLV), and the Clark County School District (CCSD). In addition, it involves new collaboration among various entities at UNLV, the project's lead organization, and a continuing collaboration with a K-8 private school, St. Viator's. The consortium's overarching goal is to build the capacity of individuals and institutional structures to support the infusion of technology throughout the professional preparation of preservice teachers.

Need for the Project

Recent research studies indicate that teacher preparation programs are not adequately preparing graduates to teach with technology (Moursund & Bielefeldt, 1999; U. S. Congress, 1995; Willis & Mehlinger, 1996). Many impediments to technology integration in colleges of education have been cited including the lack of technology resources, time, professional development, and support. While our consortium members have attempted to address these obstacles, efforts thus far have led to "pockets" of progress rather than firmly entrenched systemic solutions. Project THREAD's goal, therefore, is to move from isolated "pockets" of technology integration toward widespread infusion in all aspects of our teacher preparation program. This, of course, will take time to put in place. As Fullan (1991) reminds us, "It takes a fortunate combination of the right factors--a critical mass" (p. 92) to institutionalize desired changes. While all of the initiatives proposed in this project are designed to be carried out within the one-year time frame of the grant, the interventions described mark beginning efforts in what we propose to "ramp up" and expand over the next several years.

Technology Use in the COE

A recent study by Falba, Strudler, & Boone (1999) documents the attitudes towards technology by UNLV COE faculty and their use of technology in teaching. Survey data suggest that although virtually all faculty believe that technology integration in teacher education is important, their use of technology in teaching is limited (see Figure 1). This finding refutes the belief some have held in the past that if faculty learn to use technology for their own professional productivity, they will eventually find ways to integrate technology into their teaching.

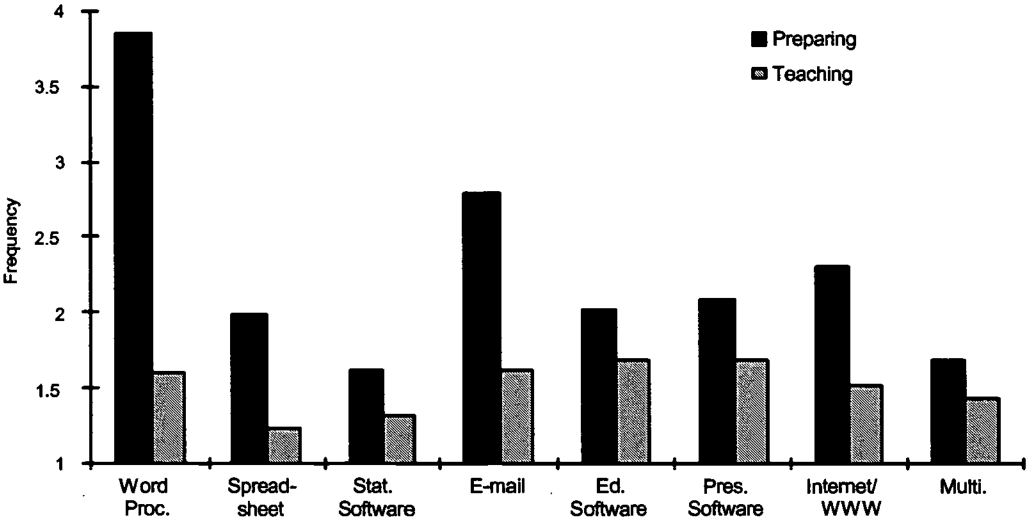

Figure 1. Means for Use of Technologies in Preparing for and in Teaching Class
Note: (1) Not at all, (2) Once during Semester, (3) Monthly, (4) Weekly

Despite the gap between COE faculty's use of technology for their own productivity and their integration of technology into their teaching, 66% of COE faculty rated technology in teacher education as very important and 27% rated it as somewhat important. Less than 7% of the faculty indicated that integrating technology was not too important and no one selected not at all important. Despite the availability of computer resources and the belief expressed by faculty that technology in teacher education is important, survey data reveal that more than half the faculty do not integrate technology in their teaching.

It is the goal of the project to address the "disconnect" between faculty's beliefs about technology and their actual use. Research confirms that this gap can be reduced through comprehensive planning, professional development, and follow-up support (Falba, Strudler, & Boone, 1999; Strudler, McKinney, & Jones, 1995). While efforts have been made to support faculty with workshops and some individual assistance, past attempts to

implement a systematic planning model for technology infusion were met with limited success (Falba, Strudler, & Boone, 1999). We concluded that to make progress in formulating a systematic plan, greater emphasis needs to be placed on helping faculty develop their vision for technology use in their particular subject areas. It was further concluded that the hesitancy of faculty to commit to technology integration could be overcome by continuing to expose them to compelling reasons, specific suggestions, and very importantly, ongoing access and support. To meet this identified need, this project includes increasing faculty's access to technology for teaching, an extensive professional development program, follow-up support, and a planning model designed to support the infusion of technology throughout the entire teacher education program.

Technology and First Year Teachers

A study of first year teachers in the CCSD confirms gaps in their preparation to use technology. Respondents to a recent survey reported positive attitudes concerning their required technology course as well as their views about integrating technology into P-12 education. They reported, however, that their program did not provide opportunities to use computers with students in their teaching. Only one fourth of beginning teachers were required to teach a minimum of one lesson using computers in their field experiences (Strudler, McKinney, Jones, & Quinn, 1999). This finding is consistent with the survey reported by Willis & Mehlinger (1996) which concluded that technology was barely considered in student teaching placements and only a minority of student teachers were required to teach with computers in student teaching. This project intends to address this need by various initiatives to integrate technology into students' field experiences. This will involve working with UNLV faculty, CCSD and St. Viator's mentor teachers, and field placement staff from all of the institutions.

Project Goals and Initiatives

A recent study of colleges of education deemed exemplary in their integration of technology (Strudler & Wetzel, in press) documented a range of student learning opportunities that lead to desired technology-related outcomes for preservice teachers. Typically, preparing teachers to use technology is accomplished in three interrelated components: educational technology courses, integration of technology into subject area methods courses and other university courses, and integration of technology into students' field experiences. Below is a description of how we propose to address these components, organized by the goals of the project.

Goal 1. To enhance the ability of university faculty and field supervisors to effectively model technology use and support preservice teachers in their use of technology.

Efforts to integrate technology into teacher education courses will consist of: (a) a large-scale program of professional development for COE faculty and university supervisors; (b) providing follow-up support for faculty seeking to integrate technology; and (c) implementing a mini-grant program that further supports the faculty's efforts to restructure a component of their courses with a technology-based module. A description of each of those components follows.

Professional Development

Consistent with research within our program as well as the larger body of literature, professional development is critical to achieve widespread technology integration. While data indicate that a large majority of faculty are competent in a variety of computer applications, steps need to be taken to help faculty find ways to integrate technology to enhance their classes. To accomplish this, a collaborative staff development program will be implemented by the Project THREAD staff and UNLV's newly created Teaching Learning Center. During the fall semester, a needs assessment was conducted to help identify topics that the faculty believe would best meet their needs. The following workshops, listed in order of preference, were identified by the faculty: web-based teaching using WebCT, creating web pages, educational software for particular curriculum areas, overview of COE technology resources, teaching with a mobile lab of notebook computers, and making presentations using Power Point.

University supervisors and adjunct instructors will be invited to participate in the sessions planned. A

minimum of five different sessions are planned; each offered at least two times. In addition, we anticipate offering additional workshops that address the needs of a small group of faculty.

Follow-up Support

Research indicates that follow-up support is critical to implement any major changes in one's teaching repertoire, whether at the K-12 or university level. COE faculty have confirmed that this is a major need that must be addressed for us to effectively infuse technology into our programs (Falba, Strudler, & Boone, 1999). While some resources have been allocated in the past to address this need, due to efforts to increase the quantity of teacher education graduates, adequate funding for technology support has not been forthcoming. Therefore, Project THREAD proposes to provide ample support in this one-year period to meet this need and enhance the capacity of the faculty. Both the Project Director and the Associate Director have been allocated one course released time per semester by UNLV's College of Education.

Other personnel for the project include a project coordinator, one half-time graduate assistant, and three undergraduate students assigned to work with UNLV faculty and at the Paradise Professional Development School. Overall, we view this concentrated effort to provide support as a much needed ingredient for the success of the project.

Mini-grant Program

An additional component of our faculty development efforts include a mini-grant program which provide an incentive for faculty to develop technology-based modules to enhance their current courses. Faculty will submit a proposal and specifically address which of the Foundation Standards established by the International Society for Technology in Education (ISTE, 1995) for beginning teachers that they intend to address. If funded, faculty will work during a two-week period when school is not in session during the summer. The Project THREAD Advisory Board, composed of UNLV personnel and representatives from CCSD and St. Viator's, will review the proposals and rank order them. Ten proposals will be funded for up to $1500 each—a $1000 stipend and up to $500 for equipment or software. Criteria for rating the proposal will be based on the quantity and quality of learning for the faculty involved in the project, and the degree to which the proposal meets specified ISTE standards and address gaps in the current COE programs. Gaps in the standards will be ascertained via the planning process describe below in Goal 2. To foster integration in coursework and throughout programs, faculty will also be encouraged to submit collaborative mini-grant proposals.

The newly created university Teaching and Learning Center (TLC) has agreed to partner with the COE to support this mini-grant program. The director of the TLC has committed that his staff will collaborate with the Project THREAD staff to support faculty with their mini-grants and other training needs.

Goal 2. To develop a COE/CCSD planning model for systematic integration of technology throughout the teacher education program.

To achieve this goal the project staff plans to get "buy in" from the faculty on a planning process and agree upon a set of standard for outcomes pertaining to preservice teachers' use of technology. We intend to begin with the ISTE standards, but may modify them based on faculty input. The proposed planning model would involve a detailed process (Strudler, Handler, & Falba, 1998) of assessing current levels of technology integration organized by the ISTE standards. Individual faculty's current use of technology would be compiled across the entire program and gaps in current uses (i.e., unmet standards) would be identified. Following, project staff would work with interested faculty to identify new technology applications that might fit into their current courses. Faculty would also be encouraged to work with others in their subject areas as well as with faculty across disciplines. The long term goal is to get faculty to commit to making specific applications of technology an integral part of all sections of particular classes. To accomplish this we plan to motivate "volunteers" through workshops, follow-up support, and the mini-grants and work towards establishing a critical mass of adopters over time. Our long-term goals is to achieve systemic change so that technology integration becomes part of the fabric of our programs.

Goal 3. To develop and test a coordinated field placement system for preservice teachers in partnership with CCSD.

This goal addresses the critical need of providing students opportunities to apply technology in their

practica .and student teaching. As the literature attests, this component of technology integration in teacher preparation is clearly the most lacking, and arguably, the most important. We recognize that to fully integrate technology into students' field experiences will take several years. It is our goal in this one-year period to get started with several approaches, that if successful, can be expanded in the coming years.

Based on effective practices in exemplary colleges of education (Strudler & Wetzel, in press), we are beginning to offer students the option to request student teaching placements with a technology-using teacher. UNLV Field Experience office has committed to collaborating with CCSD to make this option available, on a limited scale at first. The field experience office has adjusted its database to match interested students with CCSD mentor teachers who would like to integrate technology into the student teaching experience.

In addition, we are creating a new undergraduate course for students who have completed our required technology course. Based on the model from the University of Virginia (Strudler & Wetzel, in press), students will obtain skills in applying the WWW and multimedia authoring to K-12 classrooms during the first half of the semester. Then students will be paired with exemplary technology-using teachers from CCSD and St. Viator's School for a 7-week field experience. Finally, students will complete the semester back at UNLV to reflect on their experiences. When in the field, students will keep a reflective log of their experiences and will communicate with other students and the course instructor via a WebCT bulletin board set up for the class.

While we recognize that creating an additional educational technology class does not provide a long-term solution for technology integration, we feel that undergraduates who are ready for substantial field experiences should have that opportunity today. We agree with the recent ISTE/Milken report (Moursund & Bielefeldt, 1999) that supports the value of technology integration over educational technology classes, but while we are working to make progress in this area, we intend to work with motivated undergraduates to begin implementing a technology-based field component today.

An additional way to advance the integration of technology into field experiences is to work with partner schools in established cohort programs. We plan to do this with the Urban Teaching Partnership (UTP) program and the Paradise Professional Development School , both of which are joint UNLV/CCSD projects that have expressed interest in furthering the infusion of technology in their respective programs. It is hoped that successful integration of technology in these two alternative program will serve as a model for other collaborative, field-based ventures.

Goal 4. To expand access to technology resources in College of Education courses.

Access to technology resources is another key factor that supports faculty integration efforts. While we currently have three multimedia carts for check out, faculty have reported that these resources are not adequate to meet the expanding demand for using this equipment. Furthermore, we would like to provide opportunities for faculty and students to go beyond the presentation mode to actually integrating class sets of computers. To do this, we are planning to acquire a portable lab consisting of 10 laptop computers that are housed in a convenient cart (that holds up to 16 computers). The cart includes a mechanism to recharge the laptops when they are placed in the shelves that are provided.

Another approach to increasing access to technology resources will be through the development of a web-based version of our introductory course in educational technology. The Department of Distance Education has supported this goal and committed to fund the development of the course in Fall 99. As an urban university supporting an ever increasing population of working adults, the option will be a welcome addition to our offerings.

A final attempt to increase access to technology resources involves our collaboration with UNLV's Curriculum Materials Lab (CML). Its director has committed to purchase CD-ROM materials for review in the CML and for check out by students. This access will allow students to use educational software from UNLV in their field experiences. Currently, no system is in place at UNLV that provides this opportunity.

Resources

The COE has two instructional computer labs with a total of 50 computers--one Mac lab, one PC lab, each with projection units. In addition there is a open computer lab for students to use with 20 Macs, three multimedia carts, two notebook computers, and a portable projector available for faculty to use on a sign out basis. Additionally, the Bennett Professional Development Building is expected to be completed by January, 2000. This building will contain a state-of-the-art laboratory for use by students at the Paradise Professional Development School as well as UNLV students and faculty.

Project Evaluation

Evaluation has been a careful consideration throughout the development of this proposal. The evaluation will have both formative and summative components. The formative element will focus upon the processes used in implementing the project and will generate feedback to the program that will help to ensure that any barriers to effectiveness are identified so that they can be removed. The summative component is the most critical element in the evaluation and will focus upon the results of the grant activities. In both components of the study, quantitative and qualitative measures will be employed.

Preliminary Results

By the deadline for submission of this paper, grant activities were just getting underway. Requests for field placements with technology-using mentor teachers were compiled. Of the 332 students who received this option, 97 (29.2%) requested placements with technology-using teachers. Additional results of project activities will be reported at the SITE 2000 Conference.

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Effective Means of Integrating Technology into the School of Education

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Abstract: Technology integration in teacher preparation is indispensable. Various efforts and approaches were taken in the past two decades; however, the results were not satisfactory. This paper addresses many obstacles that challenge the reform effort. To overcome obstacles and maximize the efforts of technology integration, this paper presents a new working plan to address various issues and different aspects of technology integration. The plan can be highlighted by students leading technology efforts and technology course development.

In search of a working plan

Although educational technology has been around for more than two decades, the results of technology integration in the schools are far from satisfactory. Many people accuse the higher education teacher preparation institutions for not doing a good job to adequately prepare teachers to use technology in teaching and learning. In fact, various approaches were taken to integrate technology in many teacher preparation programs (Brehm, et al., 1997; Handler & Strudler, 1997; Kahn, 1997). When higher education teacher preparation institutions strove to infuse technology in the degree programs, many efforts were seriously challenged by some undesirable obstacles, including, (a) insufficient funds to support the needs and resources for the integration of technology, (b) teacher education faculty being out of touch with the reality in the public schools, (c) inadequate staff development and time allocation to support the use of emerging technology in teacher education courses, (d) strong resistance from some faculty members who do not buy into technology or who are reluctant to participate, and (e) inadequate plans excluding preservice or inservice teachers, students, and local community.

Sheingold (1991) stated, "The successful transformation of student learning in the nineties will require the bringing together of three agenda of reform: an emerging consensus about learning and teaching, a movement toward well-integrated uses of technology, and the push for restructuring. Each agenda alone presents possibilities for a very powerful redesign of education. Yet none has realized -- or is likely to realize --its full potential in the absence of the other two." A well-designed restructuring plan, supported with the three agenda of reform, becomes indispensable to address the concerns mentioned above.

At the School of Education at the College of New Jersey, based on the guidelines of a developed conceptual framework, an initiative was taken to develop a working plan to restructure the teacher education programs with computer technology integration. First we examined the reality about the current practice in the schools as well as what has been

going on in teacher preparation institutions. We then examined the traditional restructure plan that focuses on faculty development and identified factors that hindered successful technology implementation. A revised plan, centered on the well-conceived conceptual framework, was established. This revised plan, intended to minimize the faculty's resistance to integrating computers and to help include all that are concerned, shifts the focus from the faculty to students. A group of student experts of educational technology, after they received sufficient training, became the task force and took leadership in this effort. To address the needs of use and to get everyone involved in the restructuring process, this working plan can be characterized by (a) the honor students-based peer mentoring and support system; (b) cooperation and collaboration between the students, faculty, information management team, school teachers, community, and industry; and (c) computer course revision. This paper discusses procedures of implementation for various stages and address other related issues.

Reality check

The Office of Technology Assessment [OTA, 1995] reports that the number of school computers has been significantly increased and the ratio between computers and students has been positively improved. However, computer use in the school has not been adequately implemented. Teachers are not yet ready to use technology in their teaching. Neither are many university professors ready to implement technology. In reality, computer technology integration universally faces a series of challenges. The following are a few examples. Dias (1999) pointed out that the most common barriers to technology integration include time, training, resources, and support. Also according to Dias (1999), most teachers or teacher educators do not know how to integrate technology into curriculum. Zehr (1999) indicated that educators have a lot of digital content to choose from, but much less is worth using in the classroom. To decide where we are going, we need to know exactly where we are and a survey of reality is essential to our effort.

- *Technology needs for the teacher educators.*

From a recent faculty survey, we learned that most teacher education faculty members agreed to the importance of computer technology in teacher education as well as technology integration in the curricula. However, we also learned that most faculty members were in need of help with their own technology needs. Some of them requested assistance in catching up with the emerging technology, others demanded good specific examples of practice in computer integration in curricula.

- *Inservice and preservice teachers' technological skills.*

In a recent computer literacy survey of preservice and inservice students in a required Microcomputer for Educators course, we found almost all students have access to computers. Their primary computer experiences are mainly surfing the Web, sending e-mail, and typing papers for term reports. Taking a further look at their technological skills, we were surprised to know that most students do not possess adequate skills or knowledge about the current computer applications for curriculum integration.

- *Observation of the technology implementation in student teaching.*

Clinical experience is a clear indicator to show how technology is integrated into curricula as well as how public schools have been affected by the teacher preparation programs. With many visits to the classrooms where our student teachers were gaining their first-hand classroom experience, we were surprised to see only minimum of computer integration in the curricula. Oftentimes, students were sent to the computer lab with the computer coordinators. The computer tasks they were learning were mostly irrelevant to the learning contents covered in the classroom. In addition, teachers were absent in this exercise. With the tight schedule and many prearranged activities, as well as many other obstacles, our student teachers did not get many opportunities to use computers.

Vision statements

To develop a consensus of the directions in which we should move and to provide a clear picture of what goals we want to be at the end of the restructuring effort, the following vision statements promote the intended outcomes of the effort.

- All students should possess basic computer literacy skills before they start taking regular computer courses.
- All faculty members are equipped with needed computer resources and skills in developing an exemplary practice of integrating computers into their own curricula.
- Students are learning in a technology-rich environment and will naturally be able to integrate computers into their future teaching and learning.
- Our student teachers are able to make an impact in the school where they are receiving their clinical experience. They will become proud of what technological skills they have and the kinds of services they provide.
- The School of Education at The College of New Jersey will be able to take leadership in providing services to the global community by extending our computer integration efforts throughout various projects, cooperations, and collaborations with the local community and national or international partners.

Initiatives

To attain the goals of the technology integration, a plan with proactive efforts was made containing the following four initiatives.

a. Computer course restructuring. The first initiative is to improve the technological skills of the teacher education faculty and students. This initiative involves the acquisition of technological resources and development of computer literacy skills in which students may explore the integration of technology into instruction. All teacher education students must demonstrate competence in the design, development, selection, utilization, management, and evaluation of processes and resources for learning. Teacher education students must also be able to seamlessly integrate technology as a tool for enhancing the teaching/learning process. To attain these goals, a series of computer courses is offered to ensure students' basic computer literacy skills and the continuity of

applications of computer skills in future teaching and learning. Courses are revised to address students' needs as well as to meet the NCATE standards. A computer literacy test will be administered to demand that all students start their teacher education program with necessary computer literacy skills. A general computer literacy course where students can acquire all needed computer skills to become productive and efficient will be required. Further on, some extensive computer courses will be offered to address the issues of technology integration in content teaching throughout the junior professional experiences and student teaching. These courses are designed and conducted with various devices to help students accomplish the most in the learning components (Pan, 1999). At the end of the teacher preparation program, an electronic portfolio assessment is recommended for all students in the School of Education.

b. Student leaders/educational computing experts. This initiative is to create a technology-rich environment by providing needed technological resources and technical support to users. The College of New Jersey campus has more than 20 computer labs for various purposes. More than 75 percent of new students come to campus with their own computers. The campus network has reached every classroom and dormitory. To take advantage of the existing resources and to maximize the power of computers for integration, this initiative aims at producing computer experts all over the campus. The campus Information Management team, who used to provide assistance and services to faculty members, will join the force to help train the students as well. Students, who are proficient in computer skills, will be identified and assigned to provide leadership and services to others. These students will be offered scholarships or assistantships while they are studying and working as honored consultants. The leading technology experts will be assigned all over the campus, helping the faculty and other students teach, learn, and solve problems.

c. Extend computer technology into lifelong teaching and learning. This initiative aims at getting all faculty members and students involved. Faculty members are invited to work on technology-based projects with students. As many faculty members indicated in the survey, they are interested in working on technology-related projects as well as in integrating technology into their curricula. Many faculty members also candidly expressed their concerns about low computer skills. They hoped to see some examples of successful integration of technology, and they definitely needed help with their technology work. In reality, integrating computer technology may mean different things to different people. Taking students to the computer lab once a week for 40 minutes is not necessarily integration. Morton (1996) suggested that technology is integrated when it is used to support and extend curriculum objectives and to engage students in meaningful learning. Technology should not be treated as a separate skill, instead, technology should be an integral part of life in teaching, learning, and problem-solving.

d. Computing for a global community. This initiative intends to extend leadership and provide services to the global community by extending computer integration efforts throughout various projects, cooperations, and collaborations with the local community and national or international partners. To extend the influence of the technology reform to the public schools, we ought to send the best student teachers to work with cooperating

teachers. The school teachers stay informed of the best practices and in turn make modifications in their own teaching and restructure their own curricula. We also need to extend efforts in seeking external funding and grant opportunities, with which we will be able to keep up with the newest development of technology and develop a close tie with outside businesses and industry who may also have input about the future trend of educational development.

Expected outcomes of the initiatives

Goal 1: reaching consensus among faculty members regarding college technology reform
Goal 2: restructuring course work
Goal 3: identifying student experts and assigning student leaders to work with the faculty
Goal 4: getting the faculty interested and involved
Goal 5: engaging collaborative projects between the faculty, students, and other classes
Goal 6: writing grants for extended services
Goal 7: reaching out to community, schools, and local business

Issues

- *Design computer courses to help students accomplish better.*

Some universities require students to take a basic computer literacy course where they learn about different applications, create web pages, make presentations, and generate multimedia materials for instructional needs. Levin and Buell (1999) pointed out some potential problems in this approach. The course may become a one-time course that fulfills a degree requirement and has no relevancy to other courses. Students may postpone the course until the end of their certification program, or they may quickly forget how to use technology because there is no continuity in their learning. An alternative approach is to integrate technology into each course without a prior computer foundation course (Levin & Buell, 1999; Waugh; 1998; & Zola & Armbruster, 1995).

Simply requiring professors to integrate technology into their curricula or assigning technology-based tasks will present problems. Most students do not possess needed technological skills to do the tasks, so they either will require the professor to teach them or they will have to spend extra time learning on their own. In either case, the focus of the learning contents has shifted to more learning about technology, and the class may become inefficient. For example, a professor asks his or her students to produce a web page for their final project. Students who have no knowledge of or experience with web page construction will be puzzled and frustrated. This is likely to result in more complaints from students and incur faculty resistance.

To provide a better solution to the problem, we believe computer literacy skills for students are essential to the success of technology advancement and integration in teaching and learning. Basic computer courses are important to attain this goal; however,

it is also important to develop a plan to extend computer skills to other areas of course work, term projects, and various kinds of collaborations.

- *Focus more on students rather than the faculty.*

In examining why many higher education technology plans didn't work, we could easily pinpoint resistance from the faculty. Integrating technology requires tremendous amount of time and effort from individual faculty; however, there are not enough incentives to motivate every faculty member to participate in such a practice. In addition, there is inadequate technological support and training and meager resources. To infuse technology in curricula, we must get faculty members involved. To break the isolation and resistance from faculty members, we shifted the focus from the faculty to students. We invited faculty members to work on technological tasks with students or to assign technological tasks to students. For example, a group of students from the computer literacy class were assigned to work with faculty members to design and develop the faculty's personal and class Web pages. Many faculty members became excited about this project. They became involved and gradually became aware of the procedures of setting up their own Web pages. Eventually these faculty members realized the convenience and importance of their Web pages and integrate the Web into their work and teaching. Other faculty members accidentally found out that their students were making presentations with ClarisWorks and PowerPoint programs in the computer literacy classes and were impressed by the quality of the results. They started asking students to make electronic presentations as a course requirement.

When the focus was placed on students, the resistance from the faculty will be minimized. Students can work with faculty members for various projects and challenges. They can learn quickly about technology as a tool and apply their computer skills in the other content learning. In a simple manner, faculty members can easily assign technology-related tasks. Faculty do not need to have high technology expertise to know every aspect of computing, but students are expected to perform with the best effort using skills and knowledge they have acquired from what computer experience they had from previous basic computer literacy courses. Most faculty members will find technology integration a good move instead of a burden.

Summary

In recent years, there has been growing recognition of the need to restructure teacher preparation programs to support efforts of improving education, among which technology integration into curriculum is one of the most important. To successfully integrate technology into curricula and to develop exemplary practice for public education, we will have to face many challenges. This paper discussed various issues that challenge the technology restructuring efforts and described a working plan to minimize the resistance and maximize faculty performance and student accomplishment.

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Evolution and Innovation: Integrating Technology in a New Teacher Certification Program

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Abstract: How could/should technology be integrated into a certification program so as to enhance students' learning about both content (subject areas and technology) and the process of teaching? From the outset, the technology component was designed as an integrated learning experience woven into and throughout our program. In one innovative project, pre-service teachers created a "Virtual Geometry in the World" book that involved learning web-based skills while exploring geometry and how to use technology in service of the teaching/learning process. However, just as technology itself continues to evolve and change, so does the technology component within our program. Contributing to our success is an on-going collaborative effort involving faculty and support staff members.

How could/should technology be integrated into a certification program so as to enhance students' learning about both content (subject areas and technology) and the process of teaching? Now in our fourth year of operation, our K-8 teacher certification program continues to rapidly evolve as new ideas and knowledge emerge, faculty and staff change, and resources shift. Even with the transformations, our program remains distinctive due to how technology is integrated into the overall program, the emphasis on using technology wisely rather than focusing only on skills, and the collaborative teaching involving faculty and support staff members. This presentation has three parts: first, a brief rationale and description of rapid programmatic changes; second, an innovative illustration of integrating technology, math, and pedagogy; and third, challenges and opportunities regarding the integration of technology in a teacher certification program.

The Context: A Dynamic Teacher Certification Program

Established ten years ago, our new campus is part of a Research I university and mostly serves place-bound, time-bound adults in a growing suburban area. In our fourth year, the certification program utilizes a one-year post-baccalaureate cohort model with approximately 25-30 students. The students are in their early twenties to second- or third-career seekers in their fifties; the average age ranges between 30-40 years old. Few are students of color; fifteen percent or less are males.

Computer technology, both as a means of communication and a tool for teaching, was identified early on as an integrated and important aspect of the program. From the outset, we did not want technology as a separate, decontextualized course. Integrating computer technology into the classroom calls for teachers to reconceptualize and reorganize their teaching and classroom management (Newsom 1996; Sandholtz, Ringstaff & Dwyer 1997). We knew that educators at *all* levels need time and resources to rethink 1) instruction that includes technology in the service of learning; 2) time and work allocations; 3) how to organize students, especially when limited resources are available; 4) how to manage multiple levels of computer ability; and 5) their own level of knowledge and comfort in using technology.

During the first year, implementing a totally new program captured most of our attention. Computer technology, while introduced through the use of e-mail and accessing web sites, was not a focal point. In the second year, a three quarter, one-credit per quarter integrated technology course was designed to support assignments within the various content courses.

Our third year was a transition year as a new faculty member brought changes to our program. Now in our fourth year, the three quarter, one-credit course is a one quarter, two-credit course taught the first quarter; however, technology is now explicitly integrated in the foundations courses and the math course. One

innovative experience using the web to integrate technology, math, and pedagogy is described in the following section.

An Illustration: Integrating Technology, Math, and Pedagogy

Teaching a course called Knowing, Teaching, and Assessing in Mathematics challenged me to encompass technology both as a way of enhancing mathematics as well as exploring how to use technology in service of teaching and learning. One project in particular documents the preservice teachers' growing appreciation and understanding of the inherent usefulness, power, and beauty of mathematics made possible through computer technology.

While reviewing books for possible purchase for our new curriculum library, I found *Shapes, Shapes, Shapes* (Hoban, 1986) which is a wordless collection of strikingly photographed objects emphasizing geometric shapes. The book inspired me to create an assignment of "publishing" a Virtual Geometry in the World book. Students took photographs, scanned them onto disks, sorted the photos into categories that became chapters, and created a web page for each chapter. As webmaster, I created a central web site with a table of contents that linked all the chapters as well as added another chapter.

The Virtual Geometry in the World book premiered the ninth week of the quarter with six chapters. After opening every frame within a frame, students gathered in their chapter groups to address three questions:

What did you learn by doing this?

How can this virtual book be used in your classroom?

If you were to do it again, especially for your own students, what would you be sure to do?

Their responses included learning about technology, math, curriculum in general, and social or personal aspects of working together. Using the virtual book idea, the preservice teachers identified thirteen math-related classroom extensions as well as five other curricular areas and four technology-related possibilities. When anticipating how to use the virtual book with their own students, responses included seven curricular activities and four technology issues. They also identified discrepancies in access to technology in their various schools and districts for their field placements.

Using technology, the preservice teachers experienced and captured content and processes in ways that even a few years ago were impossible. While implementing this learning experience, I confronted issues of access, expanded my own knowledge and skills, considered possible copyright infringement, and reconceptualized the teaching/learning process in my own course.

Considerations: Challenges and Opportunities

In identifying what we have learned about technology and how to integrate it, several considerations emerge around two areas: first, suggestions from our endeavors and accomplishments, and second, remaining opportunities.

The students in our program enter with skills ranging from not knowing how to turn on a computer to professional web masters. While still evolving, we developed some options for those with more advanced technology skills. However, upon completing the program, *all* of our students have a basic operating knowledge of computer skills and have experienced computer technology as part of integrated learning experiences.

Rather than an isolated and decontextualized course, the technology component of the program is closely linked with other courses. Through discussions and working closely with the university's support services staff members, our program continues to evolve and strengthen the opportunities for our preservice teachers to have quality teaching/learning experiences. One key to the success of our program is drawing on the strengths of faculty and support staff members, especially through collaborative teaching.

How technology *could* be integrated in a teacher certification program suggests institutional implications in terms of hardware, software, human resources, and the intersection of hands-on skills and knowledge necessary to actually teach a group of students. How technology *should* be integrated reflects value judgments and considerations regarding pedagogical, philosophical, ethical, and moral issues about the role of both the teacher and technology in classrooms at all levels and society at large. Just as K-12 teachers are challenged to wisely incorporate technology into their classrooms, teacher educators are faced with rethinking

instructional practices, having the support systems and necessary resources available, and discerning uses of technology.

Although challenged by the widely varying resources of the surrounding schools and districts, we need to include more opportunities for our preservice teachers to explore how and when (and when *not*) to incorporate technology in classrooms in service of the teaching/learning process. Also, more consideration needs to be given to issues of access ranging from who uses computers for what purposes to the differentiated availability even within schools.

Our program continues to evolve as does the technology component within it. The change process is definitely a journey rather than a blueprint with multiple players as change agents (Fullan, 1993).

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Living with Technology Diffusion Confusion

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Abstract: This paper is a report on the implementation of a project to diffuse technology throughout a teacher education program in elementary education. Rather than relying upon a single technology course in a pre-service program, students develop technology skills in a variety of courses in the education sequence and through collaborative projects. Several ongoing projects are described that include the development of discipline specific technology courses, collaborative projects involving students and faculty and technology projects in elementary education content courses.

Background

Pre-service teachers often view technology as an important, but isolated skill. In addition, they are unsure about how or when to integrate technology into the curriculum. Often the model used in pre-service programs reinforces this problem. Their primary experience with technology occurs in a stand-alone course that focuses on computer skills and they do not systematically experience technology as a tool in content area courses or during field experiences.

The teacher education program at Millersville University is committed to the goal of providing pre-service teachers with a broad range of meaningful experiences using technology for teaching and learning. A Link-to-Learn grant from the state of Pennsylvania has provided the resources for the development and implementation of a new model designed to meaningfully diffuse use of technology throughout the program. This model is currently being implemented in the elementary education program.

A Model for Diffusing Technology across the Curriculum

The model includes three parts: (1) faculty from a variety of departments integrating technology projects as a component of their courses, (2) the development of a technology course designed specifically for elementary education teachers, and (3) a series of collaborative projects and relationships involving students and faculty from both content courses and the technology course.

The overall effect of this plan is to diffuse technology education throughout the elementary education program rather than relegate it to a specific technology course. Pre-service teachers experience technology as a tool with specific content area applications. This model also allows the emphasis of the technology course to shift from just developing basic computer skills to emphasizing pedagogical issues that focus upon the implementation of technology into the curriculum.

Scope of Curriculum Integration

The first part of the model involves integrating technology across the curriculum. Nineteen faculty participated in the project and each received a stipend to develop a technology project that supports their

curriculum. The faculty represents a wide range of disciplines and all teach required courses in the elementary program. The departments involved in the project include math, special education, biology, art, music, library science, elementary education and secondary education. It is estimated that by the completion of their degree, the average elementary education student will take from 6 to 9 courses from faculty directly participating in this project. While the majority of faculty used the summer to develop projects for implementation for the fall 1999 semester, the rest will begin implementation during winter the spring sessions. Faculty participating in the project received one-to-one assistance to develop and implement technology projects that support curriculum in courses for elementary education majors. The project covers a full two semesters, which allows for the opportunity of continual technology support and collaboration in regards to pedagogical issues.

Discipline Specific Technology Course for Elementary Education

The second part of the model involves development of discipline specific technology courses. The required technology course for education majors has undergone a radical change. In its place is a set of technology courses designed for specific disciplines. Special education, music education, art education and elementary education have technology courses designed to meet the needs of the teachers in those areas. In addition, secondary social studies, English, math, science and foreign language students are placed in individual technology courses that correspond to the methods course in a junior block. There are several purposes for this change: 1) Since the inception of the required technology course for education majors some 14 years ago, technology has undergone a tremendous change resulting in a proliferation of discipline specific products. The student makeup of the previous generic technology course included a mix of both elementary and secondary students from different disciplines making it extremely difficult or impossible to adequately cover discipline specific software; 2) The focus of the technology courses is shifting from technological skills to pedagogical skills for integrating technology. Issues facing elementary education majors are different from those facing secondary education majors. Elementary education majors must consider developmentally appropriate uses of technology and need to learn to integrate technology across the curriculum. Elementary education majors also need strategies for supporting young students in the use of technology; and 3) An instructional technology course consisting exclusively of discipline specific education majors provides opportunities for collaborations with other populations of pre-service teachers.

Collaborative Projects involving Pre-service Teachers and Faculty

The third part of the model focuses upon collaborative projects involving students and faculty from more than one course. During the fall semester of 1999, two collaborative projects involving students and faculty from several sections of the third year elementary education technology course and a first year introductory elementary education course were implemented. One project involved third year students mentoring first year students, and in the other, first year students were required to evaluate technology projects produced by third year students.

The mentoring project involved about 50 third year students in the technology course and approximately 100 first year students from Introduction to Elementary Education, the first education course in the elementary education sequence. First, students in the third year technology course learned internet and web editing skills by developing a K-6 topics web page with text, graphics and links and uploading it to a server. With these newly learned skills, the peer mentors then taught freshmen students the basic technology skills required for completing an assignment which involved developing a web page and uploading it to a server. The mentoring took place over a 5-week time frame and the third year students were responsible for scheduling instruction and developing strategies for helping their peers.

The outcomes expressed by the third year students were very positive. In reviewing student reflections about the project, many cited a feeling of accomplishment, developing confidence in their abilities to teach, and that they were doing something useful. Comments about being flexible and realizing the importance of having a plan were recurring themes. Some unexpected or peripheral outcomes included discussions between first and third year students about the education major and college experiences in general.

First year students also responded positively to the experience and viewed it as a great confidence builder. A recurring theme was they were surprised about how easy it was and the simplicity of the process. Many had wondered how web pages were created and the assignment answered those questions. A few students went beyond the assignment by eliciting information from their mentors about the education program and describing the experience as an opportunity to talk with upper classmen in the education program.

Some of the frustrations experienced were technical problems in uploading the files to the server. Most often cited were error factors involving user names, passwords, and incorrect input of file locations during uploading. Other frustrations involved the inability of some students in keeping scheduled meetings or in contacting peers. Students suggested that part of this could be resolved by distributing phone numbers and e-mail addresses to both mentors and peers. During the first implementation of the project, the mentors were responsible for contacting their peers. Since some students waited till the last minute to contact their peers, several first year students were very anxious about completing their project in a timely fashion and requested phone numbers from their instructors.

In the second project, first year student evaluated technology projects created by third year students. In the introductory elementary education course, a module involves discussions about setting up an elementary classroom and how the classroom needs to accommodate a variety of uses and student differences. From this discussion, the first year students developed a rubric for evaluating the functionality of an elementary classroom. This rubric then served as the basis for a technology project for third year students. The technology project consisted of third year students using the rubric to design and create an ideal classroom by using a draw program, one of the competencies of the computer course. The completed design was then uploaded to a server so that first year students could access and evaluate the projects. After the ideal classroom projects were evaluated, first year students were required to write a rationale explaining the reasons for their choices. The written reports were presented as feedback for the third year students (each project was reviewed by three first year students) and comprised 50 percent of their grade.

The outcomes of the project were very beneficial. For the first year students, it gave them a set of unique examples to which they could apply theory to practice. The abundant set of examples also served as a focus for much discussion during class time. For third year students, in addition to learning new computer skills, the project represented the practical application of computer software to solve a problem, or designing a classroom environment for a future classroom. Since the completed project was uploaded to a server, the web site enabled all of the students from all sections to see each other's work, something that was not possible before.

Challenges of Technology diffusion

Diffusion of technology education throughout the curriculum is a complex and challenging process. While the potential benefits are enormous, there are also significant challenges. The model implies that the curriculum that was once taught in a single course by a few specialized faculty members is now integrated across a large number of courses from departments across the university. This process of technology education decentralization raises two key challenges. First, how can a decentralized approach guarantee that students will meet a broad range of technology competencies without undo overlap? Second, will students gain these competencies in an appropriate sequence?

An example serves to demonstrate how these issues can have very real implications. A professor teaching a course in children's literature would like to involve students in making HyperStudio presentations of poetry for children. This project is wonderful because it provides a model for using multimedia to construct meaningful literary projects and it helps pre-service teachers see that they can use the same approach with their future students. In planning for this project, can the professor assume that students will know how to use HyperStudio or that they can learn it on their own? Should HyperStudio also be taught in a technology course or should the focus shift to the pedagogy of constructivist use of multimedia?

Guaranteeing Basic Computer Skills for Pre-service Teachers

Clearly, there must be support mechanisms in place for students to acquire the necessary skills if more and more technology is integrated into content courses. As technology takes on a greater role outside of the required technology course, students need information on a timely basis and cannot wait till the technology course. Limiting skill acquisition to the technology course severely restricts its possible uses and applications in other courses. If it makes pedagogical sense to use HyperStudio or to create a web page in a course outside of the technology course, then the technology should be used to support the instruction. The question becomes, how do students get the necessary instruction?

One possibility is through a mentoring program of skilled students teaching first year students the appropriate basic skills for a specific project. Even though in-coming freshman display greater computer savvy than the year before, many are still limited in their basic computer knowledge or are not familiar with specific educational software. A mentoring program requires a great deal of collaboration among university faculty, but

from the results of the mentoring program described earlier, can have very beneficial results. For example, first year students learned the basic skills required for creating and uploading a web page and the technology students got to practice teaching a skill set to peers. They also learned that relying on peers for new learning is something that will carry over into their new professional life as in-service teachers and many third year students commented that the mentoring experience helped bring this idea to light.

An additional support mechanism is the utilization of on-line materials for specific projects. For the projects described in this paper, a web site was created to provide context and basic start-up skills required for technology projects. The web site (http://harmony.millerv.edu) is a virtual elementary school that contains K-6 pupils, teachers, administrators, classrooms as well as case studies, rubrics, products and support materials. The help sheets are custom designed to meet the requirements of available computer lab resources and faculty assigned projects.

Supporting Faculty Technology Integration

In this project, a grant provided financial incentives for faculty to develop technology projects to support their teaching and learning. The purpose of the individual technology projects was to encourage faculty to use technology in their teaching, thus diffusing its use throughout the elementary education program. In addition, the projects were to serve as models for its use in the classroom. In order for this to happen, significant support through one-to-one tutoring sessions is available over a one-year period. In addition to the projects described earlier in this paper, below is a brief description of a number of projects currently underway.

Methods of Teaching Science

The grant provided for the acquisition of software to support technology projects in courses taken by elementary education majors. As a result, pre-service teachers in the science methods course investigate a variety of computer software products that support the teaching of science in the elementary classroom. These titles included stand-alone products as well as software designed for collaborative learning. In the course, pre-service teachers collaborate to evaluate software and to develop lesson plans for use in the classroom.

Language Arts & Children's Literature

Pre-service teachers create multi-media presentations on children's literature. Students use HyperStudio to create a presentation that tells a story and includes student narration or digitized speech. To accomplish the task, students use HelpSheets on the virtual school web site and the HyperStudio tutorial.

Fundamental Methods of Math I and II

Pre-service teachers integrate technology with hands-on collection and analysis of authentic data and functions using graphing calculators and electronic data collection instruments. Students use dynamic geometry tools to investigate geometric concepts.

The Language of Music

Pre-service teachers access a set of 60 recorded folk songs with lyrics. The musical scores are available for playback in a web based elementary classroom. Each folk song is accompanied by an activity that is appropriate for a specific age group.

The Millersville Curriculum Library

The media center in a web-based school includes tutorials for accessing traditional sources of information such as online catalogs and periodical indexes offered through the university's library. Special attention is given to evaluation and critical thinking as crucial components of Internet searching. The media center is designed to provide resources including bibliographies, tutorials, and web assignments for a variety of the content courses in the elementary education program.

Fundamentals of Studio Art

Pre-service teachers access, interpret, and evaluate a set of electronic graphic presentations created for a web-based classroom. Students use technology resources such as draw and paint programs to generate original artwork that is posted within the virtual elementary school.

Orientation to Special Education

Pre-service teachers participate in case studies presented in the web-based school involving the impact of technology on special education. These case studies include evaluation of technology applications appropriate for general and special education, technology's affect on inclusionary practices, and the use of adaptive and assistive technology. Students also use technology such as databases to analyze and summarize student performance relative to Individual Education Plans (IEP) and PowerPoint presentations for interactive student centered lessons.

Foundations of Modern Education

Pre-service teachers create documents such as brochures and newsletters using desktop publishing and other tools to creatively communicate with parents. They will also create a final project entitled, "Creating a School of the Future" that incorporates web pages and multimedia presentations.

Science Introduction to Biology

Pre-service teachers engage in several newly designed lab assignments using technology. These lab assignments will be in the form of interacting with a simulation of a biological process or responding to a case scenario on the web. Technology is used in large lecture classes associated with lab sections (1) to demonstrate concepts either visually or with simulations using multimedia presentations, (2) to support meaningful note taking in lectures and (3) to support active mini-experiments by demonstrating scientific principles and engaging students more directly in the content of the lecture.

Comprehensive Nature of Program

As noted earlier, one of the concerns that accompanies diffusion of technology education is how students will be able to gain a comprehensive set of competencies without undo repetition. The experience of this project does provides some initial answers to this question. First, the large scope of courses and departments involved in the project virtually guaranteed broad coverage of technology skills. When helping faculty plan their projects, the directors did not dictate approaches or specific technologies. Nevertheless, faculty teaching different courses and in different departments naturally choose a variety of tools for their students to use. For example, the children's literature professor wanted his students to work with HyperStudio, while the methods of teaching science professor involved her students in the use of databases and science specific software. It makes sense that incorporating technology within specific disciplines would lead to a variety of technology uses. If a particular technology tool was not included in any of the courses supporting technology integration, it might be an indication that the tool was really not a useful application for elementary education teachers. The key for this project has been encouraging faculty to integrate technology tools that make sense for the content they teach.

It has also been helpful to have regular communication and collaboration between faculty members involved in various projects. This is one of the benefits of the collaborative aspect of the model. There have been instances where professors had considered including e-mail discussion groups as part of their course, but decided not to because they knew students would be involved in such groups in several other courses. It is also helpful to have the discipline specific course in technology. Not only does this course provide for in-depth development of skills, but it also provides an environment for more in-depth reflection on the value added to specific instructional strategies by technology tools.

Conclusions

Since the implementation of the model is still underway, only preliminary conclusions can be made at this time. The mentoring project was successful in that technology support can be diffused through several mechanisms. It is clear that students can successfully teach other students while learning something in the process. As a result of instruction from third year students, the first year students were successful in completing a technology project that required the creation of a web page and uploading it to a server. Also as a result of the project, first year students developed supplemental skills involving file management such as file name conventions, creating folders, and file pathways. Additional assistance through on-line HelpSheets also supported the first year students when the mentors were not available. The combination of mentor and support materials indicates that specific computer skills can be addressed using this model.

One thing learned in working with this model is that initially the diffusion of technology throughout a program rests on the ability and willingness of faculty to collaborate. Collaboration is essential, but remains the biggest challenge. When it comes to teaching, many university faculty regard their autonomy very highly. This feeling of independence often runs in opposition to a project requiring a great deal of collaboration. Working together with other faculty to integrate technology into a course requires not only the acquisition of new skills and course modifications, but also the prospect of taking some chances. Even though there are substantial benefits from collaborative projects, this risk taking could work against faculty members in terms of student course evaluations, a necessary part of the promotion and tenure process at many universities. Therefore, it is important to include administration in the planning stages and provide clear communication concerning the implementation and outcomes of projects of this nature.

Modeling Instruction with Modern Information and Communications Technology: the MIMIC Project

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Abstract: This paper describes the design and development of a project where proficient K-12 classroom teachers mentor university faculty on the integration of technology into undergraduate teaching. The faculty in turn model best practice with technology in pre-service teacher education programs at five universities. Students enrolled in the pre-service teacher education programs encounter further technology modeling from cooperating teachers mentored by educational technologists and the pre-service students are provided with opportunities to implement technology in field placements and student teaching.

Introduction

Historically, higher education reforms related to technology have emphasized the themes of hardware and software availability, the development of basic technology skills, instructional materials development or more recently connectivity to online resources. The considerable funds expended in the pursuit of these reform themes have been necessary (Jerald & Orlofsky, 1999). However, the sufficiency of this approach to reform is open to question as the teaching methods modeled in typical teacher preparation programs have changed little in the past twenty years. The scarcity of faculty modeling of technology integration is problematic and the probability of improvement low as incentives to improve instruction are haphazard and resistance to change in higher education is extensive.

Why has teacher education reform in regard to technology integration been so difficult when the investment for and promotion of technology has increased dramatically? In part, it is because prior reform efforts discount the importance of what Lortie (1975) documented twenty-four years ago, "that teachers teach as they were taught." Despite the addition of equipment, instructional materials and basic skill development, novice teachers do not use technology appropriately because informed models of technology use are lacking or absent in their learning experiences. At best, there is little within teacher preparation programs to systematically encourage novice teachers to embrace technological innovations. More often, the unknowns associated with technology use discourage novice teachers from adding technology to their teaching repertoire.

Despite the impediment of having few faculty models in higher education to emulate, numerous teacher practitioners have modified their teaching in meaningful ways to include technology. Daily, practitioners who have benefited from in-service professional development efforts implement technology in the context of real classrooms, with diverse student populations. To these classroom pacesetters, technology suggests opportunity -- instructional opportunities overlooked in many pre-service teacher preparation programs. Sadly only a limited number of pre-service teachers benefit from the modeling provided by these classroom teachers. As a group, the technology proficient teacher practitioners represent an untapped resource for enhancing pre-service teacher education.

To realistically develop the technology skills of the populations serving pre-service teachers, the Modeling Instruction with Modern Information and Communication Technologies: MIMIC Project recruited technology proficient classroom teachers (henceforth in this paper termed Master Classroom Teachers or MCTs) to assume a major role in the preparation of pre-service teachers. The underlying premise for including classroom teachers in the project was to provide instructional models for higher education faculty and pre-service teachers while constructing a bridge between theory and practice.

A precedent existed for incorporating the ideas and services of master classroom teachers in the teacher preparation programs of Cleveland State University. From 1982 to 1990 the College of Education conducted a visiting instructor program (VIP). In the VIP program, local school districts received permanent substitute replacement costs for classroom teachers for the academic year and these selected classroom teachers team-taught undergraduate methods courses with senior CSU faculty. The program proved both exciting and effective but the increased costs and accreditation issues related to an increased percentage of part-time faculty in the teacher education program led to eventual demise of the program. Using successful ideas from the VIP program the MIMIC project set out to involve master classroom teachers who are successfully responding to today's educational technology challenges into the teacher education programs at Cleveland State. Recognizing that replacement costs are prohibitive the MIMIC project developed a mentoring approach whereby the time and efforts of classroom teachers and university faculty remained focused on issues related to the integration of technology.

Project Design

Support for the design and development of a teacher preparation project based on modeling and mentoring of technology integration originated from the field of technology and teacher education, and from the literature on instructional methods promoted by School-to-Work (STW) initiatives. Each perspective advocates particular techniques and identifies concerns for implementation.

Teacher education programs have recognized that in order for new teachers to effectively use technology they must first have appropriate experiences and instruction throughout their pre-service preparation (Thompson, Hansen, & Reinhart, 1996). It is essential that teacher educators possess technological skills but skill in using technology alone does not guarantee technology integration. Teacher educators must also possess the capability to apply technological skills in a pedagogically sound manner. This pedagogical capability is the key premise for integration. Handler amplifies and extends the premise by noting that in order to develop this capability teachers must observe the use of technology in the instruction they experience if they are to perceive technology as an instructional tool (Handler, 1992). Several informal and formal approaches have been considered for increasing the use and acceptance of technology in K-12 classroom instruction and these approaches hold promise for pre-service programs. In particular, one innovative K-12 program involved students with technology skills as partners with teachers. The teachers were responsible to deliver instruction but the partner students assisted with the lesson preparation and materials development (Harper, Conor, & Course, 1999). Technology integration mentoring by students has also occurred in teacher education programs. The Iowa State University, College of Education, initiated a program where graduate students proficient with technology were assigned to faculty. The faculty in this study had a range of technology backgrounds. Although, it became apparent that technology integration was time consuming, the mentor-mentee relationships proved both meaningful and successful at improving the integration of technology (Thompson, Hansen, & Reinhart, 1996).

The primary goal of School-to-Work is to provide students with learning experiences that will assist them with the development of work related skills. Recognizing that higher education faculty have limited time to devote to the development of technology integration skills, the MIMIC project concluded that STW elements are applicable for mentoring university faculty on work related technology integration skills. In particular, the 3 core elements of STW: 1. school-based learning, 2. work-based learning, and 3. connecting activities offered practical ideas for implementation. School-based learning includes high academic standards, work-based learning provides experiences structured to specific work implementations and connecting activities include the integration of classroom and work experiences (Berns, 1999). Teacher preparation programs consist of analogous elements. High academic and pedagogical preparation standards as school-based learning, practicum and student teaching as work based learning and micro-teaching, classroom teaching opportunities, and field observations as connecting activities. As such, four instructional methods included within School-to-Work were incorporated into the MIMIC project design. They were problem based learning, collaborative/cooperative learning, project-based learning and work-based learning.

Problem based learning is experiential learning organized around the investigation and resolution of real-world problems (Torp & Sage 1998). The problem serves as the organizing center for curriculum activities. As students become immersed in a problem situation they are more likely to become engaged and motivated. The messiness of a realistic problem contributes to authentic learning. The primary problem posed in the

MIMIC project is how to integrate technology into pre-service teacher education. This problem is authentic and relevant to the faculty who volunteered for the MIMIC project. The question, "Why do I have to learn this information?" was avoided using the problem based approach. Examples of a problem based activities within the MIMIC project include; investigating technologies that are already applied by teachers in a content area, learning how to use those technologies, and implementing specific technologies in a classroom setting.

Collaborative/Cooperative Learning is an instructional approach where students work together to accomplish a common goal. In cooperative learning, students work face to face in teams of 2-5 members, there is positive interdependence among group members yet individual members are accountable for their own learning (Davidson & Ledlow, 1999). The collaborative /cooperative learning method has proven successful at the college level (Johnson & Johnson, 1993). In the MIMIC project, collaborative / cooperative learning is encouraged by including mentor-mentee teams in the development of instructional materials. Also, teacher-faculty dyads are expected to team teach both at a K-12 classroom location and at a university location. In this teaching example, the pair work together, are dependent on each other for assistance, and are accountable for the instruction at their location.

Project-Based Learning focuses on the central concepts and principles of a discipline, by involving students in problem solving investigations. Importantly, it allows students to work autonomously to construct their own knowledge and culminates in realistic products (Buck Institute for Education, 1999). In project-based learning, problems are typically interdisciplinary in nature. One project that all participants in the MIMIC project participate in is the creation of an instructional videotape that demonstrates the integration of technology in a chosen grade level and content area. In this project the participants face a real-world problem presented in its full complexity. In the video project, the participants learn both the technology of videography as well as how to implement technology in a classroom setting.

The fourth method adopted from the School-to-Work elements is work-based learning. Work-based learning can include a number of different activities. These activities may be defined along a continuum from short introductory experiences to long term immersive ones. In each activity the emphasis is placed "doing" and "reflecting" upon an actual work activity (Naylor, 1997). The MIMIC project employs work-based learning in the requirement that faculty participants apprenticed by classroom teachers implement technology into their teaching. Simple examples span the continuum of faculty assisting in a MCT led demonstrations of technology to the culminating activity of implementing technology infused lessons in pre-service teacher education courses.

Master Classroom Teachers as Mentors

The project partners recruited the assistance of MCTs selected from Ohio SchoolNet trained and certified staff to provide a host of technology integration classroom experiences to faculty and students. The opportunity for master classroom teachers to mentor higher education faculty advances numerous practical insights. The influence of such able classroom teachers in educational methods and selected arts & science courses provides technology proficient role models for students. Having someone to interact with who has successfully used technology in the classroom and who shortly will return to that classroom is advantageous to both higher education faculty and pre-service teachers. The MCTs bring a realism to pre-service programs by introducing solutions to the kinds of technology problems faced by teachers in today's classrooms.

In their role as mentors to faculty, the MCTs have direct input into the ongoing shape of the courses and clinical supervision of related field experiences for teacher preparation. The curricular revision, and the development of technology infused teaching strategies that the MCTs introduce lead to modifications in university classroom instruction. The benefits of those modifications remain on campus for future student populations. As such, technological infusion into teacher preparation courses becomes institutionalized.

The MCTs apply technology to further what research supports about how students learn best. Applying their Ohio SchoolNet (1999) framework the MCTs encourage the higher education faculty and pre-service teachers to model learning strategies that involve more student interaction, more connections among schools, more collaboration among teachers, and more emphasis on technology as a tool for learning. On their return to their classrooms, these teachers will provide the project partners with a unique pool of educators who will then participate on a continuing basis as supervising teachers.

From the standpoint of participating school systems, the MIMIC project offers a unique chance to reward outstanding veteran teachers and importantly to identify and recruit new teachers competent in the

classroom use of technology for their district. This recruitment strategy is especially important with our partners who provide placements for our practicum and student teachers.

Conclusion

The MIMIC project began in the Fall of 1999, to date the project has recruited Master Classroom Teachers, paired these MCT's with university faculty and together they have developed individual mentoring plans. Monitoring and evaluation of participant interactions is ongoing and feedback has been provided to participants. E-mail has been used extensively to promote community and to serve as an example of modeling of technology integration. A web site designed by the MIMIC team and local classroom teachers is currently under development. K-12 teachers who model technology in their classes have been recruited for the purpose of developing videos that exemplify the integration of technology in the classroom. The long-term success of the MIMIC project is dependent on the active participation of the mentor-mentee dyads. As such, emphasis has been placed on supporting participant control over project activities and minimizing administrative requirements. To this end, the project team has simplified recorded keeping, provided technical support and kept physical meeting to a minimum.

As participant interactions increase, the mentor-mentee dyads will document the successes and failures of the school-based learning, work-based learning, and connecting activities implemented. Management of the project will be revised based on this documentation. Finally, indications at this point are that both classroom teachers and university faculty are reacting favorably to the mentoring arrangement and more importantly that the university faculty are starting to integrate technology into their teaching.

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PRESERVICE TECHNOLOGY MENTORING

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Abstract. This pilot study investigated the experiences of preservice teachers enrolled in a required technology course as they mentored educators about technology. Data were collected over the course of a semester through e-mail. A qualitative analysis revealed the following themes: reasons for mentoring, what happened, course resources, thinking about it, useful experiences, and mentor learning. Findings indicate that mentoring may reinforce course learning. In addition, convenience of mentoring sessions and reflection appears to enhance mentoring experiences.

The term mentoring is derived from the Greek meaning to endure. It is the goal of teacher education programs to help train and prepare inservice teachers to become enduring preservice teachers who will not only contribute to the students learning but also continue to grow and develop as learners themselves. Mentoring in general is becoming a popular and effective model to support novice learner and expert teaching in many professional fields (Office of Research, 1993).

Traditionally, inservice teachers are mentors for preservice teachers. In the information age however, it is more likely that the new teacher will have a great understanding of technology than will the practicing teacher. Hence the concept of a mentoring project that can support teachers of different abilities and experiences in authentic and practical contexts. Many higher education and K-12 institutions have technology mentor programs in which students mentor faculty about the use of technology (Bently & Mumma, 1999). However, given the status of K-12 teachers' use of technology in the schools, it seems appropriate to consider preservice mentoring of practicing educators. Research indicates that many preservice teachers do not retain of transfer skills acquired in isolated preservice technology courses (Vagle, 1995) and mentoring provides a means of making course learning relevant to practical situations.

Mentoring builds on evidence that teachers are more likely to adopt technology when technology use comes from a perceived curricular or instructional needs and is situated in their work environment, as illustrated in the Cupertino ISD (Barnett & Nichols, 1994), SEIR-TEC (Byrom, 1997) ACCOT (Apple, 1999), and Georgia INTECH (Georgia DOE, 1999) models of technology staff development.

The US Department of Education (1998) reports that effective professional development practices must be grounded in what teachers need to know in their own teaching context and draw upon "shared concerns and strengths" (p. 41). Teachers want and need ongoing learning experiences that reflect their interests and perceived student needs to be delivered in a clear and reflective manner. These attributes apply to both inservice and preservice teachers. By allowing preservice teaches to mentor inservice teachers, co-learning will surely be inevitable. The novice teachers will learn about the nature of teaching and learning as the experienced teachers acquire technology skills and understanding, all within the workplace.

The Project

In the 1998-99 academic year, the school of education in a small private university in the Northwest piloted a preservice mentoring project for inservice teachers. All degree and certificate-seeking students were required to complete a two-hour technology course. Preservice teachers enrolled in the basic educational technology course were given an opportunity to mentor a current or future teacher (K-12 or higher education), of their choice, about technology. Twenty-six preservice teachers chose to participate. They were required to send an e-mail message to the course instructor after each session and then answer a few reflective questions at the end of their experience.

Method

This descriptive case study (Merriam, 1998) explores patterns among the mentoring experiences of preservice teachers. Informants experienced their interactions with mentees with minimal direction from the course instructor and no direct feedback from their peers. Since this was a pilot project, there was little information and no theory from which to base possible outcomes of mentors' experiences. Although the mentors experiences were in isolation of each other, the phenomenon of mentoring evoked commonalties (Creswell, 1998).

Preservice mentors were asked to meet with their mentees until their negotiated goals had been met. They e-mailed the course instructor after each meeting to report on progress, concerns, or ask any questions. The course instructor gave encouraging feedback and occasionally asked for clarification about their experiences. Each participant met with their mentee at least three times, two mentors met seven times.

At the conclusion of the mentoring experience, preservice teachers were asked if they wanted to share more about their experience and if they had suggestions for future mentors. This allowed a degree of saturation (Lincoln & Guba, 1985) as the investigator asked ongoing questions, when necessary for clarification, and allowed informants to share as much as they chose about their experience. Informants were not required to submit evidence of their mentees learning but they were asked to describe projects, tasks, and activities. Mentees were also invited to e-mail the course instructor and indeed, several did. Products and their description, as well as feedback from mentees, provided triangulation of data. The long-term nature of the project and exchanges among instructor and mentors contribute to the validity of the study validity (Merriam, 1998).

A constant comparative data analysis allowed for timely clarifications of reported experiences. As patterns emerged from data, themes were identified and defined, as described in the following section.

Findings

Predictably, most preservice teacher messages described the mentoring goals, processes, and outcomes. However, data analysis revealed patterns of shared culture among individual experiences. These patterns include: reasons for mentoring, what happened, course resources, thinking about it, useful experiences, and mentor learning.

Reasons for Mentoring

Preservice teachers chose their mentee for various reasons, mostly out of convenience. Eight selected their mothers, all but one of whom work in K-12 education. Seven mentored teachers which whom they were placed in field observations. Six preservice teachers chose fellow students and two chose education faculty. Two mentees were grandparents and one was a middle school aged daughter. Given the freedom to choose someone connected associated with education allowed mentors some leeway and probably contributed to their successful experiences, as noted in a later theme. Too many constraints or inconveniences may facilitate procrastination or incompletion of the task.

The what and how of mentoring sessions was mostly negotiated among participants. Most mentees proposed an interest or a need that focused them on the task at hand. This helped to set a goal and prepare the mentor for their sessions. The peer group wanted to get "a head start on my media class" which is required of all certificate and degree seeking students. Inservice teachers typically had specific software or skill goals, as did the university professors. These included Power Point presentations, WWW site development, spreadsheets, databases, word processing documents, searching the Internet, and multimedia development. All of these topics were covered in the course.

What Happened

The descriptions of what happened in the sessions were clearly of two types. One group described a demonstration approach as mentors said they "showed [the mentee "how to" while others used a more hands-on approach as indicated by phrases such as "I let her" or "he then entered data." The *show-*

ers eventually noted that the learner did get to practice while the *let-ers* tended to incorporate more practice during sessions. Both groups appeared to encourage or arrange opportunities for tasks between sessions. These included such tasks as "sending e-mail messages," gathering data for spreadsheets or databases, "working on typing skills," or gathering "images off the Internet."

This variance may only reflect the medium of reporting, e-mail, and the choice of descriptive language. Teachers may say they have *shown* someone how to do something although they may have given verbal instructions rather than direct modeling. When questioned about this, the *show-ers* did acknowledge that they did model, some noting that they had a hard time "keeping their hands off of the mouse."

Course Resources

Most of the preservice teachers mentioned using course materials or teaching approaches in their mentoring. They often showed their mentee "what I did" in their own course work. They also used course "handouts" and "cheat sheets" to guide their learners. Almost all mentors commented that they "did what [the course instructor] did in class" drawing upon processes modeled for them.

The technology course design was part whole group and part individual instruction, with considerable peer mentoring during formal and outside of class meetings. The nature of their learning experiences may have facilitated the modification and use of course materials and activities.

Thinking About It

Throughout all of the messages, including those sent by the mentees, there was an abundance of reflective statements about how the mentor felt, the anticipation of both parties, and of the learner's reactions.

Both mentor and mentee expressed "excitement to learn to use the computer." Statements of this sort continued throughout the reporting of the mentoring sessions as both parties "looked forward" to the next session and many said their mentee was "excited to learn." Many mentors said that both they and their mentee are "having a good time." This may be a result of the open-ended nature of the task in which participants determine the outcomes and therefore was less stressful that if a mandated goal had been designated.

The mentors commented about their own behavior during the session as well as their concerns. These statements often included comments about the status quo such as, "things have been going well" or "this was another productive session." Three quarters of the mentors noted perceptions about their expertise or lack thereof. Many recognized their developing knowledge as one preservice teacher said she "actually knew what I was doing." Other mentors noted that they didn't go into some areas because, in the words of one preservice teacher, "I didn't know myself."

It is unclear whether or not the lack of knowing inspired further learning however this type of experience might trigger reflection about the scope of skills that will be useful in practical settings.

The mentors made also commented about their perceptions of mentees experiences. Many of the mentees were "especially interested" in specific applications which focused the sessions and probably contributed to the excitement described above. The mentors often expressed surprise that the mentee "understands what I taught" and "caught on quickly." The mentees were often "very amazed at what [they] could do" and found the sessions "very useful and not difficult." These reactions may suggest that the mentees, in general, may not have had previous opportunities to learn in one-on-one sessions or to learn specific tasks about which they wanted to learn. The generalized nature of academic learning and professional development does not often provide for individualized learning.

A few mentors described that their mentee "was confused" about a task or concept. This prompted them to "clear up the confusion" with additional explanation or modeling. These instances did not appear to detract from the overall value perceived by the participants.

Useful Experience

The mentors all noted that they and the learners felt that mentoring was useful for many reasons. Oftentimes, through interactions with their learner, mentors came to new realizations about the usefulness of technology resources. There were "obvious benefits" to basic software tools and the Internet seemed to inspire both mentor and mentee. Many mentoring sessions included a discussion about "possibilities for incorporating all of what we are going over" into the mentee's work or personal life. Mentors who taught the basics of e-mail had their mentees mail them messages, sometimes resulting in a plethora of messages and "forwarded stuff." One mentor commented that she thought her mentee "now spends all her free time e-mailing."

Part of the usefulness may have been related to the just-in-time nature of the tutoring sessions as well as learning in the learner's context, be it at home or in the workplace.

Mentor Learning

Almost all of the mentors directly discussed their own learning as an outcome of the experience. Oftentimes this was stated as a means of reinforcement to course learning. The mentoring "... helps me understand more what I am doing," and "tutoring has helped me learn a bit more about this class because I have to remember what we have been learning!" Most found that the experience "...reinforced what I knew."

Some mentors realized the limitations of they knowledge, as one preservice teacher said, "I know I still have a lot of glitches to work out." Another mentor noted that, "I can really understand this [the discomfort of learning something new] as I felt very out of my own comfort zone when I was trying to construct my HyperStudio© cards for the first time." Although not a general pattern among informants, being able to recognize a learner felt during a lesson came up in class discussions about teaching K-12 students about using computers.

Most mentors gained confidence about their own abilities as expressed in the following statement. "I found that through mentoring I learned a lot about my own capabilities and how much I was actually capable of teaching to someone. I think this project was a good way to test my own abilities." Teaching others allowed mentors to apply their learning in a new context as they transferred skills from the computer lab to authentic work and learning environments.

Mentors also learned about how to teach someone something, as illustrated in the following revelations that were common among informants.

> "... keep it to the basics..."
> "I had to use a lot of patience ... because she did not understand things as quickly as I thought she would."
> "... sometimes one has to draw information out of one's students."
> "I realized how difficult it is to teach someone when you do not have control of the mouse."
> "... go into depth on their topics of interest."
> "... you have to be prepared."
> "... have more time to play around."

Several learned that it was helpful to "ask what [the learner] wanted to learn instead of saying what I am going to teach" them. The learning outcomes, for the most part unanticipated by study informants, reveal insights into mentoring that have implications for preservice technology learning.

Conclusions

Is pre-inservice mentoring the answer for long term skill acquisition in preservice technology courses? It may be for some students. This was an optional activity for course participants and it may be that this was a self-selected group. One reason it may have worked well is because that the mentees were readily accessible and did not require great effort in scheduling. Students were encouraged to "double-dip"

assignments and tasks whenever possible, making connections among other courses and activities. This may have created a path of least resistance for them. The outcome was universally positive, as one student exclaimed, "In doing this I retained much more than I thought possible."

Although the findings presented here are limited in their generalizability to other settings, some broad considerations may be insightful for others when developing activities that support preservice skill acquisition.

- Provide opportunities for students to use and apply learning outside of a computer lab.
- Provide one-on-one interactions among novice and more advanced learners.
- Encourage learners to reflect upon and identify their strengths and weaknesses.
- Carefully consider materials used in class, they may be used in non-academic contexts!

There are many unanswered questions in a project such as this. How did the preservice teachers who mentored compare with those who did not? How did the motivational levels, abilities or achievement levels compare? Was the private school population, accustomed to service work, more likely to be successful in such a venture as opposed to those in larger public institution in which service work may not be enculturated? Technology mentoring may provide an opportunity to help preservice teachers make connections among course learning and practical applications that are often lacking in certification programs.

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Technology Integration within University/Public School Communities

A Panel Discussion

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Abstract: Preparing tomorrow's teachers to use technology in schools is a complex endeavor requiring the infusion of technology into curriculum and instructional practices at all levels of preservice and inservice programs. A large, private western university is committed to developing technology-proficient educators including university faculty, public school teachers, and preservice teachers. This university brought professors and public school teachers together in three professional development seminars on integrating technology into the K-12 curriculum. The State Office of Education and the professional development team for technology application from the university provided instructional support for these seminars.

The Panel

This panel consisted of four participants in the workshop: 1) a District Director of Information Systems, Cindy Nagasawa-Cruz, 2) a State Internet Specialist, Rick Gaisford, 3) a public school teacher involved with the State Education Network, Steven Haderlie, and 4) a university faculty member, Nancy Wentworth. They discussed the issues of integrating technology into curriculum and instruction as they pertain to both preservice and inservice development. They described topics included in the seminars, provide sample projects produced during the seminars, and interact with the audience about issues of integrating technology into preservice and inservice programs. The following is a short summary of their participation in the workshop.

Nancy Wentworth

Background

The teacher education program at this university was seen to provide modern technologies to every student, and connect several classrooms to one another and to the outside world. However, the program needed to increase the use of high quality learning resources integrated into the curriculum, and increase the support of teachers (both university faculty and public school cooperating teachers) as they use technology to improve teaching and learning.

The preservice program include university methods and certification courses and field experiences for preservice teachers, along with technology support for university faculty and students. The teacher education program includes only one technology course, the lowest technology requirement of any teacher education program in state. The course was designed to help students develop skills in using a variety of educational technologies; however it was not concerned with integrating the use of technology into curriculum and instruction in the classroom. Focus group data have demonstrated that graduates from the teacher education program have technology skills for personal use but not for classroom integration. In a few isolated methods courses the use of technology in curriculum and instructional practice is modeled, but this modeling does not always align with curriculum from the public schools. In a limited number of field experiences public school teachers provide examples of lesson plans and assignments that engage pupils with technology, but these experiences were not available to all preservice teachers. Few active technology users work to support colleagues who are beginning to use technology in their classrooms.

All participants in the preservice program needed to learn to integrate technology into their curriculum and instructional practices. University professors needed to develop expertise in using technology in their instructional practice and in aligning their activities with curriculum and technology used in public schools. Public school

teachers need to make university professors aware of the availability of technology in public schools and of ways that it can be integrated into instruction. These participants needed to model these instructional practices to preservice teachers and to encourage them to implement technology during their preservice practica. All participants needed to become critical, knowledgeable consumers and decision makers concerning use of technology in education and to be capable of acting as change agents supporting the use of technology in teaching and learning.

The Seminars

Participants were introduced to basic methods of using a variety of technologies in the classroom and creating curriculum materials, which could be used in classrooms. University faculty teamed with master teachers from the partnership districts to acquire technology development skills and to create a curriculum project which used technology to extend instructor and student capabilities for learning and thinking using higher order processes and skills. During the week several master teachers demonstrated and modeled learning activities which used technology, but the majority of the week was spent with hands on learning and curriculum project development.

Infrastructure

All participants in the preservice program are linked in an infrastructure that encourages them to share ideas and resources. The University-Public School Partnership has connected the University and five nearby school districts as a legally contracted partnership of educators for more than 15 years. During this time participants in the Partnership have come to understand and respect each other's perspectives. All members have worked collaboratively in creating and implementing the university's elementary and secondary teacher education programs. They have also collaborated with the State Office of Education and the State Education Network

Through the Partnership some participants have collaborated concerning uses of technology in education, but they are only beginning to focus specifically on the preservice program. Interested university and public school personnel discussed program changes that will infuse technology throughout the teaching and learning experience of all participants, and they began to identify participants at all levels who incorporate technology into the learning process. Beginning in the summer of 1999 public school teachers who have integrated technology use into their curriculum and instruction will begin a collaboration which will last throughout the year with university professors who teach content-specific methods courses and teacher certification courses to preservice teachers. Discussions will continue to occur in Partnership activities to develop a shared vision about the use of technology in curriculum and instruction.

Steven Haderlie

Data Acquisition from Focus Groups

Two meetings were held in the spring of 1999 for the purpose of determining need and direction for the integration of technology into the Teacher Education department at Brigham Young University. The first meeting involved the five district information system directors of the BYU Public School Partnership school districts. Several enlightening observations were made of the newly hired teachers who had graduated from the McKay School of Education and their experiences with technology integration while at the university:

1. New teachers had considerable expertise in technology for personal use, (i.e.) email and web browsing. They had almost no experience in how to use the technology in the curriculum. They understood the mechanics of using technology well but the implementation was extremely weak.

2. University instruction focused on the mechanics of technology use with little instruction on the integration of technology into the classroom curriculum.

3. The small amount of instruction on technology integration was limited to a one or two technology course.

4. University faculty rarely made assignments that would enhance skills developed in the technology course. University faculty did not model behaviors that would demonstrate to students technology integration into curriculum.

The second meeting brought together nearly fifty teachers selected by the district information directors as teachers who were among the best in the five partnership districts in technology integration. This group outlined criteria for a summer workshop and formulated design principles. It was determined that those invited to attend should have basic computer skills but not be computer experts. Priority should be given to exceptional classroom teachers who already possess excellent teaching skills. Attendees should be teachers who are risk-takers and early adopters. Teachers who are invited to attend these sessions will become "fire-starters" when they return to their schools and excite others to learn the skills needed for effective use of technology in the curriculum. Skills to be mastered included digital cameras, scanning, acquisition of materials from the Internet and the creation of a unit of instruction using Microsoft PowerPoint to allow for participants to obtain and retain ownership of the concepts and principles.

Teachers in this design meeting frequently mentioned that in their experience with attendance at workshops, the learned skills do not follow them back to the classroom. Two reasons were given for this: 1) their classroom does not have the needed hardware and/or software; and 2) after the experience in the workshop has concluded, they are left on their own to try to find answers to all the questions and problems that they encounter. The design group suggested that follow-up sessions be planned as part of the summer workshop so that the participants could meet three times during the following school year for additional training and to answer questions and solve problems. It was also recommended that an email discussion list be created to allow for questions to be posted and answers provided by instructors and participants.

Additionally, during the past two years in working with McKay School of Education faculty it was observed that the faculty was hesitant to attend instruction intended to teach them technology integration skills. It was observed that the structure of university faculty advancement was a detriment to technology integration. Faculty was hesitant to allow peers to observe their lack of knowledge of technology, especially when they were in competition for tenure track positions. This environment did not encourage collaboration and the attitudes continued even after tenure was achieved. Most importantly, faculty was hesitant to participate in inservice activities when the instructor was younger and less academically qualified than himself or herself. For the most part, technology has advanced so rapidly and has such a short history most university faculty have not had the opportunity to be part of the information revolution. The technology experts are often their own students and traditional teaching styles which require that the instructor always know more than the student inhibits use of student expertise to infuse technology into learning environments.

Observations during Inservice Activities

The university faculty was grouped with three master teachers during inservice activities during the week. The faculty was instructed to provide expertise in the content area. It was observed that the public school teachers quickly assimilated the technology skills and immediately began work on their group project. The university faculty was less inclined to begin working but the enthusiasm and initiative of the public school teachers soon involved them in the creation of the group instructional unit. As the week proceeded, it became clear that the secret to involving university teacher education faculty in meaningful technology inservice activities was to group them with master public school teachers. Several outcomes were observed:

1. Public school teachers were not intimidated by peers and collaborated more effectively than university faculty.
2. University faculty adapted to the public school teachers' attitudes about collaboration and became an effective member of the group both offering information and asking for help in solving encountered problems.
3. University faculty seemed to thrive in this new collaborative environment and finished the week with a new enthusiasm and confidence that they had acquired the skills necessary to begin technology implementation in their own instructional strategies. Additionally, they were now unafraid to ask questions of the public school teachers when they encountered problems with technology issues.
4. University faculty were able to observe that many public school teachers have already acquired the skills and equipment needed to infuse technology into learning and that as cooperating teachers to pre-service student teachers they can model many of the technology infusion skills which university faculty have yet to develop.
5. University faculty who attended the summer workshops was more open to technology inservice activities during the following semester and began to request equipment and physical facilities that would expedite their integration of technology into their instructional activities.

Rick Gaisford

It has been difficult for schools and districts to effectively train teachers currently in the education system with knowledge and skills on how to use technology in the classroom, let alone train new teachers coming into the system. The Curriculum Using Technology Workshop, sponsored by the BYU/Utah Public Schools Partnership has tried to address this problem. The project began with two "simple" goals. One, train classroom teachers to more effectively use technology resources in the classroom to enhance teaching and student learning. Two, train university faculty to use technology with pre-service teachers and encourage them to have these same pre-service teachers use it in their university coursework, methods courses, and student teaching. When these teacher candidates graduate from the university they will leave better prepared to teach curriculum standards and they will know how to use technology effectively in teaching and learning. This will allow schools and districts to focus their training on teachers in the system drawing on the skills of these new teachers.

This past summer the BYU/Utah Public Schools Partnership sponsored two week-long technology integration workshops. One week was devoted to elementary teachers, the other to secondary teachers. Members of the BYU faculty were invited to participate during either week. Because this was a pilot project the numbers were kept intentionally small. Each week approximately twenty-five classroom teachers from partner districts

participated. In addition five to seven BYU faculty participated each week. The underlying premise for all participants was to think about the curriculum they are responsible to teach and to select a topic that could be enhanced with technology resources and tools.

The first day of the workshop focused on the question of why use technology in education, and what technological tools and resources are available to teachers. This first day was designed to build a common foundation of knowledge for the participants to draw on during the week. Rick Gaisford, Internet Specialist for the Utah State Office of Education, presented about the various technology tools and resources available to teachers. He highlighted tools from video to the Internet to multi-media authoring programs that teachers and students can use in teaching and learning. He emphasized the point that the students in the system today must be able to problem-solve, learn and work in new, complex and technology rich environments. Dr. Laurie Nelson, Professor of Instructional Psychology and Technology, shared some of the latest research about the effectiveness of technology in teaching and learning. Through a series of activities participants noted both the positive and negative aspects of integrating technology into the curriculum. Interestingly, the positive effects revolved around the benefits for students, while the negative aspects centered on the difficulty in having adequate tools and training for teachers.

During the afternoon of the first day Dianne Smith, technology trainer for Davis School District, presented a unit of study, which aptly demonstrated the power technology can have in teaching and learning. The students, BYU faculty and classroom teachers, were guided through a unit of study based on the musical composition The Mouldau, by Bedrich Smetana. Through the use of the Internet, and multimedia authoring software, the students learned the history, geography and culture of Czechoslovakia. In addition, they learned about thematic poems in music, musical themes, and the life the composer. The use of technology enabled the teacher to present her information in a multi-sensory way that both engaged and inspired the participants. At the end of her presentation, the workshop participants were gently reminded they were to create a similar type of project but not on such a grand scale, since they would only have a week to develop it.

The second day of the workshop introduced teachers to the technology tools and skills they would need to accomplish their own project. Mini-workshops were held that focused on: 1) How to use a scanner and digital camera, 2) Internet resources for educators, and 3) copyright issues in education. During the afternoon the participants were instructed on how to use PowerPoint by Microsoft to create a multimedia presentation. Time was also given to district technology specialists to share strategies on how to create a good project using technology.

Days three and four were devoted to project development with support from workshop staff and district curriculum specialists. During this time teachers worked independently or in groups to develop a curriculum project using technology resources and tools. Many of the BYU Faculty partnered with classroom teachers in the development of projects with each side sharing their expertise, insight and skills. During these two days of project development four master teachers were invited to share a project they have done in their classrooms. These one-hour presentations shared skills and tips on how to effectively use technology in teaching and learning.

The final morning of the project let the participants finish up their multimedia presentations. The highlight of the day and week was when each group or individual shared their curriculum ideas and presentation. There was a real sense of accomplishment as the participants realized how much they had learned in just few days. To view the schedule of the week's events and to see the projects that were created visit the following website: http://msed.byu.edu/cites/curriculumUsingTechnology/index

The evaluation of this project by the participants clearly demonstrated its effectiveness in meeting the project goals. The evaluations without exception stated the time spent during the week had been valuable and useful. They stated that they had learned skills and resources they would take back and use in their classrooms. Many of the BYU Faculty came away with a new vision of the power and usefulness of technology in education. They noted how important it is for them to make sure the pre-service teachers know and use technology resources both in their coursework and practicum experiences. The workshop staff noted the depth and complexity of the curriculum projects created by the teachers and faculty compared with other workshops they had participated in. Several reasons were cited: 1) setting a good foundation on the first day, 2) having the teachers focus on their curriculum, 3) time to learn and experiment – 5 days, 4) small teacher/pupil ratio, 5) hands-on learning, 6) project- based, each teacher had to create or help in the creation of a final project. The project staff noted that the vision the participants had of technology in this workshop differed from their experiences in other similar types of workshops. Here the participants left with the attitude of I will vs. I might. They had a sense of being that I can vs. I may.

The work with the BYU Faculty and district teacher participants is not over. Several opportunities for follow-up and skill building have been scheduled during the school year. The first follow-up session was held in November where additional skills and technology integration strategies were shared. An e-mail listserv has been established to better facilitate communication and inform participants of new learning opportunities. Additional help is only a phone call away for the project participants. BYU has two classroom teachers on staff to help the faculty learn new resources, skills and tools. Each of the districts has trainers that will follow-up with the teacher participants.

This has been a pilot year for this project. The experience had during the two one-week workshops demonstrated the usefulness and effectiveness of this project. This model will continue to be evaluated and improved. The planning for a year two series of workshops is under way. It is the feeling of the project staff that the goals of this project were met and in many individual cases surpassed.

Cindy Nagasawa-Cruz

Jordan School District is a K-12 public school district located in the southern section of the Salt Lake Valley in the state of Utah. The district is the largest in the state with a student population of approximately 73,000 students, 3,502 full time equivalent certificated staff and 3,161 full time equivalent classified support staff. The district operates 25 traditional calendar elementary schools, 28 year round calendar elementary schools, 15 middle schools, 10 high schools and 3 special schools within a 250 square mile radius. As one of the fastest growing districts in the state, Jordan School District has experienced dramatic growth from the early 1960's to the present.

The Jordan School District Instructional Technology Strategic Plan is in its fifth year of implementation and is currently undergoing a major revision. The plan is structured using a traditional strategic planning model containing beliefs, parameters, a clearly defined and measurable mission statement, objectives, strategies and action plans. This provides the framework and direction for setting annual priorities for district instructional technology programs. Specific projects are identified and implemented in order to obtain the critical mass necessary to make an impact using technology in instruction. Each instructional technology project is designed with a corresponding staff development plan.

In its initial years, the district plan focused on network infrastructure, world wide web connectivity, hardware and software acquisition for students and teachers, and basic technology skills in its staff development programs. In more recent years the focus has shifted to how the technology can become a common tool to support regular, everyday instructional practices. While there still exists some need to provide inservice for basic technology skills and personal productivity, current efforts are focused on moving teachers to the next phase of using technology; that is to use technology as an effective tool in teaching and learning.

Moving to this next phase of technology use in the classroom is a major change for teachers, particularly in comparison to the "traditional" model of teaching experienced in most preservice or inservice programs. Using technology effectively in the teaching and learning process requires a shift in paradigm. This shift in paradigm is described as "technology integration" into the curriculum. The classroom environment begins to take on a more constructivist atmosphere. It becomes increasingly student-centered, inquiry based, and project oriented. Students begin to play a more active role in information gathering, analysis, problem solving, creation and presentation. Additionally, effective use of the technology can support diverse learners, student learning centers, and cooperative student workgroups.

To communicate the vision of integrating technology into existing curriculum and instructional practice, the district has been establishing "demonstration classrooms" where the effective use of technology is being modeled in live teaching environments. Individuals from preservice and inservice programs are encouraged to attend these classrooms to gain the insight and vision of technology integration. Additionally, the district uses three curriculum technology integration specialists (one at each elementary, middle and high school), whose main focus is

to review existing curriculum and develop methodologies to use technology as a supporting tool for teachers and students.

Promoting this vision of technology integration has became a common need for preservice programs at Brigham Young University (BYU) and inservice programs at Jordan School District. In a district the size of Jordan School District, the process of making a systemic change across the board for thousands of teachers in the effective use of technology in instruction is a monumental task. The existing BYU Partnership structure was a natural fit for supporting this effort. When offered the opportunity to attend a five day technology integration summer workshop with university faculty, more teachers applied then were seats available. Teachers were provided a paid stipend upon completion of five days attendance and creation of a multimedia/technology-based instructional project. The district teachers who attended include: nine 5th grade teachers representing one year round elementary school and three traditional elementary schools; and nine secondary social studies teachers from three middle schools and one high school. The district also provided the service of the three curriculum technology integration specialists as well as one distance learning coordinator to assist with the activities throughout the five day workshop.

Response from the summer workshop and follow-up sessions has been notably positive. Some teachers who viewed themselves as already "technology savvy' expressed excitement that they learned many new skills and ideas about using technology resources in their classrooms. Others have stated their newfound discovery and use of the technology resources allow them to teach with more "breadth and depth" of existing subject areas. Teachers are realizing that when students use the technology to create and present, the students work harder towards a more complete and finished product. The workshop has also encouraged communication and collaboration among teacher teams from all participating schools. The finished multimedia products and the ability to share them with each other have proven to be a valuable teacher resource long after the initial summer experience; as is the continuing additions and updates to the workshop web site.

The cooperative effort between university faculty, public school teachers and preservice teachers will continue to foster valuable future developments in the area of technology integration. School districts must be positioned to offer high quality instruction that is effectively supported by the use of technology as a tool for teaching and learning. Today's students have come to expect technology use as a natural part of their everyday lives.

More information about Jordan School District can be found at: www.jordan.k12.ut.us.

Promoting the Integration of Technology in Teaching: A Collaboration between School Districts and the University

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Abstract: To encourage and promote collaboration between and among university and district personnel at all levels to solve educational problems and issues, the Dean of College of Education at Weber State University (WSU), along with six local district superintendents in WSU's service region, formed the Students for Success Alliance (SSA). The primary purpose of this organization was to establish a consortium which would identify common educational problems, solicit resources and solutions, and develop appropriate professional development opportunities. Furthermore, the organization provided opportunities for the involved entities to share resources and expertise.

This paper will describe the collaborative efforts of public schools and a university to train classroom teachers in the integration of technology.

The Need to Train Teachers

One of the first major projects undertaken by the Students for Success Alliance (SSA) was to increase the integration of technology in the teaching and learning processes in the classrooms. School districts in the state of Utah have long been provided financial support in the acquisition of hardware. But the training of teachers to integrate the technology has lagged behind.

Initial Steps

In one of the initial SSA planning meetings, the superintendents identified the integration of technology in classrooms as a major need and priority. To increase the level of awareness and understanding of the issues, a full day retreat was planned to provide the superintendents with the most current information available on technology integration. WSU, collaborated with WestEd (an educational research laboratory funded by the federal government), to structure the day which included topics on effective utilization of technology, current research, standards, and vision. By beginning with the superintendents, the development of a potential solution was given a high priority within the districts and was an incentive for district and school administrators and specialists to participate.

In phase two, key district administrators and specialists were invited to attend a similar type of session. Personnel represented both the areas of curriculum and technology. A couple of the superintendents were able to attend and participated with their district staff. The participation of the two superintendents also greatly assisted in emphasizing the importance of the issue with district administrators and teachers.

Phase three emerged as a result of two Requests for Proposals (RFP): a Goals 2000 grant and a Technology Literacy Challenge grant. Representatives from each district and the university jointly wrote proposals for each grant. This collaboration was successful in obtaining funds to support this project to provide professional development for better technology integration and development of professional development sites developed by the team.

A Professional Development Model

The crux of the professional development effort was the identification of Professional Development Sites (as opposed to Professional Development Schools) staffed by teachers who were using technology in their teaching in a manner worthy of emulation and replication. These sites were located throughout the six districts to encourage interdistrict collaboration and exchange of knowledge. The sites included teachers from K-12: elementary, middle/junior high, and senior high schools. Also, a number of disciplines and content areas were represented.

These teachers, who were identified as Technology Mentor Teachers (TMTs), were currently using and integrating technology within their classrooms. Many had learned on their own over the years and have been teacher leaders in technology in their schools and/or districts. Many were knowledgeable and represented a variety of ways technology could be integrated. The teachers were identified by district personnel because of their technology knowledge and use as well as their willingness to share with other teachers.

The primary thrust of this professional development model was that what classroom teachers need was continued support during their development of technology integrated instruction. Someone needed to be available at a moment's notice or an email message away to answer questions of any nature. Thus, the notion of a Technology Mentor Teacher was developed—a classroom teacher who was readily proficient and comfortable in using and integrating technology into the classroom.

To begin the project, an initial orientation session was held where the TMTs were introduced to concepts of effective mentoring as well as the general procedures they would follow. Having visitors come into the classroom can be effectively managed and not be distracting to either the TMT and/or their students. Also, expectations for the TMTs were outlined during the session.

Essentially, the TMT project was designed to provide the following opportunities for professional development:

Each TMT was to be available to work with individuals or groups of teachers to provide specific ideas and direction in which technology could be effectively integrated into the curriculum. This included scheduling visits to the TMT classrooms to view the technology integration in action as well as to participate training and demonstrations of technology outside of the class time. The relationship between the TMTs and teachers was to extend beyond just attending a workshop or demonstration or one-shot session.

The Technology Mentor Teacher was available to assist teachers in any way possible. Funds from the grants were used to provide substitutes for the TMTs to release them from their classrooms so that they could go and train other teachers. And these teachers were also provided substitutes so that they could visit the TMT's classroom sites and view how technology was actually being used and integrated into the curriculum.

Furthermore, all teachers set up e-mail accounts encouraged to disseminate information via individual e-mail, listserv, and project website, as well as other means of communication. The listserv provided a forum for the TMTs to exchange information, ideas, and to ask questions which others might be answer.

TMTs could also set up workshop sessions and conduct training sessions where they were needed. In certain instances, these sessions were helpful for classroom teachers and administrators who did not have a vision of how technology could be integrated. Therefore, this traditional strategy was used as to establish awareness. Then, specific assistance was available as described earlier.

Preservice teachers from Weber State University were also given assignments to visit the TMTs so that they can actually see how classroom teachers were using and integrating technology. This opportunity supported what the preservice teachers were learning in their instructional technology class.

For their participation, each TMT received a small stipend as well as funds to augment their technology and/or software inventory in their classroom.

For the rest of the first project year, the TMTs formalized what they were doing and were preparing to mentor teachers. A website for the project was established in which all the TMTs and their areas of specialization were posted. Procedures were provided on the website for teachers to use in making arrangements to visit a TMT.

The identification of TMTs within the local districts provided a great setting to send pre-service teachers to view model technology use and integration. Often it is difficult to identify good uses of technology within classrooms for pre-service teachers to watch and then it is usually a problem for several students to visit a class because the teacher doesn't have the time or interest to explain everything. But having TMTs available that had both the time and interest to explain and demonstrate the uses of technology really provided an excellent resource for the university teacher education students.

Year Two and Action Research

During the second year of the project (which is in progress), the TMTs were brought together with district technology leaders to share and update information. This provided a forum for collaboration within the TMTs as they were able to find others that were working in similar areas or other areas of interest. District personnel were able to stay abreast of what was taking place in their districts and other districts and help with directing teachers to TMTs that would provide useful examples. Technology directors were also able to inform TMTs of current district areas of interest and resources that were available related to their use of technology. K-12 classroom teachers also attended the session to develop a vision of what was possible.

Also, during this second year, TMTs and interested teachers will continue their technology integration efforts through the development and implementation of Action Research projects. This is a major aspect of Goals 2000 and the TMTs will be inserviced on how to identify and develop action research (Calhoun, 1994). This will be the initial efforts to measure effectiveness, at least at the classroom level.

Summary

Though far from being complete, this project is an example of one university and several school districts joining together to meet the technology needs of K-12 classroom teachers. Faculty members from the university participated in the process and orientation session as well as in the project evaluation phase. But the university did not provide the leadership in this particular collaboration but was an equal partner. One of the districts did assign an administrator to oversee the administration of the projects.

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Edu-Tech Connect: A Win-Win Endeavor

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Abstract: A current issue in teacher education is how to develop meaningful instructional experiences that incorporate technology in educational settings for in-service and pre-service teachers. Central to the development of such experiences for pre-service teachers is the need for college professors in all subject areas to use technology as an instructional tool. This paper will describe how an on-going, collaborative relationship between Harris-Stowe State College and Gateway Elementary Math, Science, and Technology Magnet School resulted in the creation of the Edu-Tech Connect Project. This project has focused on activities that capitalize on the strengths of the two institutions and faculties while addressing the needs of pre-service and in-service teachers. Central to this project is the formation of technology learning communities composed of college faculty members, classroom teachers, and teacher candidates. The paper will focus on the objectives, components and implementation of creating such a targeted learning community.

Introduction

Schools in the United States will need an estimated 2 million new teachers in the next decade. Many educational leaders believe that any hope of realizing the potential of new technologies on student learning and achievement rests on how well these new teachers are prepared to integrate technology effectively into their teaching. At the same time, recent studies on the integration of technology in education point to failure on the part of many college teaching programs to adequately prepare new teachers with the skills and knowledge necessary to use technology and to integrate technology into teaching and learning activities (CEO Forum 1999; International Society for Technology in Education 1999; National Council for Accreditation of Teacher Education 1997; U. S. Congress, Office of Technology Assessment [OTA] 1995). The funding by the U. S. Congress of the Department of Education's initiative, "Preparing Tomorrow's Teachers to use Technology," further recognizes the seriousness of the problem and the need to assist colleges in addressing this problem. This paper describes ways one college, supported by school and business partners, is attempting to better prepare new teachers to use technology in educational settings.

The college, Harris-Stowe State College, and Gateway Elementary Math, Science & Technology School, the college's preK-5 partner school in this endeavor, have built a relationship over the past four years that supports professional development and collegiality among college faculty and classroom teachers. This relationship connects two institutions with very different histories. Harris-Stowe has over a 100-year history of preparing teachers, while Gateway is a magnet school in the fifth year of its existence. The partnership builds on the strengths of each institution to address a need that ultimately benefits each partner. The two institutions have joined and accepted responsibility to work together to enrich the preparation of pre-service teachers. The supportive interactions between the college faculty, teacher candidates and classroom teachers include all the

ingredients for the natural formation of learning communities whose efforts focus on the instructional improvement of the students the institutions serve.

Edu-Tech Connect Project

In spring 1999, Harris-Stowe State College, Gateway Elementary Math, Science & Technology School of the St. Louis Public Schools' system, MicroAge and Bank of America formed a tripartite consortium, the Technology Learning Consortium (TLC), to explore and attempt to address the problems of preparing new, technologically literate teachers. The result of this collaboration among higher education, preK-5 education and business professionals is the Edu-Tech Connect Project, a project that capitalizes on the strengths of the consortium members. The main goal of the Edu-Tech Connect Project is to prepare future urban classroom teachers with the knowledge and skills necessary to use technology effectively to support and enhance learning and instruction. While the initial project includes only a preK-5 partner, the project will expand in later years to include both middle and secondary schools. This project offers one model for simultaneous transformation of education and technology use across the curriculum in teacher preparation programs and preK-12 schools.

As the lead organization in the Edu-Tech Connect project, Harris-Stowe State College (HSSC) has a long history of preparing teachers for positions in the metropolitan St. Louis area. The typical pre-service teacher enrolled at HSSC is a non-traditional age, minority student. Through a series of surveys and focus groups, designers of the Edu-Tech Connect Project identified areas in pre-service teacher's technology experiences at HSSC that needed improvement. A majority of students surveyed in spring 1999 sections of the one, required instructional technology course reported that they had not used computers in their K-12 education, and they rarely saw technology used in college classes outside of computer classes or in most K-12 site-based experiences. Faculty members in all disciplines indicated that while many of them have some knowledge of technology, only a small percentage were comfortable with the systematic use and infusion of technology into classroom instruction. Based on these findings, a major goal of the Edu-Tech Connect Project is to prepare faculty and teacher candidates with the knowledge and skills to infuse technology into the curriculum to improve teaching and learning. The college contains a small core of faculty, with an extremely high level of expertise and experience in education and instructional technology, and they have assumed leadership in the project.

Gateway Elementary Math, Science, & Technology School is a magnet school within the St. Louis Public Schools' system. Gateway is housed in a building constructed in 1995 that was designed to enhance and promote learning in an interactive setting. Students enrolled in the school are selected through a lottery system and come from the surrounding urban and suburban areas. The school is unique in the level of modern technologies available in the school and the integration of technology into daily classroom instruction. The administration and faculty of Gateway School are committed to sharing their expertise and resources to support the success of the project. The instructional coordinator of the school is co-director of the project.

Harris-Stowe State College and Gateway Elementary School have supported each other through a variety of collaborative activities designed to utilize the strengths of the two institutions while addressing the needs of faculties and students at both institutions. These activities include: (1) professional development opportunities for Gateway staff through courses and workshops offered by HSSC faculty members, (2) the hosting and support of large cohorts of HSSC student teachers by Gateway staff, (3) opportunities for micro-teaching by HSSC students at the elementary school, (4) hosting of HSSC methods classes by Gateway staff, (5) partnering in the writing of grant proposals and implementation of grants, (6) sharing of resources and information among college faculty and classroom teachers, (7) tutoring support provided by HSSC students to Gateway students, and (8) creation of applied curriculum-based projects by HSSC students for use with Gateway students.

The Technology Learning Consortium includes two corporate partners who are responding to a national outcry for businesses to take a more active role in supporting urban schools, particularly in cities undergoing urban renewal. Representatives of the two corporate partners, MicroAge and Bank of America, share a commitment to increasing the effective use of technologies in the schools, and they view this project as one way to advance the quality of urban teacher preparation. MicroAge's local educational specialist has been actively involved in the design of the project and has pledged time and support in developing additional consortium partners in order to sustain and expand the Edu-Tech Connect Project. Bank of America is

contributing the services of members of its Management Information Systems Department to provide technical assistance to the project.

The Edu-Tech Connect Project supports the creation of comprehensive learning communities in which technology connects to and supports learning and experimentation by teacher preparation candidates, college faculty, and preK-12 classroom teachers. While this paper emphasizes the learning communities, the project contains several additional components. These include: (1) an intensive summer technology camp, (2) mini-grants to provide resources for faculty integrating technology into courses, (3) creation of an electronic discussion area to foster sharing of expertise and resources and ideas on integrating technologies into teaching, and (4) review of both the teacher education preparation curriculum for all certification programs and the entrance and exit requirements for the professional level of the program at Harris-Stowe. In additional to the learning communities, teachers from Gateway Elementary will be active and equal participants in the summer technology camp, the electronic discussion, and the review of the teacher preparation curriculum and exit and entrance requirements for the professional level at Harris-Stowe.

Learning Communities

The key element of the Edu-Tech Connect Project is implementation of a pilot project involving the formation of two learning communities designed to nurture the growth of expertise among faculty and student members in the use of technologies and integrating technologies into teaching. Each ten member learning community is composed of Harris-Stowe faculty members, Harris-Stowe teacher candidates, and preK-5 teachers, with varying degrees of technological expertise. Teachers from a non-magnet elementary school have been invited to join the Gateway teachers in the learning communities. Members of the MIS department at Bank of America provide technical support for each of the communities. In addition to face-to-face meetings, members of the communities interact using email, discussion lists, and teleconferences. Each member of the learning communities is equipped with a laptop computer and Internet access to facilitate their work and communication. With the learning community support, the HSSC faculty members are developing and implementing ways to increase the use of technology within the courses they teach. The HSSC students have the opportunity to assist in the implementation of technology-based lessons, and to design lessons and materials to be used during student teaching with preK-12 students. The preK-5 faculty members are sharing and expanding their expertise in integrating technology into the preK-5 curriculum. The MIS support members serve as technical advisors to the learning communities. They are gaining an increased understanding of ways technologies are integrated in all levels of education and the role that a business partner might play in assisting in that integration.

Through the use of pilot learning communities, members of the Technology Learning Consortium are attempting to provide "a culture of adult learning and mutual support" (McKenzie, 1999, p. 71). In the initial meeting of the learning communities, members were surveyed on their levels of comfort and expertise using technology, and on the expectations they brought as members of a learning community. The learning communities enable individuals with different skill levels to assist each other in the learning of technology and ways to integrate it into teaching and learning activities. Learning occurs in both informal and formal settings, with outside support and expertise provided when requested by members of the learning community. Learning communities form a supportive environment for members with diverse experiences and ideas about technologies and teaching to experiment, share expertise, and learn together in ways that sustain the different learning styles of the members. The strength of a learning community lies in the emphasis on members teaching each other what needs to be learned and at a pace that meets individual needs and preferences (McKenzie, 1999). The learners are in control of their learning. Emphasis in the pilot learning communities is on supporting projects and results that have a direct impact on teaching and learning. Participants' experiences form the backdrop for developing and reflecting on these projects.

An evaluation plan that carefully evaluates and monitors the successes and problems of the initial pilot communities is critical to the success of future learning communities. Inherent in the formation of learning communities with membership from diverse groups, i.e. college faculty, college students, preK-12 teachers, and business personnel are many challenges. If a learning community is to be successful, membership must be "flat and non-hierarchical" (McKenzie, 1999) in the sense that all members are equal partners. The learning communities should have an impact education that radiates beyond the individual members of the communities. The focus of each member of a community must be on ways to use technology to improve teaching and

learning, not simply on the development of technological expertise. Secondly, each member of a learning community must recognize and accept the responsibility to take the acquired skills and knowledge back to their circle of professionals. Each member must be willing to continue to build on acquired skills and knowledge, even after participation in a learning community ends.

The Edu-Tech Connect Project is indeed a win-win endeavor. The project's activities are designed to support a cycle of increased integration of technology into teaching and learning activities with the ultimate goal of instructional improvement for the students the institutions involved serve.

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EDUCATIONAL PARTNERSHIP BETWEEN TEACHER-COLLEGES AND PRIMARY EDUCATION: WORKING TOGETHER ON THE REALIZATION OF EMERGING PRACTICES

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Abstract: In 1998 the Ichthus University started the Explo project that resulted in an innovative teacher-training course. The course is set up as a profession-oriented learning center. One of the projects that benefits the course is the development of the ICT-E (ICT-Educational) Expertise Center. The goal of the Expertise Center is to integrate the educational use of ICT in primary education and in the mentioned teacher-training course. The expertise Center emphasizes on the innovative power of ICT. Integration of ICT-E should be reached through the creation and sharing of knowledge. To give this goal more visibility we can use the concept of educational partnership.

Educational Partnership

The concept of educational partnership can be divided in three different areas, namely:

1. Partner co-operation: The Expertise Center has contacted several primary schools to make an investigation of innovative educational projects. A selection of schools was offered a contribution to the projects in the form of educational partnership. This means that teacher-trainers, students and primary school teachers work together as knowledge partners. Each primary school has a separate partnership with the Expertise Center. Such partnerships enable schools to participate in a learning community stimulated by the Expertise Center. Example: Third-year and fourth-year Explo students make (small-scale) contributions to the innovative projects initiated by their placement schools. Placement supervisors (primary school teachers) coach the students during this process. Coaching is done in co-operation with teacher trainers from the Expertise Center. External experts may also be involved. The described working method creates concrete (teaching) activities; pupils can develop their own interests and talents, both individually and as teams.
2. Creation of knowledge: Partner co-operation will lead to an optimization of ICT usage in primary education. This optimization should become a huge challenge for primary schools. The possibilities that ICT offers are not only used to benefit a pupil-monitoring system, but also to change the learning process concerning a particular subject. This means changes both in the ICT application and in learning contents with the creation of knowledge as a final goal. Knowledge is achieved via processes and products. Such products can be described as educational contents. The described innovation projects require a cultural change; current learning strategies have to be abandoned. Example: The use of computers by children to work and learn independently. Children can (either in small groups or on their own) select and compose the contents of their education. When considering the subject of World Studies, this would mean, the use of CD-ROMs and the Internet, allowing the subject matter to be tied no longer to textbooks. Children can find and explore their own subject matter. The 'double' innovation is the use of technology combined with the use of a new teaching and learning method.
3. Flexible and powerful database: one of the goals of the Expertise Center is to give partner institutions the possibility to learn from each other's projects. To enable this (and much more) a powerful web-enabled database should be developed. A prototype of such a database can be shown at the moment. The final database opens up knowledge and experiences acquired through the innovative projects. Both process characteristics (development and introduction of an idea) and product characteristics (characteristics of innovative ICT use) are recorded. At first, the database will be filled with the projects of the knowledge partners. The final goal, however, is to include examples of non-partner schools in the database. It must be possible for national and international parties involved in primary education to supplement the examples presented with their own experiences and ideas. The educational partnership is based on a learning-as-you-

work principle; the continuous expansion of a knowledge pool by students, primary teachers and teacher-trainers.

The Expertise Center in practice

The Expertise Center will carry out the following activities:

- 1999/2000 Realize and monitor first 6 projects with knowledge partners
- 1999/2000 Develop and test database prototype
- 2000/2001 Evaluate and update steps 1 and 2
- 2000/2001 Realize second 6 projects with new knowledge partners
- 2000/2001 Develop and implement final database

After step 5 non-partner schools will be able to register their projects in the database. The Expertise Center will see to a correct and clear description and evaluation of projects. The Center may involve external experts for this purpose. The co-operation with schools during the first step will concern projects in the field of:

- New learning concepts in which ICT play a central part;
- Adaptive education in core subjects;
- Learning concepts for kindergarten;
- Second languages;
- Environmental education (human and nature);
- Art orientation.

Results of the ICT-E Expertise Center

The Expertise Center enables school teams, students and trainers to enhance knowledge concerning the integration of ICT and educational developments, by offering products and experiences. The final database will function as a 'shop', stocking a whole range of interesting projects. Those projects may serve as examples for primary schools, although they are not total solutions. The projects are offered as half fabrics that still need to be finished. The database also offers the possibility to start discussions between project designers and database users, which means that the designers can function as consultants for primary schools.

Originality and exemplary character

The following points explain the originality and exemplary character of the project:

- The working method and usage of students as described was determined during the Explo project. The Expertise Center plays an exemplary role in the Netherlands towards other teacher-trainer institutes and as such has a distributional task;
- The concept of educational partnership is not totally new. Businesses and Universities developed this concept long ago. However, introducing the concept in primary education is new;
- The interactive database in which both process and product data are recorded. A parallel study conducted by the University of Twente (The Netherlands) will decide the way in which this is done. Where possible, this study will use the analysis and describtion instruments that were already developed by Voogt and Odenthal (1998) as a result of their EP (Emergent Practices) study.

Parallel study by the University of Twente

The parallel study includes:

1. An analysis and description of the educational characteristics of the products that have been developed. This concerns:
   - The roles of students and trainers;
   - The relationship with other parts of curriculums of primary schools and the teacher training course;
   - Characteristics of the infrastructure (organization and instrumentation).
2. An analysis and description of the implementation of the projects at the teacher training course and at the partner schools. This concerns the process characteristics, such as:

- Characteristics of the school;
- The attitude and expertise of teachers (both teacher trainers and primary educational teachers);
- 'Technical' preconditions at the teacher training course and the partner schools (number of computers, available software, technical support staff, etc.).

1. Definition of functions and components of products for the development of the database.

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RESULTS OF EDUCATIONAL PARTNERSHIP: STUDENTS AND TEACHERS WORKING TOGETHER TO REALIZE EMERGING PRACTICES

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Abstract: In this poster products and results of the expertise center will be shown and evaluated. The meaning of the center is explained in the paper as "Educational partnership between teacher colleges and primary education"

The ICT-E Expertise Center

In 1998 the Ichthus University started the Explo project that resulted in an innovative teacher-training course. The course is set up as a profession-oriented learning center. One of the projects that benefits the course is the development the ICT-E (ICT-educational) Expertise Center. The goal of the Expertise Center is to integrate the educational use of ICT in primary education and in the mentioned teacher-training course. The expertise Center emphasizes on the innovative power of ICT-E.
Integration of ICT-E should be reached through the creation and sharing of knowledge. To give this goal more visibility we can use the concept of educational partnership. This concept can be divided in three different areas, namely:

Partner co-operation

The Expertise Center has contacted several primary schools to make an investigation of innovative, educational projects. A selection of schools was offered a contribution to the projects in the form of educational partnership. This means that teacher-trainers, students and primary school teachers work together as knowledge partners. Each primary school has a separate partnership with the Expertise Center. Such partnerships enable schools to participate in a learning community stimulated by the Expertise Center.

Creation of knowledge

The partner co-operation will lead to an optimization of ICT usage in primary education. This optimization should become a huge challenge to primary schools. The possibilities that ICT offers, are not only used to benefit a pupil-monitoring system, but also to change the learning process concerning a particular subject. This means changes both in the ICT application and in learning contents, with the creation of knowledge as a final goal. Knowledge is achieved via processes and products. Such products can be described as educational contents. Working on the described innovation projects requires a cultural change; current learning strategies have to be abandoned.

Flexible and powerful database

One of the goals of the Expertise Center is to give partner institutions the possibility to learn from each other's projects. To enable this (and much more) a powerful web-enabled database should be developed. A prototype of such a database can be shown at the moment. The final database opens up knowledge and experiences acquired through the innovative projects.

Both process characteristics (development and introduction of an idea) and product characteristics (characteristics of innovative ICT use) are recorded. At first, the database will be filled with the projects of the knowledge partners. The final goal, however, is to include examples of non-partner schools in the database. It must be possible for national and international parties involved in primary education to supplement the examples presented with their own experiences and ideas. The educational partnership is based on the learning-as-you-work principle; the continuous expansion of a knowledge pool by students, primary teachers and teacher-trainers.

The Expertise Center in practice

The co-operation between schools will concern projects in the field of:

- *New learning concepts in with ICT play a central part*: 'De Fontein', school for primary education, in The Hague: Due to the already used integral approach of education towards ICT this school develops in a structural way the guiding of children during the learning process;
- *Learning concepts for kindergarten: 'De Repelaer'*, school for primary education, in Dordrecht: This school is anxious to integrate ICT in the lower forms. Goal is to create a structural contribution in the development of young children and not to use ICT as a tool to concur with more traditional learning programs;
- *Second languages*: De Groen van Prinstererschool', school for primary education, in Rotterdam: In this multi-ethnic school teaching is carried out in a child adaptive way. The goal of the partnership is to create a course of language development with the use of ICT as a motivational factor;
- *Environmental education (human and nature)*: 'De Bongerd', school for primary education, in Zuidland: This school trains the children to do their learning as independent as possible. They want to use ICT as a tool to collect information and to control the internal and external communication with their partner school. This is a school on the Antilles (on Aruba). The theme "Water" is brought up by the school to be the subject in an e-mail project together with the Antillean school;
- *Art orientation*: 'De Stelberg', school for primary education, in Rotterdam: The chosen theme is art education and complements a wish of the Ichthus University. Earlier this year the University received the 'Jan award for it's art education focused on children in a multi-ethnic community.

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Professional Staff Development Models That Work!

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Abstract: The Plainview - Old Bethpage Central School District recognizes that there is a technology gap between analog oriented teachers and digitally oriented students. In order to empower our teachers with the ability to close the gap, the Plainview - Old Bethpage Central School District has created a SEED program, whereby teachers are Supported, Encouraged, Empowered and Developed with an active professional development program. Focusing on the three areas of Technology Integration, Independent Research, and Math, Science & Technology, we provided the teachers with the training and support necessary to successfully raise the level of instruction. This presentation provides practical information on the following topics: setting goals for a professional development program, working with other school districts and universities, and technology and its impact on professional development and instruction.

Introduction

School districts across the nation are faced with important educational initiatives that address improving curricula and teaching methods. At the forefront is the need to improve science and math proficiency, use of technology, Independent Research techniques and higher order thinking skills. Difficulties arise in preparing teachers and students to face these challenges. We focused on three areas this year: Technology Integration; Independent Research and Math, Science & Technology. We are gaining ground in all three areas and attribute the success to long-term planning and quality staff development. Each program has a specific formula for providing teachers with the training and support necessary to raise the level of instruction. We realized very early on that in order for change to take hold, teachers needed more that one workshop or course offering. Continuous contact with teachers and administrators is an essential ingredient in bringing about change.

The SEED Program

The Plainview - Old Bethpage Central School District recognizes that there is a technology gap between analog oriented teachers and digitally oriented students. In order to empower our teachers with the ability to close the gap, the Plainview - Old Bethpage Central School District has created a SEED program, whereby teachers are **S**upported, **E**ncouraged, **E**mpowered and **D**eveloped with an active professional development program. The SEED Program recognizes that change is a continuous process that teachers will embrace with an active professional development program.

Before we began our professional development program, the normal reaction from our teachers in regard to change was "don't bother me." As we began our program, with its many varied methods of how can I use this in my classroom?" As our program continued to grow, encompassing model lesson demonstrations, teacher mentors, conference attendance and professional hours our teachers began to ask, "how will this affect my students?" At the completion of the program, the prevailing

Independent Research as a Staff Development Tool

Independent research projects are quite different from the projects usually found at school science fairs. Independent research projects are not simple models or reports. Instead independent research projects are actual laboratory research projects created by a student or a team of students using the scientific method. Independent research projects are open – ended. The problems that the students pose have no set answers. It is important to note that all students in all curricula areas, K – 12 are encouraged to participate in the Plainview - Old Bethpage Independent research program.

Students who work on independent research projects enjoy many benefits. These include, but are not limited to: learning about "real" science and research; helping students determine career choices; learning how to write a scientific paper; learning how to present data; creating stronger college applications and offering scholarship opportunities.

The independent research program motivates, invigorates and renews teachers. The teachers who work with students on independent research projects discover that they are working with motivated students; they are working outside the standard curriculum, they have the opportunity to work with local industries and universities; they are working with the newest techniques, ideas and equipment; and that they are working collaboratively with their students in a teacher/mentor or teach/coach role rather than as a lecturer. These practices revitalize teachers and bring them into the digital era, since students, teachers and mentors communicate with one another via email.

Many of the student projects can be entered into the national research competitions. Teachers and students use the Internet to search for competitions, background information and to "talk" to experts in the field. In addition, the national competitions provide a forum for the students and teachers to discuss their research and results.

MSTe; Math, Science and Technology Project in the Elementary School

The MSTe project is a five-year teacher enhancement project created to develop models for the integration of mathematics, science and technology into the elementary schools. Twenty – one school districts in New York were chosen to participate in a collaborative $7.4 million grant involving the State University of New York at Stony Brook, Hofstra University, Brookhaven National Laboratory, the New York State Education Department and the Boards of Cooperative Education (BOCES). The goal of the MSTe project is to integrate math, science and technology into the elementary classrooms. Teacher instruction will move from the textbook, lecture model to inquiry and design based problem solving.

Three lead teachers were selected from each of the twenty-one participating school districts. These lead teachers received two years of sustained enhancement activities from leading researchers and college professors. The teachers were trained in the necessary methodology to enrich students' experiences in mathematics and science with technology experiences. In the third and fourth years of the MSTe project, the three lead teachers will train sixty teachers in their home district. In the 5th year, the project will go statewide.

The Plainview - Old Bethpage School District supports its teachers in the MSTe project in the following ways: increasing planning time, allowing for intra-school visitations, providing computer and Internet access, and holding district level awareness workshops for interested staff. In addition, the Plainview - Old

Bethpage Central School District has shown its support for the MSTe project by providing additional funds for MSTe teachers, providing monthly after school reflection meetings, supporting a two week summer enhancement workshops and providing for inter-class visitations.

Conclusions

The Plainview - Old Bethpage Central School District has demonstrated that professional development models can be created to **S**upport, **E**ncourage, **E**mpower and **D**evelop teachers. Our efforts in staff development have led to the use of technology in the classroom that enhances curriculum; a district-wide, K – 12 initiative for Independent Research, and a K-6 Math, Science & Technology training program for teachers. In addition, our professional development program has increased expectations, improved teaching, raised achievement and elevated teachers. Our professional development methods have been extremely successful and have been copied by many other school districts in our county and our state.

Acknowledgements

Thanks to the strong support from the Plainview - Old Bethpage Board of Education, we have experienced enormous success in our school district. The Board of Education has provided us with a mission statement, well defined goals and adequate funding for our professional development programs.

Technology and Beyond: Teachers Learning through Project-Based Partnerships

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Abstract: Project-Based Teacher Partnerships is a model for teacher professional development to help teachers doing technology-supported project-based learning in the Challenge 2000 Multimedia Project. Experienced teachers team with a small number of less-experienced teachers to form a partnership. The partnership plans a project that the teachers will execute together in all the partners' classrooms. The partnership submits a project proposal to Challenge 2000, and approved proposals are eligible for equipment and software grants and stipends. Evaluation data shows the model is effective in building technology, pedagogy, and leadership skills and collaboration practices that support teacher learning.

Introduction

Introducing technology into the classroom can be overwhelming for teachers. We know that training in hardware and software, even when available, only does part of the job in preparing teachers to use technology (Becker 1999). In order to teach effectively with technology, teachers need new models of pedagogy, logistics, and curriculum. The demands placed on a teacher learning all this at once are considerable.

This paper describes a model, the Project-based Partnerships Model (Partnerships), for helping in-service teachers develop expertise in the use of technology to support deep content-area learning. The paper explains the model and presents data to show that the model was effective in helping teachers develop technology skills, pedagogy and curriculum, and leadership and collaboration skills.

Teachers Learning From Other Teachers

The value of teachers learning from and with other teachers has been well established in the research literature. Teachers have explored learning together in teams as small as two, in school-to-school partnerships, and in networks of hundreds of teachers. Teachers in all configurations cite the value of other teachers' practical knowledge, but are most enthusiastic about breaking through the isolation that characterizes traditional teaching arrangements. Arrangements abound. In mentoring, a more experienced teacher advises a less experienced teacher. In collaborative projects, teachers learn by creating something together . Teachers also learn through collaborative evaluation of student work, and through collaborative study of subject matter (Ball 1996; McLaughlin and Oberman 1996; Lichtenstein, Weissglass et al. 1998; Stein, Silver et al. 1999).

The Partnerships model was designed to incorporate aspects from many of these models to help teachers acquire comfort and sophistication in their use of technology to teach core subjects. As in mentoring models, a lead teacher serves as a source of technology expertise. The other teachers in the partnership may be experts themselves in curriculum or pedagogy, so the learning is not just unidirctional. Partnerships are also like models in which teachers work together in curriculum, design, and assessment, because the partnership designs a curriculum unit together and evaluates its implementation day-to-day. Finally, as with teacher networks, partnership's activities are partially structured by an organization larger than the partnership (the Challenge 2000 Multimedia Project), which provides a curriculum model, additional technology support, equipment grants, a planning process, and stipends for participating teachers.

The purpose of the research reported here was to understand how the partnerships functioned, what kinds of support they needed, and how the model might be improved.

History: The Challenge 2000 Multimedia Project

The Partnerships model was developed as part of the Challenge 2000 Multimedia Project. The Challenge 2000 Multimedia Project (funded by a Department of Education Technology Challenge Grant) has developed a model for student project-based learning with multimedia, referred to as PBL+MM. PBL+MM involves students in learning core content by producing multi-media presentations related to that content. The PBL+MM model includes seven dimensions that define a PBL+MM activity: challenging multidisciplinary curriculum, sustained student effort over an extended time frame, student decision making, collaboration, real-world connections, ongoing assessment, and use of multimedia application programs.

The Multimedia Project sponsors a variety of professional development activities for its cadre of teachers. From the beginning, the project has adhered to a philosophy of growing grass-roots expertise in its cadre of teachers and encouraging teacher-to-teacher learning (Means and Golan 1998). By Year 4 of the project, professional development activities were planned and implemented almost entirely by teachers and Technology Learning Coordinators (TLC's), who are teachers on leave to provide technology and curriculum support to cadre teachers. These activities included teacher work days, summer institutes, dinner meetings with guest speakers, technology training days, and other activities based on needs of smaller groups of teachers.

In the fourth year of the grant Challenge 2000 staff were faced with the task of greatly expanding the number of teachers using the PBL+MM model. TLC's and project staff developed the Partnership model to take advantage of the significant expertise that had grown in the cadre by encouraging all experienced teachers spread the PBL+MM model to other teachers at their school. Thus the model served a dual function of recruitment and professional development.

Teachers who had already used the PBL+MM model with their students (called lead teachers) formed partnerships with one or more other teachers in their schools. Each partnership planned a project together that each partner implemented in her classroom. Participating teachers received a $500 stipend for completing the project in the classroom, and partnerships were eligible for mini-grants to cover hardware and software necessary for the projects. To participate in the program, teachers had to submit a detailed plan for the project-based unit they would do together.

In the 1998-1999 school year, 73 teachers participated, forming 28 partnerships. The lead teacher received an extra stipend for supporting his or her partners and helping them learn the technology necessary for their projects. At the end of the project, all teachers had to complete a survey and submit completed student multimedia projects.

Methods and Data Sources

The partnership model was evaluated using four data sources. First, all teachers who participated in a project were surveyed. Second, a researcher attended at least one meeting of each of three partnerships (a total of six meetings). Third, the same researcher interviewed five participating teachers to explore their experiences more in-depth. Fourth, researchers visited the classrooms of four participating teachers at least once while they implemented their units. The researcher visited the classrooms of two of these teachers extensively during the two months of their units' implementation. The interviews, meetings, and classroom visits were used both early on to define the issues that should be surveyed, and later to add perspective and insight to analysis of the survey data. The classroom visits were invaluable in seeing how issues that were raised in partnership meetings affected classroom practice, and how issues that arose in the classroom made their way through partnerships.

Results

There are three sets of findings. The first set indicates that the model was successful in helping teachers develop in their capacity to use technology and more generally as teachers. The second set provides insight into the aspects of the model that were crucial to its success. The third set discusses important connections between the partnership model and other kinds of teacher professional development and support.

Findings about the model's success

The Partnerships model is significant in its combination of teacher collaboration with project-based learning. Teachers' learning was structured by a classroom project they designed and then did with their students, rather than being structured around a piece of technology. This lent a sense of focus and vividness to learning technology. Teachers did not have to wonder, as they might in a stand-alone technology workshop, how they would use the new technology they were learning. Because the partnerships offered chances for experienced teachers to lead and collaborate, the model had something to offer everyone, expert or novice. Collaboration made technology use possible for teachers who would have considered it beyond their reach working alone. Finally, the project-based nature of the partnerships limited the scope of the effort, making it much more manageable to try out the PBL+MM model. When the project was over, teachers could turn their attention to other things.

Teachers found the experience valuable; 97% said they would like to continue their partnership next year. Teachers learned about technology, but they also learned much more. Teachers cited as benefits: increased skill in using particular technology applications and/or hardware (56%); how to implement project-based learning (54%); new ideas for taking a more facilitative role within the classroom (52%); and specific ideas for the curriculum (52%).

Partnerships took advantage of the expertise of both lead teachers and their partners. Partnerships seemed to have something to offer teachers of many levels of expertise. Lead teachers and new teachers alike said they learned curriculum, pedagogy, and technology from their partners, although new teachers were more likely than lead teachers to learn these. However, when asked what the most significant thing they learned was, lead teachers were far more likely to cite leadership and collaboration experience, while new teachers were more likely to say curriculum, pedagogy, or technology was most significant.

The process was effective in helping teachers complete projects. Of 28 partnerships, 24 (86%) successfully completed their projects. These 24 successful partnerships represented 95% of the 73 participating teachers.

Important aspects of the model

The model owes its success to many factors. Five of these seemed especially significant, in that their importance was supported by more than one data source and/or high percentages of respondents to survey questions.

1. The application process: Interviewees explained that having to prepare the project proposal lent a formality to their arrangement, and encouraged the detailed planning that many of the survey respondents said was crucial to success. Many teachers mentioned the importance of planning as a lesson learned or as advice to someone planning a PBL+MM unit. Furthermore, by going through the application process, teachers were ready to go when approval came, and meetings could focus on the day-to-day planning rather than questions of what the project should be.

2. Focus on a project: All partnership meetings we attended were extremely focused and efficient. Our observations and survey data show that partnerships tended to cover a wide range of topics when they met, but the demands of the project itself structured their conversation and kept it productive. Teachers gave each other advice and problem-solved together, with the necessity of keeping a class of students productively engaged always in mind. It was also important that the teachers were operating in the context

of an ongoing unit, which served as a living laboratory for partners to test new ideas and increase their skills. Teachers would decide together what they were going to do tomorrow, and then go do it. Finally, the limited time frame of the project, and the fact that projects generally ended successfully, seemed to smooth over rough spots along the way in teachers' memories, so that remaining impressions were very positive. In interviews at the end of the school year, teachers expressed the feeling that they had accomplished something significant and difficult together, even though there were things they had to work out along the way.

3. *Self-selected, voluntary, local partners:* Teachers selected their own partners, and according to interviewees, tended to select teachers they had worked with before or were friendly with. Having partners be local – within the school – meant that partners were able to respond to the needs of their partners easily because they met in the halls or the teachers' lounge. In fact, 60% of teachers reported meeting daily, mostly through impromptu encounters. Many survey respondents mentioned the moral support as critical to their success.

4. *Flexibility:* Participants were free to decide what they needed and how to support one another. Partners most often met through impromptu encounters rather than scheduled meetings, which makes sense given teachers' busy schedules. When they met, they were most likely to discuss technology issues (83%), but at least 50% answered "every other meeting" or more for how often they looked at student work together, planned activities, or shared strategies. Interestingly, 71% said they discussed unrelated issues at least every other meeting. This finding is important, because observations and interviews confirm that the partnerships helped teachers expand the nature of their relationships with other teachers.

5. *Multimedia fairs:* The project held a series of multimedia fairs at the end of the year. The fairs were open to the public. As part of their agreement with Challenge 2000, partnership teachers were expected to exhibit their students' multimedia work at these fairs. This expectation did seem to be a factor in the success of the projects we watched. The approaching deadlines helped teachers give projects an ending point that also mattered to students. It led to another round of collaboration among partnership teachers as they worked to consolidate student projects from their classrooms and get everyone ready for the fair.

Connections to other development and support

Networks of support: Nearly all teachers cited some kind of support outside the partnership. This testifies to the importance of viewing any model for teacher professional development in context of other supports, barriers, and interventions. Teachers most commonly got support from Challenge 2000 TLC's (technology coaches). Other frequently mentioned sources of support were principals and other school staff, parents and other community members. A few had business or foundation grants, and some used support from the Web, including on-line communities and training.

Importance of other support: Teachers were asked in the survey to describe what kind of support they would have liked but didn't get. Teachers' most common responses fell into two categories. By far, the most common need was for more training, technical support, equipment, or computers. This was expressed as wanting additional help in the classroom as well as more one-on-one time with students. These needs are not surprising, given the complexity of software and hardware, and the continuing scarcity of equipment. Even though the situation was vastly improved over previous years, students' own needs to perfect projects they wanted to be proud of seemed to gobble time and resources. Oddly, the model itself exacerbated the problem in some places: all of a sudden three times as many teachers were vying for time in the computer lab at the same time.

The second most common set of ideas had to do with teachers' need to give individual help to students. This is a consequence of the PBL+MM model itself. The model calls for projects to incorporate student choice and design, ongoing assessment, and intensive technology learning. The great amount of student choice means that student needs quickly diverge from one another, since they are all working on unique projects. There is no longer any one-size-fits-all instruction, and teachers find themselves struggling to keep up with student needs. Likewise, ongoing assessment and technology learning all must

be tailored to student projects and require one-on-one or teacher-to-small group interaction. Learning how to manage these demands is difficult even for experienced teachers.

Conclusion

The Partnerships model provided a way for teachers to begin using technology to support student learning in core subjects. It was effective in drawing teachers in, keeping them going, and helping them finish projects successfully. It was also effective in developing a wide range of knowledge and skills simultaneously in a large number of teachers. It reduced isolation, provided opportunities for leadership, and reduced frustration with technology, and teachers seemed to have a lot of fun with their projects along with the stress they experienced.

The cadre as a whole continues to struggle with a variety of issues, including how to develop students' collaboration skills, how to design projects to insure higher-order thinking and deep learning, and how to assess hard-to-assess skills to prove that PBL+MM units are effective. Many teachers are continuing their partnerships for a second year, and project staff are using the partnership structure to develop and share solutions in its still-growing cadre.

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Design of the MIMIC Network for Preparing Tomorrow's Teachers

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Abstract: This paper provides an overview of the variables critical to the success of an Internet site design. The site under development represents one aspect of dissemination for the Modeling Instruction with Modern Information and Communications Technologies: the MIMIC Project, a U.S. Department of Education Capacity Building Grant. The site focuses on materials useful to the integration of technology into pre-service teacher education programs. Critical to the success of this Internet site is the development environment created to support participant collaboration. This development environment evolved from a variety of approaches established to encourage student and faculty involvement. Two aspects: 1) assembling the design team and 2) defining an appropriate environment for the design of the Internet site are detailed in this narrative.

Despite the growth of the number of computers in K-12 schools, less than 10% of recent graduates of teacher education programs feel competent to use electronic network capabilities (OTA, 1995). The technology instruction provided in teacher preparation programs tends to focus more on older and simpler software applications such as drawing programs or word processing rather than newer sophisticated tools like electronic networks or problem solving applications (Baron & Bruillard, 1994). As Internet access becomes more commonplace, teacher educators will become fluent in using networks much as they have become fluent in using word processors. However, fluency in the use of a technology does not necessarily translate into integration of that technology into teaching.

The Modeling Instruction with Modern Information and Communications: the MIMIC Project, a U.S. Department of Education Capacity Building Grant, is a project initiating inquiry into the issue of technology integration. The MIMIC project was designed to prepare pre-service teachers to integrate technology into teaching and learning. One of the goals of the MIMIC project is to create an on-line community to connect three populations: 1) teacher educators, 2) classroom teachers and 3) preservice teachers with the integration of technology in instruction. The MIMIC project began in the Fall of 1999. This paper focuses on the on-line community component of the MIMIC project and provides an overview of the activities that were considered in the design process of the MIMIC site. Special emphasis is placed on the creation and support of the design team. In particular, attributes of a design team and how design activities relate to creating an environment conducive to the integration of technology by teacher educators play a prominent role in this discussion.

The purpose of the MIMIC site is to provide online resources, project information, and online communications. The site supplies one form of dissemination for the project. The MIMIC site is the product of a collaboration among five institutions of higher education. The MIMIC site was developed by a collaborative team including faculty in educational technology and students enrolled in a Master Degree Program in Computer Uses in Education at Cleveland State University.

Developing the MIMIC site required the efforts of many individuals. Each individual offered specific talents and varying levels of understanding to the development process. Assembling a team of competent individuals was the first step toward successful development. To design a site that encourages use by novices lacking in technological expertise, we used a participatory design approach that involves users in the design

process. Establishing an appropriate environment is critical for successful design. Minimally this environment must support the goals of the site development while providing structure for the participation of designers and users. (Grudin, 1990)

Attributes of Design Participants - Hot groups

Although teams with the characteristics of dedication, creativity, passion, and high achievement can turn up in academic settings, the conditions must be right for their cultivation. Leavitt and Lipman-Blumen (1995) have named teams with these characteristics as "hot groups". Further they suggest that any group can become a hot group when 1) task obsession becomes a state of mind, 2) "We" dominates "I", 3) the organizational structure is more egalitarian than hierarchical, 4) members do multiple jobs, and 5) the groups are small. These five features served as the organizing criteria for assembling and cultivating a design team for the MIMIC Project Internet site.

Task Obsession

Task obsession is a complex phenomenon. One must first have a comprehensive understanding of the task at hand, the time frame available, and a belief that successful completion of the task alone is the reward. The two authors had a vision of what the Internet site could become but the form for this vision was open. What was required to affix a form to the authors' vision was a working group who shared a passion for seeing this vision come to fruition.

Cleveland State University offers a Master degree in Computer Uses in Education. The majority of students enrolled in this program elect to take comprehensive exams in lieu of a Master's project or thesis. Recognizing that many high quality students in this program had never considered the Master's project as a viable alternative, the authors approached students in three courses. First, a brief synopsis of the grant project was provided students to see if any students were interested in the Internet site design project. Second, ten students who self-selected to attend follow-up meetings on the project were informed 1) that the project would require time and effort well beyond the scope of normal classroom projects, and 2) that the project would extend beyond the Fall semester into the Spring semester. Students were discouraged from applying, if it appeared that they were not willing to commit substantial time out of class. Four students from one course indicated that they were up to the challenge. This group of volunteers was enthusiastic and viewed the task as an opportunity to apply their knowledge and technology skills to a real world problem.

The rationale for emphasizing the workload demands was twofold. First, the authors needed to insure that team members were aware of the scope of the task they were about to undertake. Second, the authors wanted to encourage the students who continued with the project to view themselves differently from the other students enrolled in the course. Although this second point sounds elitist, it is based on examples of successful design teams. For example, in Insanely Great, Levy (1994) documented how the original Macintosh design team viewed itself on a mission, how they were separated from the Apple organization, and how they thought of themselves as a class apart. For further examples see Hot Groups (Leavitt & Lipman-Blumen, 1999). Once the students accepted the design challenge they were informed that they would be entitled to three tuition free credits for participating in the project and that artifacts from the project could be used as partial fulfillment of requirements for a Master's project.

The design team received background information on the Internet project. This background information furnished an overview of the task. In addition, the team received a persona and scenario. Persona and scenario are design devices suggested by Cooper (1999) to add realism and understanding to a design effort. The persona describes a typical user in concrete terms. When one reads a persona it describes a single user not an average user. The scenario describes the typical circumstances and constraints under which this persona uses a design artifact. The purpose of both the persona and scenario is to put a real face on the user. As such, designers know in a more precise manner who they are designing for and as a result are less likely to add features to the design that do not address the specific needs of the user. From the standpoint of task obsession, the persona and scenario helped the design team know the user audience and what the user expected.

"We" Dominates "I"

At the outset the student design team viewed the faculty as project leaders. This was anticipated and it was assumed that initially students would be dependent on faculty input but that over time they would assume responsibility for a particular aspect of the web design and become less dependent on faculty input. To encourage a "we" mindset the design process started slowly. As stated, background information, persona and scenario were distributed. Students also received lists of professional development web sites that offered information related to teacher integration of technology and a diagram categorizing the interests of the intended audience. The new information was used to increase background information and to provide students with a basis for discussing design ideas related to the web site design. After several discussion sessions it became apparent that the students had developed a high level of understanding of project purpose. At this point the students were asked to identify an aspect of the project that they would like to undertake, they were reminded that it was a group effort and that they should expect to work with different team members on other aspects of the project from time to time. At this early writing it is difficult to say with any certainty if the student's will view the design process as a team effort but comments from several students and initial collaborations suggest that movement away from "I" towards "We" has begun.

Organizational Structure

The organizational structure was flat and flexible. It was based on tasks and varied as the tasks changed. Once a task was accepted it became the responsibility of the entire design team to produce a solution. One individual might assume a primary technical function but all members were expected to contribute to the solution. Input from all team members was expected not just encouraged. The size of the group was kept small to facilitate communication among the team and to reduce the potential for the development of a hierarchical structure. Emphasis was placed on the goals of the design rather than job descriptions. Meetings could be scheduled by any designer but most organizational issues were dealt with asynchronously via public email distributions to a design team list and class meetings.

Multiple Jobs

One of the attractions for volunteering for the project was the opportunity to learn new skills. Student and faculty team members were encouraged to pursue tasks that would advance their skill development. Although various levels of graphic, instructional, and technology design expertise were represented in the design team, compartmentalization into an area of expertise was discouraged. In addition, it was made clear that some of the design problems would be tedious and all design team members would be expected to contribute to the resolution of these problems. The condition of multiple jobs led to increased communication across team members from the outset.

Small Groups

Once it became apparent that the design project offered participants with interesting opportunities, and university credit the number of queries into participation increased. No further team members were recruited. Group size remained at six to promote maximum commitment on the part of the design team and for pragmatic reasons such as organizing meetings and maintaining group communication.

Appropriate Environment for Design

Numerous technology design activities have been undertaken in the College of Education at Cleveland State University. (Abate, 1993; Abate & Benghiat 1992; Abate & Hannah, 1993). A ubiquitous feature of these design efforts was the revision process. What this signified was that all products were considered prototypes. As such, they were subject to revision initiated by input from faculty. Faculty input is important. It increases the use of the products developed but revision is time consuming and frequently inefficient. To maintain faculty

participation in projects while decreasing the amount of time spent in revision, the MIMIC project has blended the "hot group" concept with elements of a collaborative design environment.

What constitutes a collaborative design environment and why was this type of environment cultivated for the MIMIC Project? Success in design collaborations is a function of the interaction of many variables. Previously, the decisions employed in assembling a "hot group" were described and emphasis was placed on the variables associated with the design participants. Identifying and cultivating key variables essential to building a collaborative design environment are considered next.

A collaborative design environment encourages development with users. This point highlights a key benefit for the proposed Internet site: the target user is also part of the design team. Faculty who are novice technology users were recruited to serve as site evaluators. In this capacity the faculty were asked to test preliminary versions of the web site. Initial emphasis of their evaluation effort revolved around the value of the content provided in the site and ease with which one could access information. From the outset, the faculty were informed of the expectation to contribute instructional resources to the Internet site. For this project, faculty involvement is crucial but the condition of faculty involvement alone is insufficient to establish a collaborative design environment. Schrage (1989) has identified thirteen conditions common in collaborative design. Several of these conditions are evident in the environment established for the MIMIC project. They are; 1) competence, 2) a shared goal, 3) mutual respect, tolerance, and trust, 4) representation, 5) communication, and 6) responsibility. There is significant overlap among the conditions presented in a productive collaborative design environment and the variables related to the attributes of design participants.

Competence

No individual is competent at all aspects of a complex design effort. When describing the design team for the MIMIC project it was noted that the entire design team was expected to contribute to multiple assignments. In establishing the team, the focus was on sharing responsibility. In establishing the environment, the context changes. The focus now becomes does the team have an adequate level of competence for all aspects of the web design project. Based on the initial efforts and the designers' qualifications it appears that competence will not be an issue.

Shared, Understood Goal

The goal of the MIMIC project web site was not collaborative design. The collaborations among designers were subordinate to achieving the end goal of an Internet site useful to teacher educators. The environment condition of a shared, understood goal was, however, a prerequisite to the participant attribute of task obsession. Task obsession was dependent on the anticipation of an outcome. Time was a critical factor in goal clarification. It took time for all to understand the goal of the design activity. Therefore, time committed at the start of a project for goal definition was time saved in development effort and revision. Lastly, projects with a clear goal progress more quickly than projects with an ill-defined goal. As such, considerable time and effort were expended in the seminal stages of the project to define the goals of the MIMIC web site. An understanding that surfaced from this goal definition phase was that it was impossible to know in advance all the potential problems that might arise during design. The conclusion was that goals might be revised. Periodic reflection on the goals was incorporated into the design process.

Mutual Respect, Tolerance and Trust

3M is a corporation that has distinguished itself as product design leader. Peters has suggested that innovation at 3M is attributable in part from fact that employees take the trust placed in them by management to produce seriously and that management does not violate this trust with an intrusive organization (Nayak & Ketteringham, 1997). As stated previously, the MIMIC design team was free of organizational constraints. Mutual respect, tolerance and trust were fostered by an open non-judgmental atmosphere of cooperation. In the MIMIC project mutual respect was viewed differently from friendship. Friendship is built on familiarity. Respect is built upon action. For example, the design team discussed ideas and individuals presented their work

at open meetings. The work presented substantiated the designer's commitment to the project. The work submitted led to peer respect.

Tolerance among team members was promoted indirectly. All members of the team had been informed that the design activity was also a learning experience. So, although expectations for effort were high, expectations for expertise were not. Individual designers understood that the team would learn together and that mistakes were inevitable. Trust was a difficult element to address. The design team view on trust was based on the adage "we sink or swim together". Trust was built on the knowledge that each individual's success is dependent on the contributions of all members of the team. Mutual respect, trust, and tolerance were cultivated slowly. These three elements were as complicated an undertaking as the design of the Internet site.

Representation

Recognizing that representations are constructed, the MIMIC Project used a variety of methods to increase the groups understanding of the task. E-mail, written documentation, and verbal discussions were shared to assure that the designer's individual perspective translated into a singe representation. Documentation provided reference points and these points were essential for understanding among a diverse group of designers. Team members were encouraged to represent their ideas in a variety of media both traditional and computer based. Although the form of representation changed, the goal of providing a shared understanding for the other designers remained constant.

Communication

Formal and informal methods were supported for increasing the communication among MIMIC designers. Flexibility, spontaneity, and record keeping were encouraged. Channels of communication varied and the level of communication fluctuated but the design team understood the value of communication. At a recent meeting, one individual served as a translator between the graphic designers and the technical experts during a discussion of site layout. In this instance, the level of communication was open to the entire team and the level of controversy was high. As a result of this discussion, all team members had a clearer idea of how technical issues and graphics design interacted.

Responsibility

It was noted in the section on attributes of participants that each designer provided specific talents to the design collaboration, and that each designer took responsibility for a particular area of interest. There were, however, no job descriptions or divisions of labor. The MIMIC view of responsibility was that designers had clear lines of responsibility within their area of expertise but that they were not restricted to predetermined boundaries based on their area of expertise. Accountability was placed on the completion of the end goal, indicating that responsibility was to the project not to a particular assignment.

Summary

During the initial phase of the MIMIC web site design, emphasis was placed on determining the variables that increase the likelihood of design success. Two variables, 1) the design participants and 2) the design environment were analyzed and the key attributes of these variables were identified. Interestingly, there was substantial overlap of attributes between the two variables. This overlap of attributes outlined much of what needed to be considered in the development of a design team and provided guide points for determining how to start the design process.

A design team based on the key attributes of design participants and design environment initiated web site development. Background information was collected, design specifications developed, research on prior efforts conducted and prototypes developed. It is early in the site development process to conclude whether the "hot group" and design environment described above will succeed in producing an Internet site useful to teacher

educators. However, a functional design team is in place and development is underway. Ultimately, substantial design work must be completed before the Internet site becomes serviceable but when compared with prior efforts with technology developments (Abate et al. 1996) the MIMIC design team appears better organized, focused and committed.

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Building a Virtual Knowledge Community

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Abstract: The incorporation and use of the Intemet in classrooms is often viewed as an overwhelming task. One approach is to build virtual knowledge communities where faculty can both contribute, and receive mentoring and help. This virtual knowledge community, to play out the analogy, can contain subdivisions (e.g., Science, Literature, etc.) with each subdivision containing "houses" (e.g., Biology, Poetry, etc.). Individual faculty can participate in the "house" with which they are most closely associated and still benefit from other "houses" in their subdivision. Members of a subdivision can also collaborate across the community. This paper provides an overview of the virtual community building process. Both intra and inter-disciplinary collaboration potential are highlighted.

Introduction

The incorporation and use of the Internet and the World Wide Web in classrooms is often viewed as an overwhelming task – especially for faculty with little or no training, time, or support. One approach is to design and build virtual knowledge communities where faculty can contribute a part of the whole and can take advantage of the whole. This virtual knowledge community, to play out the analogy, can contain subdivisions (e.g., Science, Literature, Government, etc.) with each subdivision containing "houses" (e.g., Biology, Genetics, Life Science, Botany, etc.). Individual faculty can participate in the "house" with which they are most closely associated and still benefit from other "houses" in their subdivision. Members of a subdivision can also collaborate across the community.

This kind of a network becomes possible and feasible with the use of World Wide Web and Internet technology. The links between parts of a "house", "houses" in a subdivision, and from subdivision to subdivision is enabled through this technology. Instituting a "Neighborhood Watch Program" (e.g., filtering software systems) allows schools to control access to and departure from their community.

As with any community, the virtual knowledge community is populated with residents posessing different skill levels. When building a "house" within a subdivision (or even planning a subdivision or community), faculty with building knowledge apprentice those with little or no knowledge so there is a diffusion of infrastructure knowledge across the community members. While some will have a large skill set in some areas and others will not, the reverse situation is also true – especially in the collaboration between the technically literate and content experts. The virtual knowledge community is also populated with learners and administrators so the term "faculty" is used rather loosely. Some of the most proficient builders may very well be the learners whom the community is ultimately designed to serve.

This paper provides an overview to the virtual knowledge community building process with respect to diffusion of knowledge both from a technical perspective and from the perspective of using technology to aid content knowledge diffusion. Both intra and inter-disciplinary collaboration potential are highlighted.

Planned Neighborhoods

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The most important aspect of building a virtual knowledge community is the pre-building that must be done (Sommerville 1996; Sommerville 1997). The first question to be answered regardless of the level (room, house, subdivision, community) is "what is the purpose of this?" Virtual knowledge communities may have different purposes depending upon the designers, builders, and residents. They can be designed for: learners who may also assist in the collection and dissemination of materials for learning purposes; collaborators, such as teams of learners working on a project together, teaching teams; or as a shared resource for researchers. The second question to be answered is "what response is needed/required/desired from those who use the room?" Responses also fall into various categories: learn, spend money, post a response, etc. But almost universally, the response includes "return".

Planned neighborhoods require planners. In this case, the category "planners" includes those who understand how to design and build virtual communities and the early adopters or pioneering residents. The pioneering residents are those content experts who already have some understanding of technology or at least an interest in a virtual community. Ultimately, their role in the community will be as community leaders to recruit new members, and as master craftsmen to operate a guild for training new members to become productive and satisfied community members. Pioneering residents are extremely important in that their role cannot be delegated successfully. They are the ones who have a vested interest in seeing the community thrive, grow, and prosper.

The first step in designing a virtual community is determining the overall purpose of the neighborhood. Next, identify the subdivisions. For example, if the virtual community were the VC School District No. 1 and the purpose was to provide a mentoring and nurturing environment for teachers and learners at the secondary level, then the subdivisions might reflect the secondary divisions within the school district such as English, Mathematics, Foreign Language, etc. If the virtual community were the same school district as before, but the purpose was to provide each school within the district its own learning/teaching space, then the subdivisions would reflect either the different schools, e.g., Brougham Elementary, South High School, or the different school levels, e.g., pre-school, elementary, middle, senior high, alternative. This same type of design process would then be used within each subdivision and so forth down to the lowest level of refinement such as a room in a house.

In addition to designing the components of the virtual community, i.e., subdivisions, houses, etc., the paths and roads between different components are considered – how to navigate from one subdivision to another, from one house to another, etc. Navigation is a crucial element in the successful design of any community. Community components that are not easily located will not be used and complexity in lateral movement within such a community may cause a great deal of frustration on the part of community members. A strong, intuitive navigation system is required for intra and inter-disciplinary collaboration and exploration. The basic rule of thumb in designing navigation is as follows: once your navigation is designed, ask someone unfamiliar with the system to locate different components. If you have to resist the urge to "help" (usually by taking the mouse away from them) then your navigation system is probably poor and should be redesigned.

Just as any successful community needs to have recreation and green areas, so does the virtual community. These are areas emphasizing and enabling the same mental health restoration that parks and other green areas do in traditional communities. Mechanisms allowing community members to contribute to the overall design and structure of these areas are needed. Different types of communities may require different recreation and green areas. Part of the design challenge is to figure out what a community needs for its residents in this area.

Design consideration should include collaborative areas such as town halls, dining rooms and other common areas for purposeful interaction. The overarching focus is an interdisciplinary focus so mechanisms for "translation" between disciplines and their vocabularies and grammars may be needed.

Growth must be planned. As changes occur - e.g., new schools are built, new curricula designed and implemented, new content developed, content becomes outdated and so forth - the virtual community must be able to easily accommodate these changes and the required navigation enhancements. One of the major problems with many virtual communities today is that growth has not been planned resulting in a community with a hodge-podge of components and navigation. No one has ever built a virtual community expecting it to get smaller. Choosing the right development tools and planning for growth are important.

Development

Once the virtual community is planned, development may commence. Initially, system architects and builders must be located and employed. These are the team members responsible for the underlying "bricks, mortar, and asphalt" of the system. The architects and builders must know how to put the underlying infrastructure in place to support the different components of the virtual community: look and feel, networking, servers, various software, e-mail, databases, etc. This includes tools for the content experts to use in finishing their part of the community as well as communication and collaboration tools. Suggestions for tools may actually come from the content experts and should be very carefully considered; the benefits of using familiar tools should be balanced against cost of the tool, contrasted with learning curve for a new tool, and availability of the tool to other community members. It may be possible to allow a variety of finishing tools based on what the content experts currently use, e.g., Paint Shop Pro, Adobe Photoshop, PageMaker, Microsoft FrontPage, etc., and then choose common tools for the communication and collaboration tools, e.g., NetMeeting, Eudora, Microsoft Exchange, etc.

The pioneering residents become the initial guild members. Recruitment of other community members increases if there are mentors available to help answer questions, guide, relate "war stories" of what worked and what didn't and why, etc. The concept of a guild implies master craftsmen, junior craftsmen and differing levels of abilities, training, etc., with mentoring and mentored relationships. A guild environment is essential for the development of a virtual community; it enables newcomers to fit in, to make mistakes, to learn, and to contribute without having to be master craftsmen. Guild membership is intra and inter-disciplinary in nature, because the focus of the guild is three-fold. Guilds mentor in terms of the tools used – how to finish one's own room, house, etc. They mentor in terms of pedagogy – this approach worked for our discipline and the activities that go on here; you could use them because you are part of our discipline or because the pedagogy scales across disciplines. Finally, they mentor in terms of content – here is another piece of what you are working on that might expand, enable, add to the understanding of your work. One of the major advantages of the virtual community is that it provides the "space" for mentoring and for accessing organized information to increase productivity and participation of community members, thus resulting in faster diffusion and wider acceptance of the virtual community.

While the residents generally have input into and may actually assist or even build the underlying infrastructure, their real involvement is at the "house" and "room" level. Residents work on the various "house" components of their subdivision, e.g., in the History subdivision, there may be an American History house with a Civil War room. Residents of the History subdivision work together to decide what houses should be part of the subdivision, and what rooms those houses should contain. Residents may work together on finishing a room in a house or may work individually depending on the structure of collaboration and involvement.

Finishing a room may involve supplying graphics, sound, text, and references to other rooms, houses and/or subdivisions (perhaps even other virtual communities). The interweaving of these furnishings provides the environment for the activities that will occur in that room. This might include a discussion regarding some particular event related to the room, the sharing of a developing research idea, etc. Finishing a room requires not only the materials for the room such as graphics or sounds, but also the tools for using those materials in a learning environment.

Expansion and Maintenance

After initial development of, say, a room, expansion and maintenance begins. Changes in technology provide the impetus as do changes in the information of the field itself. What was not possible to include before, or was perhaps cumbersome to include, may become more viable or more easily included as technology advances. New developments in a given discipline will need to be included and outdated information removed. New rooms may need to be built, old rooms demolished, remodeled and/or expanded; new houses may be needed as new fields emerge; rooms may need to be moved from one house to another as reclassification occurs within a discipline. Walkways may be needed between rooms in different houses as the interconnections and relationships between their furnishings become well-defined. New residents may move away from or move into the virtual community.

Virtual communities must be dynamic to be viable. If they do not change and grow, then in general there is little of interest going on and the reasons for building them in the first place must be examined for validity.

Summary

This paper has used the analogy of a real-world community to illustrate the design and building of a virtual community. While the focus has been primarily on the planning process, there are other issues that require attention for they determine in large part the success of a virtual community. Principle among these is support for the residents within the virtual community. Support has been discussed within the guild concept and mentoring relationships. Other types of required support vital to building virtual communities are administrative support in the form of training, financial resources, time, and recognition. Time and recognition are perhaps the two most necessary. The time required to "furnish a room" means release time from normal duties, not spending additional personal time. Recognition must include a formal, written policy with respect to the promotion and tenure issues prevalent in educational arenas. Time for and recognition of mentoring is also required in order for the guild concept to work. The amount of release time and the recognition given is directly proportional to the importance administrators place on building virtual communities.

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Piloting a User Led Approach to Electronic Learning Environments and Training Networks

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Abstract: The Learning in Electronic Environments (LEE) course is a CMC course which aims to provide the opportunity for business advisors and a range of other practitioners to explore the potential of electronic delivery of services. The course has been delivered across a city network and has provided opportunities to consider electronic environments in the context of the electronic delivery skills, the electronic skills training curriculum and the local and national contexts of development of large-scale networks.

1 Introduction

Birmingham City Council (UK) is conscious of the fact that a highly skilled and adaptable workforce is central to the future of the City. To this end it has an ambition to develop Birmingham as a Learning City in keeping with the government's vision of learning in the twenty first century.

" Learning is the key to prosperity – for each of us as individuals as well as for the nation as a whole. Investment in human capital will be the foundation of success in the knowledge based global economy of the twenty-first century"

(The Learning Age Green Paper, 1997)

As a facilitator and broker, the City Council is well placed to assemble a team of partners, predominantly local, with the capability to accelerate the implementation of Learning City developments. Much of this work is currently Project based and includes local universities, further education colleges, media and technology micro-businesses. A key concern has been to co-ordinate the individual projects for maximum impact whilst ensuring that it remains open to diversity of provision and is developed in such a way that the technology becomes a means of broadening access rather than reinforcing exclusion from learning opportunities. This is reflected in the nature of projects and emerging models.

To support the development of a Learning City there has been a growth over the past few years of a Hub & Node model, emanating from the Birmingham Media Hub. This growing infrastructure aims to delivery the learning technology to people's homes, places of work and community settings via a range of connectivity including local area networks, kiosks, set top boxes and remote connection via modems.

Learnsmart, a European funded project, is an example of a local partnership concerned with the embedding of distributed learning within the Birmingham framework. This paper outlines delivery and evaluation of a pilot programme, Learning in Electronic Environments (LEE), which was part of the Learnsmart project. The pilot is described in terms of pedagogical approaches and potential growth within the local, regional and national frameworks.

2 Learning in Electronic Environments: The Pilot Programme

The Learnsmart pedagogical model has been promoted through the Learnsmart project and funded through the European Social Fund. This fund has provided revenue costs for development work that is matched by the project partners. Birmingham City Council manages Learnsmart and partners include City Further Education Colleges, business network organisations and a range of others. The following describes the development of an initial training programme and an evaluation of the pilot.

2.1 The Pilot Programme

The aim of the project is provide on-line training opportunities for Small and Medium Enterprises (SMEs), that is, companies with between 5 and 200 employees, using a branded on-line delivery system and a range of learning materials. The key features of the system are: diagnosis: feedback: content format (generic and client specific objectives, tasks and assignments): and support format (learning plans, milestones and assessment). The underpinning pedagogy for the model reflects a constructivist approach. Constructivism is described by Doolittle (Doolittle 1999) as the acquisition of knowledge as a result of active cognising where cognition is an adaptive process which allows one to organise and make sense of one's environment. It is perhaps instructive to further locate the project model of delivery in the context of situated learning as described by Herrington and Oliver(1995) where the following features are present: authentic activities, access to expert performances and modeling, multiple roles and perspectives, reflection, collaborative construction of knowledge, articulation, scaffolding and authentic assessment.

The relevant features of the model feed into what is described as the Learnsmart Corporate Memory which is available to project stakeholders. It is anticipated that learning within this model will be mediated by Learnsmart mentors who will be drawn from the existing business support network. Potential mentors have been offered training in working in electronic environments as described in the LEE pilot in this paper. In this way the model may be seen to reflect the 'knowledge community' model as described by Vries and Castelein (1999) where input from a range of project members creates a knowledge store for others' use. The concept of the knowledge community is further explored through the proposed development of the LEE programme.

In order to ensure the transfer of good practice from current business support activities and provide appropriate training for an electronic form of this practice, consultation meetings were held with a number of members from the business support community and emerging models of electronic support were identified. The Learning in Electronic Environments Programme was developed to begin to meet the training needs of people who may provide business support in electronic environments. The programme is an OCN (Open College Network) accredited programme (level 3). This is a pilot project, which has been developed and delivered by South Birmingham College of Further Education and Learn Net Advisors & Research. Five units were developed each comprising approximately 30 hours learning. Topics include use of computer networks for teaching and learning, electronic models of support and mentoring. Assessment was formative and based on individual and group activities. Self and peer assessment was built into the programme.

The programme was delivered almost entirely using Computer Mediated Communication (CMC) through Lotus Notes. The programme is designed to be asynchronous and to be accessed when and where it is most convenient to the learner, either at work or at home. The learner has a licensed copy of Lotus Notes and, therefore, is able to keep a complete copy of the virtual college on their own computer enabling him/her to work off-line. The copy of the virtual college is up-dated regularly by the process of replication, which means a short local phone call to the server. This facilitates the process of sending and receiving new documents.

2.2 The Pilot Evaluation.

2.2.1 Access: Although only a small group of 18 learners were recruited for this pilot, approximately 50% of the learners accessed the programme via networked access centres based in the community (nodes) and the remaining 50% accessed the programme from their own home via a modem. Using a networked computer limited the access to the Virtual College and brought this in line with the more traditional 'opening hours' of educational establishments. The flexibility that home users had in relation to fitting learning into their busy lifestyles was seriously hampered for approximately half the learners.

Learners accessing the programme from work reported some difficulties in setting aside time to study and studying in a work setting.

Of the 18 learners, 7 failed to actively engage in the programme. Learners who did not actively engage in the programme cited time limitations, technical difficulties, or inappropriate referral as reasons for not taking part. 11 learners completed to programme in total.

2.1.2 Engaging the leaner: This was one of the key areas of work within the pilot. A number of strategies were planned to engage the learner in the programme; some of these relate to constructivist principles in the design and delivery of the programme and others related to strategies for engaging the electronic learner.

The features of the model allowed for authentic contexts of learning , reflection, collaboration and opportunities to link to experience through activities directly relating to the work practice context, and assessment tasks linked to practice. There were opportunities for the learner to engage in more than one discussion at a time, to choose what they did or did not engage in, and to go back to earlier discussions as new learning added to the debate.
In terms of promoting learning much of the practice is reflected in Berge's successful on line tutoring paper (Berge 1996). It was important to establish electronic tutoring and support skills as a professional area for development as part of the project embedding process. Berge identifies areas of pedagogical considerations, social recommendations, managerial and technical skills for analysis. Significant findings are listed below:
The programme was delivered in a non-authoritarian manner. This enhanced the concept of the knowledge community.
Considerable efforts were made to praise and model discussant behaviour as a means of promoting appropriate practitioner skills.
Opportunities to synchronize and resynchronize were available throughout the course.
Berge recommends face-to-face opportunities for learning. Face to face sessions were included for induction and, at intervals, for evaluation. These were important in terms of demonstrating the system, clarifying the programme and providing on going support. Feedback on the face to face sessions was positive and it is intended to maintain face to face elements in future programmes.

2.2.3 The Virtual Environment: The environment was based on a project metaphor with rooms representing parts of the project process. The visioning of a structural building, we believed, would assist the students conceptualization of a place for learning that was familiar and would assist the movement of the learner between the different places of interest. This facilitation of visioning is founded on Gardner's theories of multiple intelligences and particularly engages the spatial intelligence which consciously makes sense of what we can or cannot see (Gardener 1999). The facilities that were provided for the students included a visitors' centre, which formed the entrance to the College, a project room, 2 syndicate rooms, a project resource room and a Cafe.

3 Proposal for Developing the LEE Framework

A proposed development of the pilot programme is described below and outlined in Figure 1. As stated in section two of the paper, it would seem appropriate to relate these proposed developments to the concept of the knowledge community as described by Vries (1999) from Collis. In this model life long electronic learning is described as making connections among people and stored resources through communications technology for learning related purposes. The potential framework for programme development is described below.

3.1 Short Taster Programme

A taster course will be used to promote electronic learning and raise awareness of the nature of this kind of delivery . The programme will be accessed free of charge over the Internet. To encourage participation there will be no access control to this programme. The programme will include self-assessment opportunities for identifying if personal learning style meets the requirements of learning via electronic environments.

3.2 Induction Programme

An induction programme will be available to taster programme participants who find that they are suited to this way of working. The programme will provide opportunities to further explore, and become familiar with, the electronic medium. The induction programme could lead to:

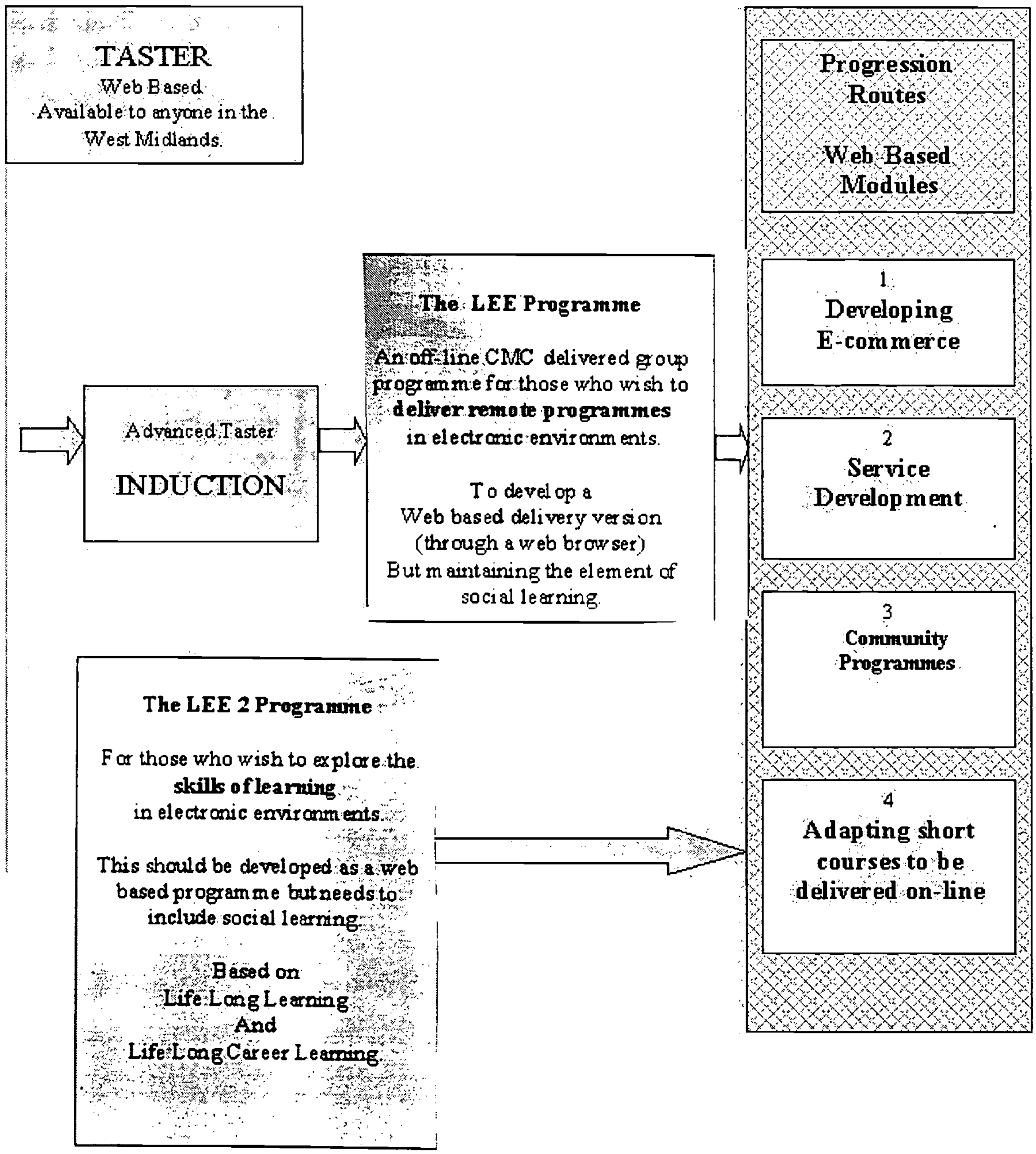
3.3 The LEE Programme

LEE Programme 1: The LEE programme will be delivered via both server /client and Interñet delivery mechanisms. An internet version of the programme would retain the same features including asynchronous communication, group collaboration, access control and the OCN curriculum (level 3) or HE curriculum (level 4). Potential tutors, business advisors and mentors on the progression modules will be asked to participate in this programme

3.4 Progession modules.

The progression modules will provide opportunities for LEE graduates to take part in various electronic learning opportunities in areas of interest. Activities may include discussion groups, collaborative activities, conferences and seminars. The conference and seminar are currently being trialled. Participation in these modules will be the focus of the development of knowledge communities.

Figure 1: Proposed Development Plan for LEE



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3.5 Programme context
The Virtual College for the LEE programme was held on the Birmingham Media Hub and students were recruited from all over Birmingham and the surrounding area. The potential benefits of designing and delivering the programme in this way include infrastructure compatibility at local and national levels. Media Hub's infrastructure development links into two major national initiatives to provide a network of distributed learning opportunities, that is, Learning Direct and the National Grid for Learning which aim to provide learning opportunities in business, community and domestic settings.

4 Summary

The pilot programme has provided opportunities to explore and plan for an extended and varied framework in electronic delivery skills which can be located within a constructivist model. In terms of delivery the programme is designed to be widely accessed and bolted into local and national developments in curriculum and infrastructure contexts. It is hoped that the extended programme will generate and sustain electronic knowledge communities for life long learning and provide greater choice for learners.

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A Best Practices Approach to the Use of Information Technology in Education

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Abstract: Based on a presentation at the International Conference on Computer Based Learning in Science (Wright,1999), this paper discusses some high profile areas of interest and concern in the educational use of information and communication technology (ICT). This paper is influenced partly by a series of nine, government funded "Best Practices" projects in the use of ICT and partly by experience. In particular the paper addresses four major areas, notably, establishing an electronic identity (including alternative delivery/ online learning and web site development), technological literacy of students, support for the use of ICT (with an emphasis on security in a distributed network environment) and, very briefly, access to information and privacy.

Establishing an Electronic Identity

Today, having an electronic identity is synonymous with having a web site. As the enterprise of education becomes more competitive and more responsive to its stakeholders, it is hard to imagine an educational institution that doesn't have an informational web site. If that educational institution is involved with the delivery of instruction, however, there is an increasing probability that it will have become interested or involved with a second dimension of electronic identity notably, alternative delivery (almost a pseudonym for web-based learning). Since a web site commonly underpins both the informational and alternative delivery components of electronic identity, this section includes a very brief list of things to keep in mind when planning and creating a web site

Alternative Delivery

The term alternative delivery can be used to represent almost any approach to instruction which differs significantly from traditional approaches (i.e. those that are typified by a group of learners receiving instruction by expository methods). For example, the use of Computer Assisted Instruction (CAI) in the learning mathematics or the use of Computer Assisted Interactive Videodisc technology to enhance the understanding of kinematics (see Wright & Pasek 1997) are contemporary, classroom-based examples of alternative delivery. Distance education, an evolution of learning-by-mail (or correspondence school as it was commonly called) is an important subset of alternative delivery. Over the course of time, many developments and innovations were introduced into distance education including the use of television, audio conferencing, and Fax technology. Despite these approaches, early attempts at distance education were largely unsuccessful particularly if judged by student success/completion rates. More recently, computer technology has been introduced into the distance education equation. While computers have continued to become faster and more powerful in the last decade by far the most significant developments have occurred in the communications area. In particular, these developments have given rise to the Internet and, through it, the World Wide Web (the Web). Interest in the Internet and related technologies has grown at a phenomenal rate. Much more than a communications vehicle because of the technologies that it can connect, the Internet is seen as having enormous potential in education. Not only does it promise to impact the general teaching/learning paradigm, it will almost certainly redefine alternative delivery. This is evidenced by the emergence of virtual schools and opportunities for online learning. Reasons for choosing online learning include:

- geographical barriers to attending conventional classes
- access to programs or courses that are not available locally (or on-site)
- conflict with the social or religious values of a school or school system
- preference for home schooling
- reasons relating to health or physical ability
- conflict with other responsibilities or commitments (e.g., employment)
- preferences relating to the pace of learning
- preferences relating to learning style

At first glance, these reasons might not seem to differ from those that would have applied to earlier implementations of distance education. However, the fact that most of them are now underpinned by electronic curricula, multimedia technology and the Internet (and all that it implies in the way of communication and access to information) makes the situation very different. So much so that online learning might well be chosen by resident learners.

Today, alternative delivery can embrace the latest in information and communication technology (such as multi-point interactive video conferencing and multimedia rich CBL) to deliver instruction either at a distance or locally to achieve one of its main objectives - self-directed, time and place independent learning. Approaches to alternative delivery can be many and varied. At one end of the spectrum it might simply imply the delivery of self contained, units of instruction or CAI software either by traditional or electronic means (e-mail or Internet). At the other end of the spectrum of sophistication, alternative delivery might entail the simultaneous instruction of several groups of learners using computer managed interactive video technologies. This latter interpretation opens up the prospect that, through creative scheduling, several classes of math students in more than one school might be able to receive instruction from the best math teacher in the district. Obvious parallels exist for the potential of electronic learning in postsecondary education but to an even greater degree.

Issues and Concerns

While alternative delivery is currently a very high profile area it is still in its infancy. As with most innovations before it, there has been a lot more said and demonstrated about its promise than has been operationalized. The issues/questions surrounding the use of ICT for alternative delivery (and online learning in particular) are many and varied and thus only a few are listed here.

Curricula: How will various curricula be made available in electronic form? It is important that curricula be re-engineered to take advantage of the power and potential of ICT. Who will do this and what processes will need to be put in place to maintain and update courses?

Quality of learning: Undoubtedly one of the most important questions of all. How will the quality of the leaning experience be ensured? Beyond the expectations, the anecdotal, and the short-term indicators, what evidence exists to confirm the quality and the depth of learning that has taken place? Indicators of quality include completion rates, student achievement, and parent and learner satisfaction. Research is under way to address this question.

Staffing: Teachers will need to be specially trained to support online learning. Teaching contracts will need to be redefined to reflect what will be a very different role. Teachers will need to be screened for their suitability to the role. Evidence already suggests that self-paced learning places a very heavy demand on teachers who need to respond to a diversity of student requests (Farber 1998). The term teacher burnout comes to the fore here. As well, it has been observed that communication with a group of learners is easier face-to-face than electronically. Being a virtual-school teacher is very demanding.

Administration: Today, many online learning experiences are centered on the establishment and use of a web site. Questions here include: who will develop, maintain, and update the site; what are the legal implications of electronic publishing; and who will assume responsibility/stewardship of the web site? Will other teachers know how to use/update the site or will their be a dependency on one individual? From a practical point of view, how dependent will the school become on the site both from the technical and staffing perspectives. What are the contingency plans if the site goes down?

Equality: If online learning is implemented in a school or jurisdiction, will all prospective learners have (equal) access to the learning opportunities available? Related to this concern are bandwidth, local access to computer workstations, and telecommunications costs.

Cost: Everything comes with a cost. There is the obvious initial cost of hardware and software and the less obvious cost of "evergreening" of hardware, upgrading of software, telecommunications, development and maintenance of electronic curricula, delivery systems, technical support, and staff training and development.

The proliferation of alternative delivery and online learning has different implications for regular schooling than it does for postsecondary education. In regular schooling, it would seem that the approach would be less acceptable at the lower grade levels than at the higher levels. At the postsecondary level, where learners are more likely to be independent and self motivated, the prognosis is quite different. Some observers (e.g., Noam 1995) go so far as to predict that electronic learning will not only become prevalent but will lead to universities and colleges losing their exclusivity in the delivery of postsecondary education.

Teachers' fears that the computer might either replace them or de-skill their profession (as referenced by the World Confederation of Organizations of the Teaching Profession, 1987) seem to prevail. This notion is supported by observations such as "in their bones educators know that technology will replace people. It always has and it always will. About this matter, educators' hunches and fears are justified (Doyle 1992)." Advocates of the use of ICT for alternative delivery have suggested that its use will free the teacher to do what they do best and that the role of the teacher will change from dispenser of knowledge to coach, facilitator, and mentor – well worn cliches. Only time will tell if this prediction turns out to be true in general. Early indicators are that technology *is* being used to reduce face-to-face contact between the learner and the instructor but that this has not necessarily led to increased efficiency or staff satisfaction (except perhaps for the technocentric).

With most universities and colleges being able to offer online delivery of courses and programs, competition for students (and the funding and fees that follows them) will evoke significant questions. Increasingly, one might expect to see more institutions incorporating competitors' course offerings within their programs. Accreditation of both courses and programs thus becomes an issue. This is an interesting situation given that the number of prospective students is finite.

The use of alternative delivery is likely to appeal to educational administrators who see this approach as a way of reducing the number of teachers required and thus the cost of doing business (Wright & Pasek 1995). It is probably accurate to say, however, that using technology in education has increased the cost of the endeavour. If all we do is splice technology onto existing ways of doing things, we will not be able to afford to use technology in education (Mcabe 1996). To capitalize on the promise of ICT, educational paradigms will need to change. An interesting question arises in this regard, however. Will we witness the emergence of superstar teachers/professors who, being acutely aware of the fact that they are reaching very large audiences, will seek to negotiate lucrative contracts much like their counterparts in the sports and entertainment industries? If so, between the cost of technology and staffing, the economic advantage might not be as significant as perceived. As well, could it be that much further in the future we will witness the emergence of postsecondary institutions whose claim to fame will be "a non-virtual

Planning and Creating a Web Site

It is not possible to do justice to web site design and development in the space available for this paper and yet it is too important to be completely omitted. With this in mind only the briefest of comments are made here together with a list of "things to keep in mind when planning and creating a web site". It is important to conceptualize the web site before doing anything. An educational web site is usually driven by a site index which typically separates content from processes. The content area includes two major categories notably, curricular content (e.g., course and program information) and administrative information (e.g., the institutions mission, program descriptions, calendar information etc.) Alternative delivery/online learning is a subset of curricular content. The process functions of a web is typified by such things as communication, access to general information on the institution and its operations and online registration. Questions to address/things to keep in mind when planning and creating a web site include:

The questions

- what are the goals for the site and are they realistic
- who is the audience, what is the message and does the site complement existing strategies
- will the site be hosted locally or will it be outsourced
- how will success be measured
- do institutional or other publishing guidelines exist (including copyright and security)
- who can develop and, more importantly maintain, the site (expertise and resources)
- is the administration committed to the site and its implications, should a web site team be established

Some do's and don'ts

- define who owns the site
- involve stakeholders in the development of content
- keep the site current
- start small but plan for expansion (in the meantime, don't post partially constructed pages)
- understand the demographics of your audience(s)
- don't overdo links
- test all links
- repeat design elements
- minimize the overhead associated with multimedia elements
- engender principles of equality and respect and preserve individual rights and privacy

Technological Literacy of Students

It is instructive to think of the use of ICT by a teacher as falling into one of two broad categories. Teachers can use ICT;

1) as a tool that can be applied to address any task-related problem or challenge or

2) in the practicing of their craft (teaching)

The use of ICT for alternative delivery is an example of category two. For those who are involved in teacher education it is important that both categories be advocated and role modeled. For the students in the regular schools it is the first category, the achievement of technological literacy, which is of most significance. Over time, a number of approaches to achieving this goal have been pursued.

Recently, the Province of Alberta (Canada) has undertaken a very significant leadership initiative to address the technological literacy of students at all grade levels from early childhood to grade twelve. Adopting an integrated approach, the Department of Education has defined an interim program of studies called the Information and Communication Technology Program Studies that will be implemented province wide beginning in September

2000. This program (see Learner Outcomes in Information and Communication Technology, 1997) defines learner outcomes in technology for each grade level according to three categories:

Foundational Operations, Knowledge and Concepts: Outcomes in this category include understanding the nature and impact of technology, the moral and ethical use of technology, mass media in a digitized context, ergonomic and safety issues, and basic computer telecommunication and multimedia technology operations.

Processes for productivity: Outcomes in this category focus on the knowledge and skills required to use a variety of basic productivity techniques and tools. They include text composition, data organization, media and process integration, electronic communication and navigation, collaboration through electronic means, and graphical, audio and multimedia composition and manipulation.

Inquiring, Decision-making and Problem-solving: Outcomes in this category build on the foundational operations, knowledge and concepts, as well as the ability to use a variety of processes. They include the ability to critically assess information, manage inquiry, solve problems and use research techniques. They should be addressed within the context of such subjects as language arts, mathematics, social studies and science Students should be expected to apply their knowledge and skills in practical situations.

Three very significant things about this initiative are:

1) that it has elevated learner outcomes in technology to the status of a program of studies on a par with mathematics, science, language arts, and social studies

2) that its objectives are integrated across all disciplines, and

3) that its implementation is not a matter of choice for the province's schools.

Rather than restricting itself to the teaching of skills in relative isolation, this program emphasizes ICT as a process and a natural way of thinking when addressing a problem or challenge.

Supporting the use of ICT

Up until the late nineteen-seventies, computing services were mostly centralized. Those requiring service requested that service from a data processing department that employed a team of programmers and systems analysts to operate a mainframe computer. At about this time, however, the microcomputer burst upon the scene. Users welcomed the microcomputer because it allowed them to address their own needs. Seemingly, there was less need for teams of data processing professionals. As the use standalone microcomputers increased, computing took on a decentralized nature. Although foreseeable, the limitations of the decentralized approach soon became apparent as evidenced by the development of local, incompatible systems that could not even share corporate data. In the last decade, microcomputers have become enormously powerful, more powerful than their mainframe predecessors. By far the most significant developments in the recent decade have occurred in the networking and telecommunications areas. Deceptively small computers that are networked to the rest of the world now sit on individual users' desktops. Distributed computing has truly arrived. The good news is that such an environment offers the prospect of standards, effective data resource management, and unparalleled access to information. Perhaps the not-so-good news is that, in becoming sophisticated, the computing environment has once again become complex thereby creating the need for distributed support which amounts to a small army of data processing professionals (especially network specialists). Recently, this need has been increased by presence of the insidious "millennium bug".

The foregoing speaks to the need for *technical* support for the use of ICT - but this is not the only support required. There is also a need to provide staff development and support for instructors who are not only expected employ technology in their teaching but to develop the technological literacy of their students. As well, in a technological age, there is an increased need to respect rights associated with freedom of information and protection of privacy.

Security in a Networked Environment
In a distributed, networked environment, a great deal of attention needs to be paid to security. The greater the connectivity, the greater the need for policy, procedures, and vigilance regarding security. As with most corporations, educational institutions will keep both corporate and human resource data in their computers Beyond this, however, educational institutions maintain sensitive personal data (including counseling records) on captive dependents who are under the age of majority - the students. Maintaining such records increases both risk and responsibility regarding security. Because it is accessed frequently by both staff and students, a school's network may be more at risk than a typical corporation's network. The topic of network security is vast and it would be impossible to do it justice here. As well, rapidly evolving technology poses new security challenges. For these reasons only a few issues and concerns are raised here and they are dealt with briefly.

Issues and Concerns

Physical security: The need to provide for the physical security of ICT is self-evident. The provision of physical security implies ensuring that ICT stays where it is supposed to be and that access to it is effectively regulated.

Viruses: Computer viruses come in a variety of forms and disguises. Before networks became prevalent, most viruses were introduced to computer systems via diskettes. This method of infection is still a significant concern in educational institutions where it is common for students to transfer work between home and school computers. The concern is not so much that corporate systems will be affected by such transmission but that computers that are needed for instructional purposes will. Effective antiviral software is available but it is important to upgrade this software as new viruses emerge. Networks greatly increase the risk that infections will occur since they can facilitate the introduction of viruses from remote locations (e.g., by file transfers, e-mail).

Network access: This is a very complicated area. These days, networks tend to be segmented thereby providing different levels of access. It is not uncommon for institutions to have an intranet, an extranet, and access to the Internet. An intranet is typically the most limited (and usually localized) network - it is generally very private and/or custom. Access to such a network is usually restricted to immediate "insiders". In the case of a school this includes staff and students. The cornerstone of security in this regard is generally password protection. Extranets are also somewhat private though they typically extend the reach of the network to external stakeholders who are strongly linked to the client base or corporation. In the case of a school district, the extranet would typically include all of the schools. Again a key element of security is password protection. Intranets and extranets are particularly vulnerable to hackers (people whose intent is to break into a system either to gain some advantage or to inflict damage). In part this is due to the fact that extranets use the same widely publicized protocols as the Internet and in part because the motivation for a vindictive act is more likely to originate from within. While it is not possible to guarantee protection against hackers, the best way to minimize this risk is to have the best network security possible and to be vigilant. Providing access to the Internet not only increases the need for security it adds another dimension - access to socially or legally unacceptable sites. Incorporating Internet increases the prospect of unauthorized or undesired access to and from private networks. One method of managing access to the Internet is to implement a "firewall". Firewalls can be hardware or software based or a combination of both. All messages entering or leaving an extranet are examined by the firewall, which can block those that do not meet defined security criteria. Typically, firewalls keep transaction logs that enable use of the network to be studied. These logs can be helpful in detecting and addressing misuse of the network. One disadvantage of firewalls is that, because they examine all data packets, they can "slow down" the network. Some service providers have offered the use of proxy servers through which users can circumvent some features of firewalls. The firewall would log the access to the proxy server but not access to sites reached via that server.

Access to Information and Protection of Privacy

Computer networks provide unprecedented access to information. Within this environment there needs to be an increased consciousness for protecting the privacy of individuals. The province of Alberta recently passed

legislation to govern the use of information by government funded bodies. This legislation, referred to as the Freedom of Information and Protection of Privacy (FOIPP) act, not only applies to government agencies but to public schools and all other publicly funded educational institutions. This legislation protects students as well as staff. The guiding principles behind the legislation are:

- *Right of access*: The act allows any person a right of access to records in the custody or under the control of a public body subject to limited and specific exceptions

- *Right of access to information about oneself*: The act allows individuals the right to access information about themselves that is held by a public body subject to limited and specific exceptions.

- *Protection of informational privacy*: The Act requires public bodies to control the manner in which they collect, use, and disclose records that relate to an individual and to take reasonable measures to ensure they are accurate and secure.

- *Right of correction*: The act allows individuals a right to request corrections to information about themselves that is held by a public body

- *Independent review*: The act provides that all decisions made by a public body under the legislation may be reviewed by the Office of the Information and Privacy Commissioner. This means that the Commissioner may review decisions regarding access to information and other questions relating to the implementation of the provisions of the Act.

Within the context of this paper, a public body implies a school, a school district, or a postsecondary institution. The concept of a record is very broad. A record implies information in any form including books, documents, maps, drawings, photographs, letters, vouchers, papers, or any other information that has been recorded in any way either in writing, by photographic reproduction, or electronically. It is not legal to destroy such records at will and the onus is on the custodian of the record to produce them if required to. In many ways this legislation is not introducing new requirements but rather, it is adding legal weight to the implementation of acceptable policy. The passing of this legislation is causing considerable attention to be paid to the capturing and management of records on computers. Those that maintain and manage records must; ensure that staff can identify, locate, and produce records, ensure that records are accurate and complete, and that there is a viable and authorized system for destroying or disposing of records.

Issues and Concerns

Whether legislation exists or not, security has always been of concern in information management. The combined effect of technology *and* the enactment of legislation, however, heighten this concern. A vast amount of personal and other confidential information is now being stored electronically in databases that are accessible via networks. Some information has been stored on removable and transportable media such as diskettes and videotapes. In many cases, erasing a disk implies only that the directory has been destroyed, not the information that is accessed through it. As well, e-mail has added a new dimension since such transactions constitute a record. To this end it is important to take great care about the content of e-mail messages. It may sound paradoxical but E-mail messages are not necessarily destroyed even if they are erased. What about access to sites on the Internet? Such transactions are traceable through the use of firewall and other logging procedures. Increasingly, educational institutions are using web sites to disseminate information that is made available by routine disclosure or active dissemination. Information such as school budgets, school timetables, general achievement, special events, and minutes of public meetings can conveniently be communicated in this manner. In so doing, care must be taken to ensure that those who do *not* have access to electronic communication are kept equally informed.

Care must be taken when working with students particularly if they are underage dependents. Increasingly, student work, which may include personal information, is being posted on web sites. In many cases students are encouraged to develop their own web sites. The development, and in particular the posting, of web sites by

students should be carefully supervised. All manner of transgressions can occur from conflict with community values, to violation of copyright, to invasion of privacy.

Technology is a great amplifier of human endeavour, it is also a great amplifier of mistakes and transgressions. Even in the face of rapidly evolving technology, the best strategy for dealing with information management is to develop and clearly communicate a well-conceived policy of governance.

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Abstract: Two brief cases from two different technology directors are cited. Case one involves subtle intimidation by a technology director, while case two points out experiences of a teacher making the transition to technology director. Specific principles derived from applications of complexity theory to institutions are offered to both understand the dynamics of each case and as a practical way to develop successful institutional leadership regarding technology.

Introduction

"Our thinking creates problems which the same level of thinking can't solve."
- Albert Einstein (quoted in Sherman & Schultz, 1998, p. 2)

Complexity theory, sometimes referred to as complexity science, is a new way of investigating questions in fields as diverse as economics, computer science, physics and organizational management. Located beyond the mechanistic, Newtonian view of science, which has provided society with marvels and understanding almost beyond imagination several hundred years ago, complexity science sees the universe as filled with complex adaptive systems.

Complex adaptive systems are observed as exhibiting spontaneous self-organization (such as birds flocking, a phenomena which occurs spontaneously with no bird leading the phenomena); as being adaptive by actively responding to events (for example, in the manner that the human brain continually organizes and reorganizes neural connections in an attempt to learn from experience); and, as different from complex (complicated) static objects (such as a television set or the space shuttle) by being alive, spontaneous and disorderly - although disorderly in a manner different from the unpredictable manifestations of chaos, as described through chaos theory. (Gleick, 1987; Waldrop, 1992; Sherman and Schultz, 1999).

Further, complex adaptive systems have the ability to bring order and chaos into a very important, unique balance. This balance is referred to as the edge of chaos,

"....where the components of a system never quite lock into place, and yet never quite dissolve into turbulence, either. The edge of chaos is where life has enough stability to sustain itself and enough creativity to deserve the name life. The edge of chaos is where new ideas and innovative genotypes are forever nibbling away at the edges of the status quo, and where even the most entrenched old guard will eventually be overthrown. The edge of chaos is where centuries of slavery and segregation suddenly gave way to the civil rights movement of the 1950's and 1960's, where seventy years of Soviet communism suddenly give way to political turmoil and ferment, where eons of evolutionary stability suddenly give way to wholesale species transformation. The edge of chaos is the continually shifting battle zone between stagnation and anarchy, the one place where a complex system can be spontaneous, adaptive, and alive." (Waldrop, 1992, p. 12)

Nobel Laureates in physics and economics, world class scientists and researchers in a variety of fields, and government, foundation and business support have all helped to make continuing developments in this field a reality. This reality is based on the belief that the tools now exist to investigate and understand the lively, self-organizing systems of this planet in ways not previously possible. Such understanding can lead to applications that will have positive impact in fields as diverse as economics, business and politics, among others.

Specifically, organizational management is an area where complexity theory may provide benefit with regard to understanding the structure, dynamics and personal experience of people in institutions ranging from businesses to government agencies to social service organizations (Sherman and Schultz, 1999). Sifonis and Goldberg (1996) in their book, "Corporation on a Tightrope: Balancing Leadership, Governance, and Technology in an Age of Complexity," apply concepts from complexity science to corporations and other institutions. In doing so, they devise seven basic principles to help an organization understand and take positive action to thrive in the increasingly changing and fast-paced world we have created. What they say has relevance to the schools and to those of us who work to successfully bring technology into the schools, including administrators, teachers, technology directors, professors, trainers, and policy makers.

The integration of technology into schooling is, at best, difficult and has often been unsuccessful, and past practice can, on a variety of levels, be legitimately criticized (Cuban, 1996; Bromley and Apple, 1998; Tyner, 1998). This brief paper is an early, preliminary attempt to apply Sifonis and Goldberg's principles to the experience of technology directors, who are often seen (either positively or negatively) as change agents and who are pivotal in integrating technology into the schools. Understanding the dynamics of the institution from a complexity theory perspective can lead to actions which help the institution to evolve in the manner desired - in this instance help the schools evolve successfully in the use of technology for learning.

Seven Principles

Sifonis and Goldberg believe that an institution must stay balanced between order (which can result in stagnation) and chaos (which can result in not being able to function). They further believe that by maintaining balance between order and chaos, an institution is in a position of flexibility necessary for taking advantage of opportunities for the growth of the institution. For businesses, this growth would mean increased economic growth/profitability. For schools, this would mean increased depth and/or breadth of learning for students. They state that there are seven basic principles an institution needs to master in order to provide the environment where the institution can successfully grow. They are:

1. Set ethical standards and do not deviate from them.

2. Establish a social contract.

3. Maintain a strong, lean central organization based on core competencies.

4. Develop leadership skills at every level of the organization.

5. Be open to learning, encourage experimentation, and be innovative.

6. Avoid restructuring when you should be regoverning.

7. Ensure connectivity.

(Sifonis and Goldberg, 1996, pp. 237 - 260)

What follows are two brief descriptions of cases involving technology directors and an attempt to locate, within the seven principles, information that will aid in understanding each situation. That information is then used as a basis for proposing action that will help the situation and move the institution toward a climate that reflects the principles. Such movement should yield a more flexible, responsive, environment, better able to adapt and evolve. For our purposes, such an institution will better integrate technology into learning with the technology director as a key agent in this happening.

Case Number One

In case number one, the technology director was described by teachers and other school personnel as having colleagues "terrorized". He was described as a "control freak." He needed to be in close control of any situation. For him, this meant feeling he was in control of people with whom he, professionally, came into contact. He, therefore, kept records of all the information he could electronically gather on every teacher (and some administrators) with whom he worked. He might obtain information from the state motor vehicle department. He might get into peoples' financial and credit records. He was very good at searching out, on the net, legally obtainable personal information. He then compiled the information into a "dossier" on an individual. He did not use school equipment or school time to gather such information. He was also very skilled at letting people know that he had

such information, without explicitly saying, “I’m watching you through my electronic data gathering, so watch your step when you deal with me - I have personal information about you.“ He let people know in a way that was not overt, but in a way that was intimidating. (For example, “I see you got a good rate last week on your refinanced mortgage.”)

It is very important to understand that this person was excellent at not stepping over the line. He did not overtly threaten. He adhered to the letter (if not the spirit) of the acceptable use policy for his district. He gathered lawfully available electronic data. He did not care about being liked and, again, was very good at being intimidating without directly threatening - so good, that many school personnel were terrified of him, the records he gathered, and the technology he used.

The principal of his building once faced him down by saying, basically, “So what. You have some information. There’s nothing you could gather on me that I’d be ashamed of. Let’s make it all public.” The problem was with other school personnel who did not feel comfortable taking such a stance, who felt threatened, and whose attitude towards technology, uses of technology, and gate-keepers of technology, remained extremely negative. Such negative attitudes can greatly complicate and hinder the positive, beneficial possibilities of meaningfully integrating technology into the schools.

From a complexity theory perspective, this technology director created a static situation. He created an environment that provided him with control (albeit negative) over many of the people with whom he came into contact. This disallowed the very nature of a complex adaptive system as a dynamic, evolving, flexible system. He blocked initiative, the free flow of information (ideas) and the co-evolutionary development of agents (school personnel) within the institution. He used information and intimidation to attempt to lock his position into stasis (what he would see as security). However, by disallowing the institution from evolving, in order to lock–in what he saw as his role, he probably guaranteed the failure of the institution regarding technology integration. By acting to limit flexibility and the personal roles of others who use technology to fit his stagnant view, it might be predicted that eventually he will be replaced when the institution fails to meet expectations regarding the integration/adoption of technology into learning.

From a seven principles perspective, it should be obvious that, at the least, several principles needed to support a complex adaptive system were not present in this institutional environment. Principle one, "Set ethical standards and do not deviate from them," was not in place. While the director was not breaking any current "rules," if firm ethical policies were agreed upon and enforced, it is likely that such behavior, clearly unethical, would not be tolerated. Principle two, "Establish a social contract," was also not in place or enforced. In the context of the institution, nobody should be made to perform professionally in the face of such intimidation, which, though subtle, is very real. A solidly established social contract should help to attract and keep workers and stimulate innovation. Principle five, "Be open to learning, encourage experimentation, and be innovative," was also not present. By his actions, information and technology were viewed as threatening, negative forces. At best, even with support it is difficult for people to take the risks needed to experiment and innovate. When the very tools (information and technology) they are asked to experiment

and innovate with are used as weapons against them in their own institution, it is not reasonable to expect teachers and administrators to take the necessary risks to experiment and innovate. The positive establishment and enforcement of the principles identified would help to create a flexible environment, a place where the complex adaptive system known as schooling would not allow such intimidation. Rather, the environment would support the activities needed to successfully evolve the integration of technology into the institution.

Case Number Two

Case number two involves a 14-year teacher moving from a teaching position to a technology director position in the same district. In spending several months recording his experiences in a journal as he started his new job, several observations remained consistent. First, from the first day he walked in as a technology director, he was startled by the difference in his relationship with teachers he had known for years. As he said, "It was obvious I was no longer one of them. From their perspective, I had entered a different group and they expected I now had different allegiances. I had lost some credibility. This meant that, not only were attitudes different, but that the information I was privy to now was different than it had been." Second, he found certain teachers acting as if he would be a threat to their use of technology because of the change that had occurred. These teachers had developed comfortable ways to use technology and received equipment and support in the past. They expected that, with a technology director within the district, more use of technology might occur among more teachers and the support they individually received might lessen - hence the perceived threat. Third, new teachers, many of whom were excited about technology, expected a "pecking order" and assumed that they would be last in line for technology resources because such resources were always scarce. They expected that senior faculty would receive resources first and that they would need to wait. This was especially troubling to the director because he knew there were resources being wasted, instances where unused technology sat on senior teachers' desks as a type of status symbol while some of the newer faculty, who were not supplied with technology, were motivated and ready to innovate.

From a complexity theory perspective these are all instances that will slow or divert the institution from evolving and growing - from flexibly adapting to change. Interestingly, this particular director began to move his role and the institution in ways similar to the seven principles - he began to create an environment where the institution as a complex adaptive system could evolve and flourish. He began to work very hard to model his role as that of an available helper who could offer support in a variety of ways, as a positive force to make what teachers wanted to happen with technology happen. In doing so, he consciously presented himself as a model of principle five, "Be open to learning, encourage experimentation, and be innovative." Further, as teachers saw him taking risks, both for them and with them, he not only gained credibility in his new role but inspired others to do the same. In effect, he was changing the institutional environment to some degree, was moving it closer to an environment based on the seven principles. Additionally, he tried to serve the needs of both the senior teachers and the new teachers. He did this by actively creating and maintaining a dialog with both. He not only tried to support each group as best he could, he also shared the reasons why he could and could not do certain things. He

involved both groups in frequent communications, sharing information, asking advice, etc. New teachers were surprised at the level of support they received (having expected none) and senior teachers were glad to be included both in terms of support and in the entire process. This is a good example of principle seven, "Ensure connectivity." By this principle, Sifonis and Goldberg mean not only the obvious technological need of supporting networks for communication, but they also mean supporting the communication itself. Connectivity means starting and maintaining communication within the institution, such communication being supported by a reliable, accessible technological infrastructure. (The forms of communication and the importance of the development of this type of contact as networks spread and evolve is a theme also present in Esther Dyson' s (1998) book, "Release 2.1: A Design for Living in the Digital Age.") He also went beyond this to try to bring the two groups together. As he modeled principle five, "Be open to learning, encourage experimentation, and be innovative," he encouraged both groups to be sources from which he could learn and which could learn from each other. In so doing, he was actively implementing principle four, "Develop leadership skills at every level of the organization." This worked well and is the polar opposite of the control the director in case one felt compelled to try to exercise in a very negative way.

Conclusion

These two instances put some of the ideas behind complexity theory as it may be applied to institutions, specifically schools, into a practical, understandable, light. The role of technology director in today's schools is one that presents much possibility both for success and for failure. Understanding schools as institutions which are complex adaptive systems seems critical in these times of ever-accelerating change, much of it fueled by technology. If institutions do not adapt and grow they will ultimately fail and, at least in their present form, disappear. As pivotal change agents in the schools, technology directors are constantly challenged to grow and adapt. While accomplishing that on a personal level they have an opportunity to help the schools, as complex adaptive systems, evolve, as they must, to survive.

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Educational Technology Plans: Keys for Successful Implementation and Accountability

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Abstract: In recent years, the providers of federal, state, local, and private funding for educational technology increasingly require more information and justification before funds are released. Planned expenditures must now be tied to stated educational goals, objectives, and standards, and funding providers are requiring some form of evaluation report to help determine the impact their dollars have made and to justify future funding. This paper reviews the efforts of the Idaho Council for Technology in Learning to provide consistent and thorough standards for planning for educational technology, keys for meeting those standards, and offers suggestions for using these keys to successfully implement and account for planned technology use in the curriculum.

Introduction

To facilitate the use of educational technology in Idaho public schools, the Idaho State Legislature created the Idaho Council for Technology in Learning (ICTL) in 1994. Since that time, the ICTL has been chaired by elected members of the state legislature and is made up of educators at all levels from across the state (Idaho State Department of Education, 1996, p. ii-iii). The legislation directed the Office of the State Board of Education (OSBE) to develop a statewide educational technology plan and required that each school district submit a district technology plan for approval by the Idaho State Department of Education (ISDE).

During the 1995-1996 school year, each district submitted a district technology plan. These covered implementation of technology during the years 1995-2000. In January 1996, the ISDE, in conjunction with the OSBE and ICTL, published *Connections: A Statewide Plan for Technology in Idaho Public Schools* (Idaho State Department of Education, 1996). The term for the district and state technology plans is approaching its end. All district technology plans and the state technology plan require updating during the 1999-2000 school year. To provide a statewide "thorough and consistent standard (Idaho Council for Technology in Learning, 1998)" for all technology plans, the ISDE published the District Technology Plan Evaluation Rubric in Spring of 1999 (Idaho State Department of Education, 1999).

Why Technology Planning?

The district and state technology plans are important documents for the following reasons (Ward, 1999):

- Technology plans document, in writing, the ties between technology use and state and local goals, objectives, and standards.
- Outline staff development and plans for integration of technology into the curriculum.
- Include evaluation plans to determine the effectiveness of technology integration plans.
- Provide a framework to support sustained federal, state, and private funding for educational technology.

District technology plans are kept on file by the ISDE to use as references and justification of state technology funding. Similarly, the state technology plan is kept on file by the U.S. Department of Education (USED) to support federal funding programs. Private grants are also supported by and related to the state and district technology plans.

In recent years, the providers of federal, state, and private funding require much more information and justification than that required when plans were first developed in 1995-1996. Not only are planned expenditures required to be tied to stated educational goals, objectives, and standards, but funding providers are requiring some form of evaluation report to help determine the impact their dollars have made and to justify future funding. Adequate planning has become much more complex, and can no longer be completed by a single individual. Rather, representatives from all stakeholders – administrators, teachers, students, parents, community members, business leaders, etc. – are needed to participate in the planning process to provide broad-based support for the plan. In addition to broad-based support for educational technology, successful implementation of educational technology in the curriculum requires several other key elements: (a) a thorough needs assessment, (b) effective instructional objectives, (c) consistent, ongoing evaluation, and (d) periodic review and revision.

The Planning Process

Planning for educational technology is cyclic in nature, beginning and ending with an evaluation of where the district or state currently is and the goals the organization is attempting to reach. The planning process is influenced by the vision/mission statement of the district or state educational agency, and is firmly rooted in the needs of the individual district or state (see Figure 1).

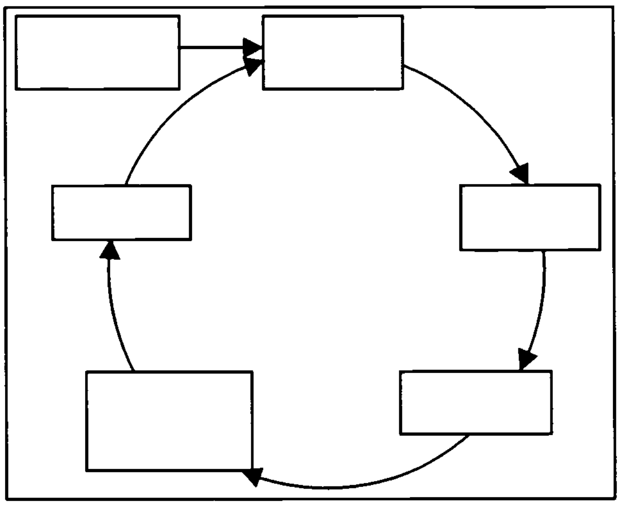

Figure 1: The Planning Cycle

1. Planning begins with a vision/mission statement and a thorough needs assessment. The vision/mission statement of the district or state gives direction to the needs assessment, which in turn may influence the vision/mission statement as needs are identified. The needs assessment describes the current status of technology (the initial state) and the desired status (the desired state) (Gagne, Briggs, & Wager, 1992). The difference, or "gap" between the initial and desired states identifies the needs.
2. From the identification of needs, goals are defined. Goals describe what is needed to close the gap between the initial state and the desired state identified in the needs assessment. Goals are general statements identifying the direction for the district or state to proceed.
3. Instructional objectives are critical to direct the curriculum and to complete the achievement of the educational goals. Objectives are measurable, attainable, understandable, and time-based. Objectives should:
   - Identify the content to be included in the curriculum.
   - Suggest a teaching methodology and the proper tools and aids needed to present the curriculum.

- Assist in the formulation of the means of evaluating student progress and achievement.

4. The instructional objectives drive the development and delivery of the instruction. Selection of the content, teaching methodology, delivery system and technologies, and testing methods are dependent upon the instructional objectives. Thus, in the context of this paper, the instructional objectives drive the technologies.
5. Evaluation of the instruction and student achievement is dependent upon the instructional objectives and the instruction delivered to the students. While there are many purposes in giving a test or other assessments (Linn & Gronlund, 1995), evaluation conducted at the end of an instructional unit is useful to determine student understanding, achievement, etc. The results of these tests may also be used to give insight into instructional effectiveness and usefulness of the teaching methodology and tools. It is important to note that the evaluation process may be used as a springboard into, or even as part of, the next cycle of needs assessment.

The Evaluation Component

Evaluation of student achievement is inseparable from the instructional objectives. The instructional objectives give direction to the instruction and mark the intended learning outcomes. Measurement and assessment determines the extent to which the objective has or has not been met.

The Idaho District Technology Plan Evaluation Rubric (Idaho State Department of Education, 1999) sets the requirements for planning the evaluation of technology integration in the curriculum:

- Measurement and assessment describes quantitative and qualitative assessments to evaluate the effects of technology integration in the curriculum.
  - Details relationship between local and state goals and instructional objectives, and measurement and assessment procedures.
  - Outlines plans to correlate results to the amount, quality, and length of integration into the curriculum.
- Includes the details of gathering longitudinal and pretest-posttest data.
- Details collection, organization, analysis, and reporting of measurement and assessment data.
- Includes schedules, funding sources, and budgets for evaluation.

The above requirements are intended to provide standards for planning an evaluation of the impact of educational technology on the curriculum. This standard was reviewed by the International Society for Technology in Education (ISTE) and approved by the ICTL (Idaho Council for Technology in Learning, 1999). These requirements must be met with an educational evaluation conducted either by district personnel, by an external independent evaluator, or by a combination of both. Because district and school administrators and faculty are practitioners rather than researchers, the ICTL has made no requirement that evaluations be conducted as experimental research with modeling and hypotheses testing, experimental and control groups, advanced statistical procedures, or other research methods. Instead, educational evaluation revolves around using those existing measurement instruments already in the classroom to describe the impact of educational technology on the curriculum.

Much of the information needed to evaluate projects included in a district technology plan is already in place in each district. Most teachers give some form of evaluation at the conclusion of major units of instruction. Additionally, statewide and standardized tests are administered systematically to all students. To complete the evaluation of the integration of technology at the district level, the existing measurement results need to be interpreted to determine the merits of the use of technology. There are numerous methods to accomplish this. Examine each bulleted statement in the rubric standard above:

1. *Measurement and assessment describes quantitative and qualitative assessments to evaluate the effects of technology integration in the curriculum.* Teachers, schools, and districts are *not* limited to quantitative measures only. Other measures, such as questionnaires and surveys, self-reports and interviews, and affective measures may be included as needed to accurately describe the effects of the technology in the curriculum.
2. *Details relationship between local and state goals and instructional objectives, and measurement and assessment procedures.* Evaluations are inseparably tied to the instructional objectives, which in turn are supported by local and state goals.

3. *Outlines plans to correlate results to the amount, quality, and length of integration into the curriculum.* Three broad factors impact the effect the integration of educational technology will have on any curriculum: (a) the amount of time spent with technology in the classroom, (b) the quality of technology use by the students and the teacher, and (c) the length of time individual teachers and students have been using educational technology for personal and academic purposes. Comparing these three factors with measures of student performance will yield insight into the effect that technology is having on the curriculum.
4. *Includes the details of gathering longitudinal and pretest-posttest data.* Analysis of longitudinal measures may be as simple as comparing the results of student measures on this year's tests with the results of last year's, next year's, or the next three or four years'. Currently, teachers occasionally include a pretest on certain topics prior to presenting the instruction. The evaluation plan may well include an expanded role for pretest-posttest measures. As this is a planning process, it is relatively unimportant that a teacher, school, or district does not have longitudinal or pretest-posttest data in place. Instead, it is much more important that plans for collecting such data are included and completed.
5. *Details collection, organization, analysis, and reporting of measurement and assessment data.* Reports are required by all providers of educational technology funding. As with all evaluation reports, the results are first described, then a judgment is made as to the worth or merit of the educational technology, teaching methodology, or curriculum project. The data will need to be collected, compiled and organized, analyzed, and placed into a report to the grantor. Analysis may be as elementary as descriptive summaries such as measures of central tendency, variability, and correlation, or as complex as advanced statistical procedures such as multiple analysis of variance, analysis of covariance, or non-parametric procedures.
6. *Includes schedules, funding sources, and budgets for evaluation.* This part of the rubric criterion guides planning to answer questions such as (a) when will the measures be given and the data collected, (b) how is the data going to be compiled and analyzed, (c) how much will this process cost, and (d) from where will the money come?

Annual Review and Update

To ensure that technology plans remain current, each state and district technology plan must be reviewed and updated on a regular basis, at least annually. The dangers of failing to regularly review and update technology plans include placing administrators in the position of (a) relying upon funding which has expired, (b) missing the opportunity to apply for new sources of funding, and (c) depending upon goals and objectives which are outdated or no longer valid. Annual reviews and updates allow the cyclic planning process (Fig. 1) to proceed naturally. Each review and update includes a needs assessment, with a description of the current or initial state of educational technology, and a description of the gap between the initial state and the desired state. Annual review and update allows realignment of goals, objectives, curriculum development, and evaluation, all based upon the mission and documented needs of the district and state.

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IMPLEMENTING PROJECT START: A PT3 CATALYST PROJECT

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Abstract: This paper discusses the P3T Catalyst Grant awarded to the Miami Museum of Science under the United States Department of Education's Preparing Tomorrow's Teachers to Use Technology program. The Museum's partners in Project START are the University of Miami, the Florida Department of Education, the Smithsonian Institution's National Museum of Natural History Natural Partners Program, NASA's John C. Stennis Space Center, the Eisenhower Consortium for Mathematics and Science Education @ SERVE, BellSouth, the BellSouth Foundation and Miami-Dade County Public Schools. The major thrust of Project START is the infusing of technology into pre-service education.

Introduction -Project START

The Florida Technology-Trainer Enhancement Center (T-TEC) at the Miami Museum of Science has formed a regional Consortium and is implementing an initiative aimed at infusing 21st century learning technology into preservice education throughout the Southeastern United States. Utilizing a faculty development "trainer of trainers" model, the initiative, entitled START (Southeast Student Teachers Are Revitalizing Teaching through Technology), is providing arts and science and education faculty with the tools to prepare tomorrows' teachers to integrate technology-rich learning resources into science and mathematics curriculum.

START is proceeding in two phases. Phase I is focusing on the design, adaptation and field-testing of faculty development training materials. Museum staff and faculty from the University of Miami School of Education and College of Arts and Sciences are reviewing T-TEC's existing technology training materials designed for practicing teachers, and adapting them for use by faculty involved in preparing tomorrow's teachers. To model effective use of technology for creating inquiry-based, science-rich learning modules, the Museum and the University are working simultaneously with representatives from the Smithsonian Institution's Museum of Natural History (NMNH) and NASA's John C. Stennis Space Center to integrate their rich digital resources into the faculty development training materials. START is also working with the Florida Department of Education on the development of an assessment tool for gauging future teacher's competence in integrating technology into curriculum design.

Upon validation of the demonstration/faculty development model, START will initiate Phase II. The Eisenhower Consortium for Mathematics and Science Education @SERVE (the Eisenhower Consortium @ SERVE) will select a cadre of key stakeholders committed to initiating preservice reform from each state to serve as the START facilitation team. Each state facilitation team will participate, as learners, in a four-day institute at the Miami Museum of Science. The institute will model faculty training modules; explore technology-rich learning materials; include scheduled opportunities to view exemplary practice at selected Miami-Dade County Public Schools, namely the Museum's on-line partner schools and the University of Miami's professional development schools; and provide time for replication. START will continue to support facilitation teams as they implement the model in their own states through on-line mentoring and technical support, a robust START website, and a regional conference.

Need

Though powerful, the force of technology has yet to be fully integrated into the classroom. The reason, according to a report from the National Council for Accreditation of teacher Education (NCATE), is that new teacher graduates are not fully prepared to use technology. Effective integration of technology into preservice training opens a broad range of opportunities for enriching curriculum content in all disciplines, allowing preservice teachers to tap into a plethora of simulations, applications, experience, expert resources, discussion groups, and technical support. Too few active teachers are doing that.

Infusing technology into the classroom can directly impact and improve student performance in science and mathematics, subjects of historically low academic achievement nationally, but particularly in the Southeastern U.S. which scores the lowest among all other regions. To improve achievement in science and mathematics, future teachers will need every asset at their disposal, including a through grasp of the power of technology for developing and delivering mathematics and science-rich, standards-based learning. The need to focus on the preparation of future teachers is underscored by the fact that estimated two million technology proficient new teachers will be needed in the next ten years to replace those retiring from service.

Goals and Objectives

The overall goal of START is to demonstrate how a networked learning community can bring together nontraditional partners (informal science museums, formal K-12 schools, post-secondary faculty, business, regional research and development institutions, national museums and federal agencies) to create robust, technology-rich science resources, that, coupled with hands-on training methodology, will enable faculty at Institutes of Higher Education (IHEs) to prepare motivated, technology-proficient future teachers equipped with the necessary skills to prepare their students for the 21st century workforce.

Specific objects of the START Consortium are:

Obj. 1.0 To create faculty development materials and training processes aimed at helping IHE instructional staff infuse technology into their instructional practices.

Obj. 2.0 To design technology-rich digital resources for use by mathematics and science faculty that model new instructional strategies and teaching practices.

Obj. 3.0 To validate all materials, tools and resources.

Obj. 4.0 To prepare technology–proficient teams from each state that is part of the Eisenhower Consortium @ SERVE, to stimulate and facilitate development and infusion of technology into post-secondary curriculum throughout the Southeastern U.S.

Obj. 5.0 To provide on-going electronic and on-site support to state facilitation teams.

Obj. 6.0 To support dissemination of model processes, materials, and findings throughout the Southeastern U.S.

Evaluation Plan

The Center for Children and Technology is serving as evaluators for Project START. To determine whether a technology-based professional development such as this is meeting its goals requires the use of multiple methodologies, including qualitative and quantitative measures. The primary purpose of the evaluation is to collaborate in the work of the project by providing ongoing, independent feedback to the staff. CCC staff is working with project staff to evaluate the pilot institute in which materials and

instructional processes will be field-tested and revised based on findings. CCC staff will administer evaluation instruments to determine the participants' assessment of the training materials and institute structure and the instructional approach. CCC will collaborate with project staff to use the evaluation findings to revise the materials and institute structure and to refine evaluation instruments to be used in the subsequent institutes in the second year of the project.

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TELECOMM: GRADUATE & INSERVICE

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The Internet has become a major force in education, and teacher education institutions are addressing this issue in a many different ways. The papers in this section demonstrate a variety of approaches, through reports of current practice as well as information about research projects in planning or implementation stages. Basic themes include developing knowledge and skills in the use of Internet tools, learning to integrate Internet activities into curriculum, designing interactive Internet-based environments, collaboration, and providing ways to help teachers overcome feelings of isolation. Specific methods include online components within face-to-face classes, online for-credit university courses, online professional development activities, and institutes that are extended through the use of online activities, to name a few. Support, both technical and academic, is essential, and is mentioned throughout.

Research into various online tools is providing educators with information to assist them in the selection and utilization of these in their own environments. Douglass Scott examined the use of a computer conference by graduate teacher certification students who also regularly interacted with each other on a face-to-face basis. Interviews with participants revealed that students felt more ownership of the computer conference than they did of class discussions. Perceived strengths and weaknesses are reported, and comments about how the results were used to improve both the online and face-to-face interactions are also included.

Student interaction and collaboration are key elements in many learning environments. Ester Alake-Tuenter and Kees Jongmans describe their in-progress research study that examines collaboration and the use of a communal database (Web Knowledge Forum). They explain the theoretical background (constructivism, situated learning, and computer supported collaborative learning) and research methodology employed.

Judi Fusco, Hunter Gehlbach, and Mark Schlager describe the use of TAPPED IN™, an online professional development community used by 15 organizations and over 6,000 members. Hypothesizing that TAPPED IN would help teachers overcome feelings of isolation and would increase effectiveness of professional development, they report on a survey that was administered to examine the effectiveness of this tool. Based on survey findings, five barriers to the use of TAPPED IN are discussed, with suggestions about how these might be overcome.

TAPPED IN™ is one of the online tools used in a course described by Debra Sprague and P. Shane Gallagher, who present a detailed description of the development and implementation of an online course for teachers enrolled in the Integrating Technology in Schools Program. Both asynchronous and synchronous activities were included, but the authors feel that some face-to-face experiences would be helpful. A discussion of problems encountered is presented to help others in planning online courses.

Course design is addressed by Robert V. Price and Nancy Maushak, who describe the PSI (personalized system of instruction) model, and provide an example of how it has been used to design a web course, *On-Line Communications and the Internet*. The authors conclude with a discussion of ways this approach overcomes some of the problems associated with traditional individual study courses.

Online courses may require new approaches for students, as well as for instructors. Carl Reynolds and Bruce Morgan describe their online course from the perspective of facilitating learning as students (and instructors) adjust to the online environment. They explain seven strategies that they used, as well as what technologies were used in the class (and why they were chosen).

Larry Holt explores the balance needed between effective teaching and learning practices as he describes how doctoral students were involved in the shift to web-enhanced and online courses. A theoretical basis for such teaching is presented along with a description of how the web is used in a Models of Teaching class. Learning is enhanced by the participatory class environment.

Online professional development activities are increasing. Julie A. Moore, Diana Treahy, Chin-chi Chao, and Sasha A. Barab describe 4 current models for teacher professional development on the Internet, and then explain their NSF-funded project to design and implement a more effective community model. Basic design principles include virtual classroom visits, each of which includes a class video along with teacher commentary. A detailed

description of the virtual classroom screen presence is included.

Melanie Zibit Goldman describes *MSTelementoring*, a professional development model in which a summer institute is continued via online activities throughout the year. Advantages of the program include extending the professional development time, promoting implementation of activities in participants' classrooms throughout the year, and a decrease in teachers' feelings of isolation. Some difficulties were overcome by working with administrators, and a similar program for administrators is in the planning stages.

Summer institutes provide an opportunity for teachers to work together to develop and share skills and knowledge in a specific area or topic. Frances K. Bailie and Catherine M. Ricardo discuss the growing emphasis on standards-based education at the national and state (New York) level. They then describe how participants in the Iona College Summer Institute study and create WebQuests as a way to use technology to meet new assessment standards. Descriptions of some of these products are presented, as is the URL at which they may be found.

Blanche O'Bannon describes how WebQuests, "a structured format in which students participate in the retrieval of information to construct learning," are being used in both graduate and undergraduate teacher education courses. She provides background information about WebQuests, discusses advantages of having students create (or explore) these, and includes some student reactions to the use of WebQuests.

Curriculum development is one of the key areas in education, and there are many different approaches to helping teachers learn to integrate technology into curriculum. Craig A. Cunningham, Frada Boxer, and Ellen Dairyko describe the Web Institute for Teachers, a professional development institute which emphasizes the importance of teachers developing curriculum for their specific students, and they show how the institute facilitates this. The authors conclude with 7 specific suggestions for others who wish to implement similar programs.

Maria del Carmen Malbrån and Claudia Mariela Villar present a brief project report, describing the theoretical background and some design considerations for a project aimed at building a virtual learning environment on the Internet. Based on findings that university teachers and graduates have limited knowledge about use of the Internet, four strategies for Internet use are presented.

Online assessment is an issue of growing importance. David Zimmerman describes an innovative approach to providing online opportunities for assessment. He presents results of a questionnaire that was administered to students who took online written masters comprehensive examinations. Results indicated positive student reactions to the experience. Comparison of exams given in person with those given by e-mail revealed comparable scores.

An essential requirement for any type of online activity is support, and Norm Nicolson, Teresa Macklin, and Curt Cochran describe an approach that they find effective. They use an "Emergency Room" analogy to explain how the helpdesk at their institution has expanded to provide online assistance for emergency permit students throughout the state. Rigorous training, sophisticated communications infrastructure, and a supportive and empathetic approach have been found to be essential to the success of the program. Lessons learned and some possible future directions are described, and may provide suggestions for other institutions.

This section concludes with a brief report about a study to be conducted. Rosa Miriam Ponce Meza and M. Farias-Elinos describe how their research study will examine undergraduates' use of the Internet to "help them to train their thinking, decision making, and information processing skills."

The papers in this section show both the variety and the similarity of thinking by persons using the Internet for online activities. Many of the themes in these papers have been similar, but the approaches have differed. As new technologies and methodologies arise, educators continue to share their experiences, in person, in print, and online. This truly contributes to ongoing professional development for all of us.

Using Qualitative Research Methods to Study Preservice Teachers' Use of a Computer Conference

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Abstract: This study examined the nature of preservice teachers' perspectives on, engagement with, and use of a computer conference during a one-year, graduate-level, teacher certification program. The guiding question was, "What is the role of a computer conference when the participants have the opportunity to interact face-to-face?" The interpretive research paradigm was used to provide a fuller picture of the preservice teachers' experiences, and most data came from face-to-face interviews rather than from the conference transcript. One of the main findings was the participants' perception of ownership over the conference in contrast to the in-class seminar which they felt was more controlled by the faculty. Thus the interns' views speak as much to the nature of the face-to-face seminar as they do to the computer conference, and to the need to continuously assess the contributions of both as well as the interactions between the two environments.

Introduction

This study examined the nature of preservice teachers' use and non-use of a computer conference in one cohort of the Master of Arts with Certification (MAC) program at the University of Michigan. MAC is an intensive teacher certification program that runs for one calendar year, beginning in early July and ending the following June.

The guiding question of this study was, "What is the role of a computer conference when the participants have the opportunity to interact face-to-face?" All MAC interns met in seminars at least two times each week, most taught in the same schools, and many interacted on a face-to-face basis everyday. With so many chances to speak with their colleagues, I wondered why and how they would use a computer conference. Ultimately, the study focused on the interns' perceptions of ownership of the MAC computer conference and the face-to-face seminar. These two arenas are discussed in greater detail below.

The Study

A World Wide Web-based computer conference was created prior to the start of the MAC program, and was made available to all interns and faculty. The conference was run on a Unix-based server at the School of Education, using a modified version of the World Wide Web-based freeware, "HyperNews." HyperNews allows for multiple threaded discussions, hyperlinks to other Web sites, and the inclusion of images, video, and audio. This conference was password protected to prevent unauthorized access.

Like all University of Michigan students, interns were given free Internet accounts and, in addition, were given a tutorial on telecommunications at the University in general and on the MAC conference in particular. Thirty-one preservice teachers were originally enrolled in the MAC program and 16 of these individuals agreed to be interviewed for the study. All MAC interns had some computer experience, and all but one had used the Internet to some degree prior to entering the program.

The interns were originally assigned to participate in the conference at least twice each week as part of their program participation grade. After two months, however, several interns questioned this policy and the faculty agreed to remove the requirement while still encouraging intern participation in the conference.

The conceptual framework for this study draws upon the "iceberg metaphor" (also known as the "Michigan model") of educational telecommunications (Scott 1999). The iceberg metaphor describes the online communication between participants in a computer-mediated communications (CMC) exercise as similar to the 10 percent of an iceberg that rises above the water's surface. The remaining 90 percent of the learning experience takes place through the participants' engagement with the conference (i.e. those behaviors and perceptions that shape, but do not appear in, the online environment). Of course, this metaphor's 10-90 split is a heuristic emphasizing the importance of off-line engagement, and the actual percentages will vary by individual or group. However, this shift in focus, from online to off-line engagement, is key to this model as its primary value is to call attention to the possibility that people who focus attention solely on the what is visible (i.e. the communications that take place online) may miss a potentially important source of information (i.e. interaction that take place off-line).

The iceberg metaphor's implication for this study was to shift the focus from the conference transcript to extensive interviews with the participants. One important benefit of this shift in focus was the ability to speak to, and learn from, non-participants and "lurkers" (people who read, but rarely contribute to the conference). The study examined the interns' engagement with one another in the conference, and not the communication technologies that made these interactions possible.

This study primarily used naturalistic inquiry methods (Lincoln & Guba 1985), and related research techniques to get a "behind the scenes" look at the participants' perceptions of, and engagement with, this computer conference. Initially, I conducted a series of interviews (Mishler 1986; McCracken 1988) with the interns to better understand their perceptions of CMC in general, the MAC conference in particular, and the relative merits of computer-mediated versus face-to-face discussions as part of their professional development program. These interviews were then transcribed and analyzed.

Findings

The interns' comments indicated that while both are important, the computer conference offered distinct advantages over the face-to-face seminar. Three advantages are discussed below: Greater intern control over discussions, enhanced reflection and thoughtfulness, and freedom from temporal constraints.

	Total Messages Posted by Semester (Read-only not included)		
Intern	Summer	Fall	User Type
Jordan	21	30	Heavy
Amy	17	12	
Lloyd	13	18	
Chris	7	4	Moderate
Monique	5	15	
Anya	4	7	
Judy	1	0	Light
Ms. Blank	1	0	

Table 1: Selected Interns' Conference Contributions by Term

Greater Intern Control Over Discussions

Most of the interns who expressed an opinion on this issue believe that they had more control of the conference discussions than they did of the in-class discussions. "Monique" [all names are intern-selected pseudonyms] stated succinctly that, "I think sometimes we see the faculty dominating too much maybe, the in-class discussion." "Jordan," the conference's most prolific participant, commented that it is "...good that [the conference is] kind of open-ended. I think that for some people it would get to be kind of boring if every time you signed on there was a specific question asked by a staff member, and it was sort of a directed discussion. It seems like in class, most of the time, the discussions are pretty directed, or maybe one person will bring in a topic that we hadn't planned on, but then we'll stay on that topic! That will be it! To me it seems good that

somebody can bring up something that they just felt like they wanted to bring up." Jordan's comments also foreshadow another benefit of the computer-mediated discussion: Freedom from linear constraints of face-to-face discussions.

"Amy," a frequent conference contributor, noted that some faculty participation, especially scaffolding discussions and encouraging participants, was helpful: "At first it was like a lot of your stuff, but that was because there was no one on there, people weren't coming on. But I think you've kind of just let people roll with it, and you kind of encouraged people at first. You said, 'That's really interesting. Let's go with that,' and that was good."

Control, But Not Safety

Interestingly, interns' perceived control of the conference did not produce a discussion space where all participants felt free to speak without fear of being judged negatively by the faculty or even by their peers who might read their contributions.

While most interns agreed that they felt greater control in the conference, one intern, "Ms. Blank," indicated that she assumed faculty control over conference content, a belief that shaped her participation in the online discussion. For instance, one of Ms. Blank's colleagues suggested that the interns share a written reflection paper online. Ms. Blank's reaction to that suggestion was that "[it's] hard....at first when he said that, 'oh, [the faculty will] never let us do that.' Because I was thinking maybe [the faculty] wanted us to post our reflections as we were still working on the assignment, and I thought maybe [the faculty] won't like that because other people can draw too much from what others have said without thinking independently." This assumption of faculty control and monitoring of the conference may explain in part Ms. Blank's limited participation in the conference.

Another intern, "Judy," who read but rarely contributed to the conference, explained that concern over negative judgement by others greatly shaped her conference participation: "...I'm afraid of people judging me for what I'm saying, mainly thinking, "oh, she's stupid" or whatever....just with my self-introduction, I sat there for about a half an hour trying to think about what I wanted to say because I didn't want to be like real wordy, and I didn't want to be stupid, but I really looked at it." Unlike Ms. Blank, who was specifically concerned about the faculty's reaction to conference messages, Judy's concerns are more general, and seem to include faculty and intern perceptions. Judy's limited participation is understandable given her concerns over how others might judge her contributions.

Jordan also edited his messages, but feels that doing so is "a respect thing....Because you're talking to the group of people, some of whom you may be close friends with, and others may just have a more school-type relationship, you want to respect people, and make sure you don't put something up there that might possibly be offensive to somebody that you don't quite know as well."

Amy described how her judgement of the quality of her writing plays a role in deciding whether to post a comment to the conference: "...If I felt that I said something well, then I would put it up [on the conference]. If I didn't feel good about what I had written, it's just like writing a paper for all of my English classes. Some of them I handed in, and was like I really hate this paper....That kind of thing I would never put up [on the conference]..."

Enhanced Reflection and Thoughtfulness

Several interns felt the conference afforded more time to think about and compose one's message than the limited time allowed in classroom discussions. Ms. Blank said this was the case "... because people have more time to reflect on what they are going to say, and they can think more about what other people are saying, too. Because sometimes in class, one of the disadvantages is that you are trying to figure out what you are going to say and sometimes you don't, you know, the person who is talking before you, you don't even know what they are saying. Whereas on line you read everyone's stuff, you can really think about it and appreciate it."

More time to write and to read conference contributions contributed, in part, to some interns' assessment that the conference might be a better forum for sensitive or controversial topics than the face-to-face seminar. "Anya" noted that "I would much rather that someone else, if they disagree with me, not express it as vehemently as some of the people in our class do. But on the other hand, that's the way they do it. That's how

they communicate and that's fine. So for me, that's one advantage of the Web page is that I have that distance." Monique concurs, adding "…that controversial things, like this whole racism thing, I think it's actually better to have it in the confer rather than face-to-face because you get a lot of people coming with a lot of baggage, and when you're face-to-face…you have the constant interruptions, and people trying to talk, screaming, shouting, whatever, whereas on the confer,…usually you have to think about what you are going to say before you send it out. So, usually it's well thought out and usually it's very, not unemotional, but at least kind of what you really thought about, what you are thinking about, but not, I don't know, off the cuff kind of thing.

Freedom From Temporal Constraints

The conference was available 24 hours a day which enabled participants to contribute whenever it was convenient, or, as "Lloyd" phrased it, "If I am feeling brilliant at 2 a.m., I can let it out on the [conference]." "Chris," a moderate conference user, agrees, and describes the reasoning behind his choice to participate in the conference late at night: "One of the greatest pros of [the conference] is that it allows, I mean I'm up late like you, and sometimes my best stuff comes out at that time. There's no discussion around. There's not even another MAC student around. Where can I go? I go to my journal, I can write it down on a scrap of paper, or I can stick it [in the conference]....I think [the conference is] very useful, and I hope that, time permitting, I'm going to get a lot more down, and maybe I will sort of focus and tighten what I have to say to make it more time-accessible to people."

The electronic discussion also freed the interns from the linear structure of in-class discussions, a point Jordan touched upon earlier. Lloyd expands upon this idea stating that "...a lot of times with in-class conversation, you'll want to respond to something that somebody says, but two other people had their hands up before you, and they take the conversation somewhere else, which is really neat–the way you have to keep on your toes and everything to keep up–but sometimes you may feel like you have something to say....With our discussion page you can insert your response wherever it's appropriate which I think is pretty cool because I'm sure there are plenty of times where people like me have wanted to say something in [class], didn't get to fit it in because things shifted. So while the stand-alone nature [of a conference discussion] doesn't have the same flow as a natural face-to-face discussion, it does have that neat feature. It doesn't suffer from the same temporal requirements of a discussion which is pretty cool."

Amy develops Lloyd's comment regarding the threaded structure of the computer-mediated conference and contrasts the linear nature of face-to-face discussions with the flexible structure of the conference: "…(Y)ou may have someone who has the start of a new thread, and people can keep reacting to that indefinitely, basically….There can be more branches that are occurring at the same time whereas in a discussion there's it's like one piece whereas in electronic you can have several pieces." Although the nature of computer-mediated discussion has its limitations (discussed below), Lloyd and Amy find advantages in its format that add useful dimensions to their discussions.

Conference Limitations

The previous section describes the MAC computer conference's strengths as seen by the interns. This section will present the interns' perceptions of the conference's weaknesses. The interns noted several limitations to the computer conference including lack of participation by their peers, and limitations of communicating via computer.

Lack of Participation

A common complaint by the interns was the lack of conference participation by their colleagues. Amy sees pros and cons to the lack of participation, and likens lack of conference participation to keeping quiet in classroom discussions: "In the sense of volume, [the limited number of people actively using the conference is] probably a positive because it makes it easier to get through it when you get on there. But, as far as people putting their opinion up there, it's definitely lacking. But I think that there are people who you rarely hear from in the seminar so it's not like it's that different really. [laughs] It's not entirely different."

Lack of participation by other interns not only keeps their opinions out of the discussion, but Lloyd feels that their lack of input inhibits his participation: "The content [of the conference] just doesn't seem to change quickly enough to merit, not to merit, I'm certain I can come up with something to say, something interesting, and relevant to say every time, but sometime I get on, and I'm going, 'I posted the last one in this category, and I'm don't know if I should say something again.'" Lloyd's comment speaks to a Catch-22 of conference participation: There is little incentive, even for active participants, to continue to post messages that receive little or no response. Jordan agrees, and expressed his frustration that the lack of new messages by others decreased his interest in logging on to the conference: " I check [the conference] about twice a week right now. I used to check it a little bit more, but since it hasn't been real active lately, sometimes you check it, and you get pissed off because there isn't nothing new right there [laughs] so I cut my access down a little bit."

Jordan seems to see conference participation as part of the interns' professional development and as an alternative means of keeping in touch when busy schedules conspire to keep people from talking face-to-face: "I'm a bit frustrated with the level of commitment on the part of some of our classmates....I think that just kind of common courtesy. The way I look at it is we're all sort of equals in the workplace as a way to compare it, so if you're gone for a week, you let everybody know. We're all each other's bosses in a sense, so you can talk about it in a carpool, but that's only a couple of people who are at your school. Everybody doesn't know what's going on. Without getting too personal, I see it as a courtesy, 'Sorry I missed you guys last week. I just had a flu. How's everything going?'"

Limitations of the Medium

It was mentioned previously that some interns liked the distance the asynchronous computer conference afforded them when discussing controversial topics. Jordan disagrees, noting that the emotional impact of one's message is dampened in a computer-mediated forum: "Sometimes [posting an emotional message to the conference] makes it more clear, maybe, just in a way of comprehending it, but it can lose the power of it completely. Sometimes the emotion is what gets the message across, what you're trying to talk about whereas other times it's just the words, specifically the content of the words without, I don't know if you can always take things out of context entirely, but sometimes the context can confuse what the person really means. It works both ways." Anya agrees that there are trade-offs when having an emotional discussion face-to-face versus on a computer conference: "There's really a difference between looking at someone, and seeing their immediate reaction, and getting a delayed reaction from the e-mail message or on the Web or whatever. But sometimes that's a good thing, having a little distance."

Chris mentioned that the process of composing and inputting text for the conference limited his participation and, he suspects, that of his colleagues: "(O)h, I like [the conference]....I think the drawback to it is it's slow, and I think people, including myself, are lazy about it especially when they're not good typists. So that's sometimes difficult....just typing it out, and again, it takes longer when you're really going to sit down and write something utilizing paragraphs, and good sentence structure, and syntax, and grammar, etc., it takes longer than it would if you were just speaking."

Conclusion

Most interns agreed that the in-class seminars were overly controlled by the faculty whereas they (the interns) controlled the computer conference (i.e. no assigned topics, faculty presence was minimal, and they could hold discussions on any topic). The conference provided a forum where the interns could direct their education with an appropriate amount of support, and lack of interference, from the faculty. This perception of conference ownership seems to primarily derive from the way both the seminar and the computer conference were structured, and not from any inherent traits of computer-mediated communications. Thus, the participants' views speak as much to the nature of the face-to-face seminars as they do to the conference itself, and to the need to continuously assess the contributions of both as well as the interactions between the two environments. As a post-script to the study, this finding (i.e. the perceived difference in intern ownership of the conference vis-à-vis the in-class seminars) initiated discussion among the MAC faculty to revise the seminar format to increase preservice teacher participation and ownership of the in-class sessions.

The nature of the concept of ownership is worth considering. Interns spoke of their apprehension of being negatively judged by both faculty members and their colleagues. On one hand, the matter might simply

be a question of whether interns or the faculty "own" the discussion. On the other hand, the issue may be more a matter of a sub-set of students establishing "ownership" in a way that left other students feeling "owned."

Other advantages of the conference were also described. These benefits included enhanced reflection and thoughtfulness afforded by the asynchronous nature of the electronic forum. Participants had more time to think about the messages they read, and gave them more time to compose their responses. These characteristics contributed, in part, to some interns' assessment that the conference might be a better forum for sensitive or controversial topics than the face-to-face seminar. The conference was available around the clock which enabled participants to contribute whenever it was convenient, even when they were "feeling brilliant at 2 a.m." The electronic discussion also freed the interns from the linear structure of in-class discussions. They could revisit past discussions if necessary, and respond to the messages in any order they wished. One intern did point out that the archived nature of the conference that made this type of engagement possible had a potentially darker side: That once a message was submitted to the conference, it was "out there" to be read at any time by any one with access. It is conceivable that this concern shaped some interns' participation, and may help explain the care with which so many of the interns composed and edited their messages.

Limitations of the conference included lack of participation by other interns which worked to lesson the motivation of even heavy users to contribute to the conference. The limitations of the medium were also identified as negative elements including the diminished emotional impact of messages and the slow pace of discussions.

This study used interviews exclusively to better assess the value of this technique in understanding the nature of interns' engagement with a computer conference. This energy- and time-intensive method was rewarded by the "amplification" of the participants' voices and resulting insights into the use, and especially the non-use, of the conference. It is doubtful that some of the findings could have been uncovered if not for the additional insight provided by these extended interviews. However, the need for some analysis of the online discourse seems clear. Indeed, the online discourse can provide important insight into connections among the learners participating in the conference. To link this back to the iceberg model, the goal of such research is to make more of the iceberg visible by bringing to light the perceptions of, and engagement with, computer conferencing. This type of investigation is useful both to enhance our understanding of how these technologies are used, and to inform the development of more appropriate online discussion formats that take into account the actual use of the technology, and perhaps to suggest ways for improving off-line interactions.

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Interaction and Collaboration among Teachers: On the Use of a Knowledge Based Network

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Abstract: The goal of this study is to develop guidelines for creating an environment in which teachers can communally build knowledge. A design perspective is used to find ways to support teachers in their efforts to synthesise information, to explore ideas from multiple perspectives, to examine knowledge at different levels of abstraction and to support co-ordinated, coherent and collaborative construction of knowledge. The conditions for creating a communal database, are examined from a situated learning perspective. This means that the context in which knowledge building takes place, which include interpersonal, social, technological and other situational factors, are taken into account.

Introduction

In many cases, educational innovations have led to unsatisfactory results (Fullan, 1991, 1993; Hargreaves, 1994). Research has shown that educational innovations are difficult to realise, jointly due to the isolated work of teachers (Fullan, 1991; Lortie, 1975). Lieberman and Miller (1991) point out that isolated work of teachers "has been held responsible for teachers' anxiety about their effectiveness, their fearfulness of external evaluation and their immersion in the immediacy of their own classrooms. This, in turn, has been felt to explain teachers' reluctance to explore and embrace alternative teaching approaches, which may challenge or move beyond what they already know and do" (p. 227). Educational researchers found that collaboration between teachers can support and promote innovation in schools (Rosenholz, 1989; Van den Berg & Sleegers, 1996). Berman & McLaughin (1977) point out that the support, feedback and encouragement teachers get from their colleagues stimulate them to develop further.

School conditions that stimulate collaboration of teachers and contribute to a successful implementation of educational reforms are often lacking. It is assumed that electronic networks can stimulate teachers' collaboration (Smith Lea & Scardamalia, 1997). Empirical data about the collaboration of teachers through the use of electronic networks, are still lacking.

In the department of Agricultural Education in Wageningen, research is done to get insight in how Web Knowledge Forum (an interactive, shared database) can be used to create teacher discourse on implementing active learning in practise. Questions to be answered are: (1) What conditions are required to create a communal database? (2) What are the strengths and weaknesses of Knowledge Forum in promoting communal knowledge building among teachers? In this paper the theoretical basis and the research methodology are discussed.

Theoretical Background

In this article theories concerning constructivism and situated learning are used to examine the way learners construct their knowledge through the use of the electronic network Web Knowledge Forum (WebKF).

Constructivist View of Learning

Constructivism views knowledge as personally constructed through representations, which are the internal mental actions of the learner. In other words, learners construct knowledge through intellectual activity. New knowledge must be built through the socially dynamic and interpersonal interplay of experiences, beliefs, and prior knowledge each individual possesses and shares within a community of collaborative learners. Learners should elaborate new information and relate this to their prior knowledge, thus constructing new internal representations of the information being presented (see Biemans, 1997). This makes it possible to retain simple information and to understand complex matters.

A model for applying a constructivist approach to learning in ICT, is proposed by Ewing, Dowling and Coutts (1999). Principal features of constructivism are adopted into a model, which has been successfully applied to a practical example. An application of the proposed model will be attempted in this study.

Situated Learning

Lave (1988) states that learning as it normally occurs is a function of the activity, context and culture in which it occurs. Social interaction is an essential component of situated learning. Learners become involved in a "community of practice" which represents certain beliefs and behaviours acquired (Lave & Wenger, 1991, p. 55). Complex practises can be learned effectively and easily where the social context is evident and supportive (Brown & Duguid, 1993). The beginner moves from the periphery of this community to its centre. The learner becomes more active and engaged within the culture and hence assumes the role of an expert. Furthermore, situated learning is usually unintentional rather than deliberate. These theories are what Lave and Wenger (1991) call the process of legitimate "peripheral participation (p.29)".

There are a variety of factors which might influence the way learners effectively interact with each other and the topic being discussed, including their background, knowledge, attitudes, personal previous experiences with computers and with collaborative work, interests, anxiety, and motivations (Young, 1998).

Computer Supported Collaborative Learning

Principles of shared knowledge building and CSCL (see Scardimalia & Bereiter, 1994) are consistent with a constructivist view of learning. In CSCL, active learner participation is required. Knowledge is the result of the individual making meaning out of information and expanding individually held knowledge through the interaction of other learners in the social context of a learning community. The social component of knowledge building is the catalyst in the process: as an individual learner makes sense of new information or experience, it is expressed to others who actively enter into the knowledge-building dialogue to confirm, modify, question, contradict, or correct shared information. In this collaborative knowledge-building process, all partners are acting to make personal and community meaning of new information as different participants share ideas, concepts and principles (Resta, 1998). According to Brown and Parlinscar (1989) the presence of other learners provides participants with the means to gauge their own progress which, in turn, assists them in identifying their relative strength and weaknesses and permits them the insight necessary to improve their own learning.

Further on, rich contexts that reflect the real world and that are closely related as possible to contexts in which this knowledge would subsequently be used can be provided. Participants can discuss authentic problems.

Web Knowledge Forum

In this study the CSCL environment 'Web Knowledge Forum' (WebKF) is used. WebKF has been developed at the Ontario Institute for Studies in Education. It is an environment for building, articulating, exploring and structuring knowledge (Scardamalia & Bereiter, 1994). The system contains tools for text and chart processing, and a central part of the system is a communal database for producing, searching, classifying and linking knowledge. Participant's can share cognitive achievement by writing notes, creating charts, referring to WebPages, reading and commenting on each other's productions. Scardamalia et al. (1994) argued that a very effective way of learning to understand and explain a knowledge object is to generate another object (e.g. hypotheses, theory) based on it. Therefor, WebKF is designed to engage participants with an extensive process of setting up research questions, generating and improving their own intuitive explanations and searching for scientific information. In this manner participants' prior knowledge can develop to more sophisticated forms of understanding and thinking. Thus, it seems that the CSILE environment has a potential to facilitate participation in higher-level practices of inquiry.

Methodology

In order to gain a comprehensive and in-depth understanding of the process of collaboration, a qualitative research methodology is adopted in this study. Within postpositivist paradigms, this study is described as interpretative and descriptive in nature. The study is conducted in five phases: every stage starts with a workshop in which the formal stage is evaluated individually and collectively and goals for the coming period are set, followed up by two months discussing on the network. The themes being discussed are directly related to implement innovations, specifically active learning, into schools.

Data sources consist of transcripts of all notes, results of pre- and post-communal database questionnaires, computer generated data sources, and notes from semi-structured interviews with participants. The questionnaires are used to gather participants' demographic data, computer experiences and attitude towards working collaboratively with colleagues, as well as the experiences they had with factors influencing the participation and outcomes of the network, such as the medium, themes discussed, the task of the coach, and the workshops.

Effects measured are concerned with the quantity and quality of contributions, as well as the interconnectedness of the notes. To analyse participation and interaction the Analytic Toolkit (ATK), a program developed at the Ontario Institute for Studies in Education, is used.

The qualitative study is currently in progress. It is hoped that the results of the study will provide insights into conditions needed to create a communal database to promote communal knowledge building among teachers. Suggestions for future collaboration projects and suggestions for further research will be indicated for designing an environment, which stimulates teachers to work collaboratively towards innovative educational goals.

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Assessing the Impact of a Large-Scale Online Teacher Professional Development Community

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Abstract: TAPPED IN™ is an online community that supports teachers' professional growth through both formal education and professional development programs provided by a coalition of partner organizations and informal activities that occur year-round. The authors of this paper are members of both the community and a research team investigating whether and how the design of our online environment can help foster a culture of learning within a large and diverse community of education professionals. The community is now three years old, and we believe it is time to examine its impact more closely. In this paper, we review data collected from a survey that was recently sent to the educators in the community. Specifically, we examine how experiences in TAPPED IN affect teaching and teachers.

Overview of TAPPED IN

The concept of *community of practice* has become a major theme of teacher professional development (TPD). Advocates claim that communities of practice can be powerful catalysts for enabling teachers to improve their practice (Lieberman, 1996; Hawkins, 1999) and for innovative TPD efforts to achieve sustainability and scalability (Schlager & Schank, 1997; Schlager, Fusco, & Schank, in press). Currently, professional development in the teaching profession differs from that in most other professions in that the process is heavily skewed toward pockets of formal, highly structured activities outside the context of their actual work (Loucks-Horsley, Hewson, Love, & Stiles, 1998).

Similarly, most teacher education programs provide students with little access to the larger community of education professionals outside the university, at best providing internships at a local school. To understand the profession and become contributing members of the teaching community of practice, preservice teachers need access to that community on a sustained basis. Although we cannot change school policies or find more time for professional development, TAPPED IN, as an education community of practice, can help provide opportunities and mechanisms for teachers of all levels to overcome their isolation and make more effective use of time spent on professional growth.

Our view is that professional development is a lifelong process in which teachers' needs change from year to year. Our goal is to begin supporting teachers during their preservice education and continue to serve them as they become leaders in their professional community. We envision a year-round TPD process that balances formal TPD efforts and informal professional activities that are characteristic of other professional communities of practice. Our approach is to invite organizations representing divergent perspectives to be tenants in the TAPPED IN environment and use it to help accomplish their own TPD agendas. In this way, online tools and practices become part of their institutional culture rather than tangential add-ons. If one tenant organization leaves, another can take its place, and the community continues evolving over time as individual groups form and disband and projects begin and end. Each organization leaves behind a bit of its expertise in the form of members who continue to participate in the community, thus enabling the community to become an ever-widening source of expertise.

We currently support a growing community of 15 organizations and over 6,000 members. On any given day in TAPPED IN, one can observe teachers, administrators, district coordinators, state staff, staff developers, university faculty, graduate students, undergraduates, researchers, and the occasional curious guest being resources for one another. Members can be central or peripheral participants in the community. This

ability to participate peripherally (Lave & Wenger, 1991) in the activities of others (both as a resource and as a seeker of assistance) is a hallmark of a community of practice and one that we believe is essential to establishing and sustaining professional relationships. By sharing space in TAPPED IN (as opposed to locking teachers into their own proprietary environments), the organizations enable their teachers to have rich interactions with a wide variety of other educators.

Our technology is a platform-independent, Web-based, real-time environment designed to meet the needs of a large and diverse community of education professionals (see Schlager & Schank, 1997, for a more complete description: http://www.tappedin.org/info/cscl97.html). Activities occur in virtual rooms that provide a basic yet powerful set of communication mechanisms (directing speech to specific people, whispering, paging, emoting) and support tools (whiteboards, notes, tape recorders, and Web viewers). The structure of the TAPPED IN community and its environment allow great flexibility in designing opportunities for pre- and in-service teachers to interact with one another and share information, both within and across institutional boundaries.

As technology proliferates in schools, the issue of how best to prepare teachers to use it effectively to support their learning and that of their students has come into the fore. For educators to embrace technology and integrate it into their classrooms, they must explore, experiment, and collaborate as a community. We have designed TAPPED IN to be a place that encourages ongoing experimentation and collaboration, and that offers immediate support to teachers as they learn the ropes of both the technology and the community. The TAPPED IN community has been growing for over three years. Since we began conducting community-wide activities, an average of 15% (with a range between 10% and 20%) of members log in at least once each month. In this paper we will present a summary of who our members are, what kinds of activities they engage in online, and how they use technology in their classrooms. In addition, we examine the relationship between how often a member logs in and their perceptions of the benefits they gain from their TAPPED IN experiences. Though a time investment is required before most users become comfortable with the environment, we believe (and many of our experienced members tell us) that the return is well worth the effort. We hypothesize that those who rate themselves as more frequent users of TAPPED IN will report lower levels of professional isolation and positive effects on their knowledge of subject area and teaching techniques.

Survey Collection and Data

Our survey was developed to help us learn who our members are and how their experiences in TAPPED IN have affected their professional lives. We invited every member of the community to fill out a 133-question survey. We are collecting data on (a) standard demographics and professional development activities, (b) technology use, and skill rating, and (c) TAPPED IN use, affordances, and barriers. We began collecting data on August 30, 1999, online through Web-based forms (available to members at their convenience). We made available a .pdf file for members to download and mail or fax back to us. We also offered to Email, fax, or mail a hard copy of the survey to any member who requested it. Two announcements were Emailed to all the members of the community; reminders were also included in the monthly e-mailings and on the log-in page. The data being examined in this paper were collected through October 28, 1999. Data collection is still ongoing; the reader should consider this paper as a preliminary look at the survey results.

The demographics of the survey sample closely match the overall membership. The data set includes 851 survey responses from 282 males (34%) and 550 females (66%); 19 respondents did not specify gender. The gender breakdown of all members (as of 11/29/99) is 4188 females (64.9%) and 2262 males (35.0%). Average age of the respondents was 43.72 (SD = 9.74), with a range of 21-67. Table 1 shows that the sample's breakdown is comparable to that of the entire community, and that the sample represents the different occupation categories in TAPPED IN. Although the majority of members are teachers, we believe that it is important to have a diverse community of education professionals. Having administrators, librarians, subject area experts, professional development organizations, and others online allows for informal conversations where ideas can be exchanged. In addition, we have a wide range of experience among the teachers. The respondents who listed teaching as their primary occupation have taught from as little as half a year fulltime to 39 years full time with 25% having taught 5 years or less, 50% having taught 13 years or less, and 75% having taught 21 years or less. Table 2 shows that the different subject areas taught by the teachers in TAPPED IN represents a cross-section of the teaching profession.

In terms of technology skills, 2.2% of respondents rated themselves as having minimal Internet skills, 21.5% as having moderate, 48.5% as having strong, and 27.8% as having expert Internet skills. Table 3

presents information about reported online technology use by our respondents, and Table 4 presents information about the use of computers by teachers in relationship to their classroom.

Occupation	n	Percent of respondents	Population as of 9/99
K-4	98	11.8	18.9[a]
5-6	64	7.7	11.4[a]
7-8	58	7.0	
9-12	125	15.1	13.9
K-12 Teacher (total)	(345)	(41.7)	(44.4)
Community College	12	1.4	n/a
School of Ed. Faculty	27	3.3	2.5
University Faculty (other)	32	3.9	4.4
Library/Media Specialist	37	4.5	5.5
Professional Dev. Staff	31	3.7	4.9
Tech. or Curr. Coordinator	83	10	2.5[b]
School Administration	28	3.4	3.8
15 other occupations on survey	41	20.0	
Other	64	7.7	20.1
Missing	23	n/a	n/a

[a]Because of differences in the wording of occupations, we can't be sure how teachers classified themselves in grades 5-6. On our membership form 18.9% identified themselves as elementary teachers, and 11.4% that identified themselves as middle school teachers on our membership form. On the survey, the grades were specified.
[b]Just Technology Coordinators.

Table 1: Survey respondent occupations as compared with occupation breakdown of the community of TAPPED IN.

Multiple Subjects	168	Computing	104	Physical Education	25
Science	122	Programming	11	Industrial Arts	7
Language Arts	82	Mathematics	109	Foreign Language	19
Fine Arts	46	Social Studies	92	Other	46

Table 2: Subjects taught by the respondents in the 98-99 school year (respondents could select all that applied).

	Percent of respondents				
How often do you do the following?	Never	Once or twice	Monthly	Weekly	More often than weekly
Use email	0.1	0.2	0.1	2.7	96.8
Access the WWW	0	0.1	7.8	7.1	91.9
Use WWW search tools	0.1	1.0	4.4	15.0	79.5
Participate in Listservs, Discussion Boards or Newsgroups	11.9	15.5	10.4	11.7	50.4
Participate in online chat rooms other than TAPPED IN	33.9	33.1	15.4	9.0	8.6
Participate in an online commuity other than TAPPED IN	39.0	26.1	11.4	9.7	13.8

Table 3: Frequency of selected online activities of survey respondents. (The n's for the questions range from 832 to 837.)

In which of the following ways do you use computers to prepare for teaching your classes or in other professional activities?	Percent of respondents: Never	Once or twice	Monthly	Weekly	More often than weekly
Record or calculate student grades	25.2	8.1	9.6	17.3	39.8
Make handouts for students	1.2	3.4	11.4	30.3	53.6
Correspond with parents	15.7	17.2	29.7	19.9	17.4
Get information or pictures from the Internet for use in lessons	5.3	7.0	12.4	31.3	43.4
Use camcorders, digital cameras or scanners to prepare for the class	33.9	33.1	15.4	9.0	8.6
Exchange files with other teachers	39.0	26.1	11.4	9.7	13.8
Post student work, suggestions for resources or ideas	34.0	25.9	16.5	11.8	11.8

Table 4: Frequency of computer use by teachers on professional activities. (The n's range from 405 to 412.)

Barrier	N	Mean	SD	Barrier	N	Mean	SD
Lack of computer at school	808	1.42	.93	Difficulty learning the TAPPED IN commands	804	2.1	.92
Lack of computer at home	809	1.2	.66	Not comfortable with real-time (chat) interaction style	808	1.68	.95
Lack of Internet access at work	802	1.48	1.01	Difficulty arranging to meet others in TAPPED IN	805	1.85	1.02
Lack of Internet access at home	806	1.21	.70	Lack of time to participate in online activities	820	2.85	1.09
Lack of experience/skill using the Internet	804	1.21	.54	Lack of administration support for it at my workplace	796	1.68	1.05
Difficulty logging into TAPPED IN	817	1.71	.94	Lack of useful resources or activities	790	1.5	.83
Having to type to communicate	800	1.42	.72	Lack of online help from TAPPED IN staff	788	1.25	.63
Difficulty learning to navigate the environment	804	1.98	.92				

Table 5: Average ratings of barriers to using TAPPED IN for the whole sample. The question asked was, "Which of the following are barriers to participating in TAPPED IN?" Possible responses: 1=Not a Barrier, 2=Minor Barrier, 3=Moderate Barrier, 4=Major Barrier

Impact of TAPPED IN	R	N
Reducing professional isolation	.47	789
Professional Relationships	.48	789
Participation in professional discourse with other educators	.49	786
Changes in how I teach	.37	782
Changes in what I teach	.32	786
Knowledge of new subject matter	.37	784
Use of technology in my teaching	.35	779
Ability to find web resources	.31	793

The scale for the independent variable of how often have you logged into TAPPED IN was: 1=Never, 2=Once or Twice, 3= Less than one a month, 4=At least once a month, 5=At least once a week, 6=More than once per week. The scale for the dependent variables was: 1=Very negative, 2=Somewhat negative, 3=No impact, 4=Somewhat positive, 5=Very positive. Higher values of R indicate a stronger relationship between the time spent online and the positive impact that members report from TAPPED IN.

Table 6: Correlation between how often a member logs in and impact of TAPPED IN.

Correlations were computed between the self-reported data of how often a member logs in and the perceived impact that TAPPED IN has in different areas of an education professional's life to test our hypothesis that the more time spent online, the greater the perceived impact. We report Spearman's Rho correlations. See Table 6 for the actual areas of professional life and for correlation coefficients. All of the correlations reported differed significantly from zero ($p < .0001$).

Discussion

Our survey was developed to help us learn more about our members. We were pleased to learn that we have teachers with all levels of experience in TAPPED IN, from the brand new teacher to the experienced veteran of 39 years. We learned that 75% of the respondents rated their own Internet skills as strong or expert, and that 96.8% used email, 91.9% accessed the WWW and 79.5% used WWW search tools more often than weekly. In addition, the teachers also reported using technology in many aspects of their profession. Over 65% of our sample record or calculate student grades using a computer monthly or more often; 95% of our sample make handouts for students using a computer monthly or more often; 80% get information or pictures from the Internet for use in lessons monthly or more often; and 60% correspond with parents using a computer monthly or more often. Smaller percentage use camcorders, digital cameras or scanners to prepare for the class (33%), exchange files with other teachers, post student work (35%), suggestions for resources or ideas or activities (39%) at least monthly. Our findings suggest that our members are more frequent and facile users of technology than one would expect in the overall teaching population. Becker's (1999) national survey of teachers' technology use collected in Spring of 1998 indicated that 68% of teachers had used the Internet to find information for lessons, and 28% of teachers did this more often than weekly. Over 95% of our respondents used the Internet to gather information for their lessons, and 43.4% of our respondents did this more often than weekly. One difference that must be considered is that our data were collected a year and one-half later.

What motivates people to use and prevents people from using TAPPED IN for online professional development are two areas we hope the survey will elucidate. In this paper we focused on the barriers. Respondents indicated that lack of time for online activities was rated the most significant barrier that inhibits their use of TAPPED IN. Although online interactions can decrease the time needed for attending a meeting (by eliminating driving time), there are still a finite number of hours in a day. Time can be made available through more professional development days, by paying for time over the summer, or by offering credit (which can result in salary increases), but these are things that will need to be considered at the level of school districts and states. Future analyses will focus on organizations that are currently providing incentives (stipends and district credit) for their members' use of TAPPED IN to determine whether that helps lower the barrier of lack of time. We hypothesize that when online interactions are a central or required part of professional development, time becomes less of a perceived barrier. When online interactions are another activity that teachers would like to take part in, they receive less priority and become one of the items perpetually on that "list of things to do." In addition, we believe that providing credit or a stipend for the first few times online when the learning curve is steepest may reduce the feeling that this is "wasted" time.

The next two most highly ranked barriers, difficulty learning the commands and difficulty in learning to navigate TAPPED IN, are issues that we as designers are working to resolve. We are developing a "
(new person) interface to scaffold the experience for new or infrequent users. We hope these efforts will help reduce some of the time necessary to feel comfortable online. Technological advances and standardization in Java and Web browsers will help us address our fourth most significant barrier, difficulty in logging into TAPPED IN. We have a one-click log-in process, but because of differences in Web browsers and versions of browsers it is difficult to develop a client that works smoothly for all versions, and some members experience difficulty. The fifth most significant barrier cited by our respondents is lack of administrative support for online activity. We, and many others, are working to change this situation by demonstrating the benefits of using technology and integrating it into the daily lives of both education professionals and their students.

The results from this initial exploration of our survey data support our belief that online professional interactions have a positive impact on educators. We found evidence that the more often a member logs in (based on self-report), the greater the perceived reduction of professional isolation and the higher the positive impact on teaching practices (e.g., how I teach and what I teach). Getting teachers to experiment in the classroom is viewed as the first step toward that end. First, teachers must be aware of options for adjusting their practice. Next, they must make a change in content, method, or some other facet of their teaching. Whether the change can be deemed an improvement in teaching is not measurable by our data. Our data

indicate only that members report a positive impact on changes in how and what is taught, the use of technology in teaching, knowledge of subject area resources, and knowledge of new teaching techniques and that these impacts are correlated positively with increased TAPPED IN use.

These preliminary survey findings are consistent with the anecdotal reports we receive from members each week, the observations staff make each day, and the more formal reports we receive from our partner organizations each year. Our future analyses will identify factors that contribute to the overall positive perception of TAPPED IN. We will examine the large section of the survey devoted to which activities in TAPPED IN were valuable to members and how frequently members participated in activities. We will also be investigating the relationship of group membership (which organization a member is affiliated with). Some of our partner organizations offer a stipend or credit for participation in TAPPED IN, and we will examine the effect of this practice on the barriers to participation and the perceived benefits of TAPPED IN. We will continue to report our findings and make adjustments to our community design as we continue to develop our model for professional development.

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Web-Based Learning: Moving Beyond the Internet as a Research Tool

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Abstract

As schools continue to make efforts to hook all classrooms to the Internet, teachers need to learn ways to integrate the Web into their teaching. WebQuests, virtual fieldtrips, intercultural exchange, and collaborative research projects are available online for teachers to adapt and use. Online simulations are available on several different topics from the stock market to managing a rock band to dissecting a frog. In addition to learning about these resources, teachers need experience with different tools for communicating with others. The use of these tools will allow them to collaborate with other educators and expand their own knowledge of web-based resources. This paper explores an online course that engaged teachers in learning about online simulations, intercultural exchange projects, and collaborative research projects though their direct participation in these activities. Tools used for communication with each other and with the instructor included threaded discussions, groupware, and MOOs.

Designing the Course

In the Fall of 1999, the authors of this paper were challenged with designing and teaching a web-based course for teachers enrolled in the Integrating Technology in Schools (ITS) Program. The students were in their third semester of a four semesters cohort program that resulted in a Masters in Education degree. The web-based course was to be taught entirely online. Although the students would meet face-to-face once a week with another instructor, their only interaction with the authors would be online.

Several ideas for the course were discussed and discarded. Two questions were foremost in the minds of the instructors: What did teachers need to know to use the Web in their classrooms and what web-based tools were available for teachers to use? These questions became the cornerstone for the design of the course.

A recent study conducted by the Milken Exchange provided an answer for the first question: what did teachers need to know to use the Web in their classrooms? In this study, seventy-eight percent of the teachers participating indicated they use the Internet to find information or to conduct research. Thirteen percent said they send and receive e-mail while only seven percent use the Internet to assign work to students and four percent use it to communicate with experts (Jerald, 1998). Despite the vast resources of problem-based activities available on the Web, few teachers seem to be integrating these projects into their teaching.

Although there are multiple reasons as to why teachers are not making use of web-based projects, one possible answer is they are unaware of such activities. Therefore, it was decided that the teachers in the ITS Program should be exposed to the various web-based projects available for the K-12 classroom. The authors choose to focus the content of the course on online simulations, intercultural exchange projects, and collaborative research projects. WebQuests were not included because the students had

learned about them in a previous semester. Virtual Fieldtrips were not included because it was felt students could learn about these on their own.

The answer to the second question, what web-based tools were available for teachers to use, required a little more research. After looking at several options, the authors chose a combination of synchronous and asynchronous tools. The students used Townhall (the university's asynchronous threaded discussion bulletin board – http://townhall.gmu.edu) to discuss the class readings and for socialization. A groupware program called NetMeeting (http://www.microsoft.com/downloads/default.asp?) was used for collaborative writing and sharing of ideas. TappedIn (http://www.tappedin.org), a MOO that focuses on educators' staff development, was used to plan small group activities and for collaboration on projects. These tools were chosen because students were familiar with them from a previous semester and there was no cost associated with using these tools.

Structure of the Course

Once the tools and content were decided, the authors turned their attention to the structure of the course. The course was designed with a variety of asynchronous and synchronous activities. However, the majority of the interaction was asynchronous. The instructors knew students were taking two other courses during this semester and knew the amount of workload involved. It was felt that requiring students to engage in synchronous interactions would be difficult for them so synchronous activities were kept to a minimum originally. This was altered based on feedback from students.

Students were provided links to several online resources that provided an overview of web-based learning, examples of web-based projects for students to explore, and articles explaining how to design and implement web-based projects. Students were required to read the online articles, to preview the various websites, and to post comments in Townhall. For the synchronous aspects of the course, students were put into small groups (3 or 4 students to a group) and given several group assignments. They were required to use either NetMeeting or TappedIn to complete these assignments. In addition to reading about web-based projects, students were required to have their own pupils participate in a project and evaluate the results. These results were published in Townhall. Students were also required to create their own web-based project, thereby, creating a bridge between theory and practice.

One of the biggest complaints students have about web-based courses is they feel out of touch with their instructor. Since they would not see their instructor every week, it was important to provide the students with the opportunity to interact with the instructor on an individual basis. To accomplish this, the instructor set virtual office hours and posted times when she would be available to interact on NetMeeting and in TappedIn.

Students were also given the opportunity to provide anonymous feedback to the instructor about the course. Several questions were posted on the course website (http:// classweb.gmu.edu/classweb/dsprague/). Students were able to respond to these questions and their answers were forwarded to the instructor's e-mail address (see http://www.response-o-matic.com for information on how to create such a survey for your website).

Feedback from Students

Townhall Postings

After an initial face-to-face meeting between the instructor and students, the course began with a series of web-based readings and students posting comments about the readings. It quickly became clear that several of the students were uncomfortable with this type of learning. Many students indicated that they did not like having to post their comments. They felt uncomfortable with having other people read what they wrote. They were concerned about spelling and grammar errors. In a web-based environment, students do not have the luxury of sitting back and allowing others to determine the direction of conversation, as they do in a face-to-face course. It is essential that all participate. For some students, this became a major obstacle that was impossible to overcome. For others, it was viewed as a challenge.

Several students also expressed uncertainty as to rather or not anyone was reading their comments. The students knew the instructors were reading the postings, as they frequently commented on them, but they were unsure as to rather or not their fellow students were reading the comments. Students were

reluctant to criticize others' comments because they had to see these same students face-to-face every week during their other courses (students were enrolled in two other courses during the semester).

Other students were unsure of how their classmates perceived them. One student who fell behind in the course due to connectivity problems was reluctant to post once the problem was solved. She felt that posting so late in the course would draw more attention to her than not posting at all. Instead of the cohort process allowing for a more open dialogue, it inhibited many students from participating fully and prevented an enriched discussion of the topics.

Other concerns centered around the impersonal nature of web-based learning. Students felt they were unable to express their feelings in the web-based environment as easily as they could in a face-to-face environment. In an effort to add their personalities to the postings, students began to experiment with the capabilities of the technology. Students began to add background color to their postings. This quickly led to adding graphics and animation. Other students began to write their postings in the form of poetry.

After four weeks of asynchronous learning, it became apparent that students needed an opportunity to explore a synchronous learning environment. The course was modified to allow students to engage in synchronous activities.

Reader's Theater

Students were put into small groups (3 or 4 students to a group) based on the grade level and content area they taught. They were asked to create a Reader's Theater on the pros and cons of web-based learning. A Reader's Theater is similar to a play in which each person has a role. However, unlike a play, a Reader's Theater is read with expression, but is not acted out. The students had experience in writing Reader's Theaters, so this was not a new concept for them. Students were encouraged to use TappedIn and/or NetMeeting to collaboratively write the Reader's Theater. They were asked to write the Reader's Theater in the discourse form of a talk show. One group modeled theirs after *The Jerry Springer Show*, while another group did theirs as a lunch room discussion among three teachers. The most creative one was written as a poem. The "participants" were Confucius, Shakespeare, and Dr. Suess. This group was able to capture the struggle students were having with the web-based course (Figure 1).

Figure 1: A Reader's Theater (written with permission from the students)

I am Deb, Deb-is-me
Do you like technology?
That Deb-is-me, that Deb-is-me
I do not like technology.
You can learn it on the web
I will teach you, I'm Dr. Deb.
I can not learn it through the Web
not even with you, Dr. Deb.
I'll send you articles, read them all,
then post your comments in Town Hall.
I never know what I should write
My spelling is an awful sight.
Review the web sites that I find
Tell me what is on your mind.
Sometimes I think it's nice to share
But do the others really care?
We can meet in virtual space
Come to my office to discuss your case.
I miss the contact, face-to-face,
I do not think I like this place.

Online Simulations

Each group was assigned an online simulation to explore and evaluate. Each member of the group spent time exploring the simulation. They were to evaluate the quality of the simulation and the advantages and disadvantages of having it available on the web. Common issues that emerged were the time it took to download the simulation, the lack of current information (a problem that occurred with one of the stock market simulations), and the need to coordinate completing the simulation (group project that required all participants to commit to a week of actually playing the simulation). Students were generally positive about the simulations and saw them as potential resources for use in their classrooms.

Once students had the opportunity to explore their assigned simulation, they met with the instructor in TappedIn to discuss their evaluation of the simulation before they posted it in Townhall. This gave students the chance to interact synchronously with the instructor. TappedIn is an electronic MOO, sponsored through a grant by the National Science Foundation (http://www.tappedin.org). Prior to meeting with the instructor, students were encouraged to sign-up as members (membership is free) and to participate in TappedIn's workshop for beginners. Students met with the instructor in her virtual office for one hour. Several of the students had attended the instructor's virtual office hours and were comfortable with using TappedIn. For other students this was a new experience for them and some were uncomfortable with the technology. The instructor eased their concerns by using many of TappedIn's commands to make them comfortable. The instructor passed around virtual candy and virtual wine. She sent them whispers and virtually grinned at comments. This led to questions about how to do these.

Before long, students were imitating the instructor. One student who had a difficult time understanding the concept of virtual candy and was uncomfortable in TappedIn was soon baking a virtual pizza and passing it around to others. These discussions resulted in students feeling less intimidated by the technology. Several students created their own virtual office and discussed using it with teachers in their schools to hold virtual meetings.

Using Web-Based Projects with Their Own Students

The students were required to have their pupils participate in a web-based project and then write a reflection on the experience. The purpose of this was to help the teachers take what they were learning in the course and apply it to their own practice. Many of the students were able to find appropriate projects and wrote that their pupils were excited about participating in these projects. They felt their pupils had learned from the experience. Throughout the course, as they reviewed other projects, they commented on the ones they would try with their pupils.

However, for other students, this assignment turned out to be difficult. Some of the students had taken a leave of absence from teaching in order to concentrate on the Master's Program. These students chose to have their own children participate in a web-based project or teamed with one of the other teachers in the cohort program in order to complete this assignment. Another problem that emerged was the lack of Internet access in the schools. Several students indicated they did not have access in their classrooms, only in the library. When they asked the librarian for permission to use the computers, they were told no. The librarian's response was that the computers were for research only, and if she allowed them to bring their students in to use the computers, then she would have to allow everyone to use them. The students worked around this problem by using their home access to complete the activities.

The remaining problem centered on the issue of not being able to locate an appropriate project for their content area. One student taught Algebra I and was unable to find any project that fit with her content area. Throughout the course, she expressed her frustration at the lack of web-based projects for Algebra. The instructor was able to locate one project, but when the student contacted the person running the project she discovered it was no longer active. This became a frequent complaint of the students. Many of the projects they wanted to participate in were no longer accepting registrations. As a result, they had to settle for less than ideal projects. This experience led to a good discussion about designing and implementing web-based projects. The final activity was for students to design their own web-based projects. At this time, students are working on their designs and have not yet posted them.

Face-to-Face Interaction

Students frequently complained about the lack of face-to-face interaction with the instructor. Although they saw each other once a week, they felt the need to also see the instructor. The instructor met with them the first night of class, but there had been no plans to meet again. It was felt that all interactions

could be handled virtually, through e-mail, virtual office hours, and in some cases, the use of a telephone. However, it soon became apparent that students still felt a need for face-to-face interactions. To accommodate the students, the instructor met with them again. At this meeting, the instructor went over the course requirements again and cleared up any confusion. In addition, time was spent on how to participate in an online course. The following website provided helpful tips for this discussion: http://illinois.online.uillinois.edu/model/Studentprofile.htm. Students seem to appreciate this effort on the part of the instructor.

Lessons Learned

Several lessons were learned from this course. First, although being part of a cohort provides support for teacher change (Norton and Sprague, 1996), it also can inhibit online conversations. Many of the students indicated that discussions about the web-based course and the material presented took place during the weekly face-to-face classes. For example, students had agreed to limit the amount of text on the postings in Townhall. To keep from being overwhelmed with reading each other's comments, students agreed to keep the limit to one screen of text. Decisions such as these were made during their face-to-face interactions in their other courses. The instructor of the web-based course was unaware of these decisions or of the conversations taking place outside of the virtual interactions. As a result, the web-based discussions were not as robust as they might have been if students did not have the opportunity for face-to-face interactions.

Second, web-based courses need a combination of asynchronous, synchronous, and face-to-face interaction. This course was designed with the majority of interaction being asynchronous. The instructors knew students were taking two other courses during this semester and knew the amount of workload involved. It was felt that requiring students to engage in synchronous interactions would be difficult for them. Several groups made comments about having to juggle schedules so they could meet synchronously. However, despite these concerns, there was a need to supplement the asynchronous interactions with small-. group synchronous meetings in order to keep students engaged.

Third, face-to-face interaction needs to be a part of web-based courses. It is not enough for the instructor to be available virtually. Students need to see and hear the instructor in order to feel connected. Many of the confusions that were cleared up during the face-to-face class meeting had not been brought to the instructor's attention prior to the class meeting. It is unclear as to why students did not feel comfortable pointing out the confusions via computer-mediated communication. The web-based course met three times face-to-face during the semester. This seemed to not be often enough. It is recommended that a third of the time the course should meet face-to-face.

Fourth, students need the opportunity to provide anonymous feedback during the course. Although many of the survey comments submitted via the class website (http://classweb.gmu.edu/classweb/dsprague) were similar to the individually attributable comments posted in Townhall, some of the comments on the survey brought up new issues. Several students shared their enjoyment of the course and the content. Others used the survey as a chance to express their frustration about web-based courses. What was most interesting is that students were critical of the method of the course, not the content.

Fifth, web-based teaching and learning requires new skills than those used in traditional education. Students do not automatically know how to participate in a virtual course. Although the instructor warned students not to get behind in the course, several students soon fell behind. It was difficult for them to get caught up again. Providing students with information about interacting in a web-based course would be a good strategy to use at the beginning of the course. It should not be assumed that all students have the knowledge and skill to do well in a virtual learning situation.

Conclusions

As universities continue to move in the direction of on-line courses, attention needs to be spent on the design of these courses. On-line courses should consist of a balance between asynchronous, synchronous, and face-to-face interaction. What the balance would look like should depend on the nature of the students, the content, and the instructional goals. However, all three forms of interaction should be present in the course. Such interactions will enable the students to stay engaged with the material and

enable the instructor to deal with confusion and problems that emerge. Time should be spent at the beginning of the course discussing web-based learning as a discourse form and helping students learn the skills they need to be successful in such a learning environment.

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A Framework for the Design of Web Based Courses

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Abstract: The world-wide web provides a convenient and inexpensive means of course delivery and institutions of higher education are rushing to put courses on the web. Once the decision has been made to develop a web-based course, the next important decision is the instructional design model to be used for the course delivery. There are many instructional design models which may be used with web courses including behaviorist, information processing, and social interaction models. One model which is well established and is suitable to web course design is the personalized system of instruction (PSI) model. The PSI approach is based on the elements of high student involvement in the learning process, immediate feedback, self pacing, mastery learning, proctoring, and careful planning and instructional design of course content. PSI is appropriate for courses in which the content is primarily cognitive information.

This article provides a review of the possibilities for using the web for course delivery and support and reviews techniques for the use of PSI for web course design. The basics of the PSI model are reviewed, a summary of research on PSI over the past 30 years is provided, and problems associated with PSI are discussed. Adaptations of PSI to make use of modern technology are included and a web-based course based on the PSI model is described.

The world-wide web provides a convenient and inexpensive means of course delivery and institutions of higher education are rushing to put courses on the web. However, instructors are typically provided with little or no training in producing a web course. Frequently, there is also inadequate time and financial support for instructional development of web-based courses. If training is provided, it typically deals with authoring software and technical matters rather than instructional design. This is a formula for producing mediocre courses. This article provides a review of the possibilities for using the web for course delivery and support and provides a description of the use of one well established instructional model, the Personalized System of Instruction (PSI), for web course design.

Use of the Web for Course Support and Delivery

The world-wide web can be used in many ways in courses ranging from the simple to the complex. The use of the web for courses can be divided into three categories: 1. Web supplemented, 2. Web dependent, and 3. Web based (King, 1998). In *web supplemented* courses, instructors typically begin by using the Web to supplement their regular courses by establishing a course web site on which to publish a course syllabus and provide links to sites related to the course content. As an instructor becomes more comfortable with using the web for course support, they may add a provision for students to submit assignments to the instructor through the web via e-mail or through using a fill-in-the-blanks form on the web site. Another popular feature of the web is on-line conferencing which allows students and the instructor to discuss issues outside of class. Class discussions may be conducted asynchronously through mailing lists or Internet news groups or synchronously (live) using chat programs. Courses in which the web becomes a major component or predominant component of the course are said to be *web dependent*. Web dependent courses may store lessons on the course web site for downloading, require that some assignments be sent to the instructor via e-mail, and require participation in on-line discussions. Sophisticated course web sites may also include live video conferencing and multimedia. In web dependent courses, face to face instruction may be less important than the on-line component. However, students are still expected to complete some course activities such as lab assignments, tests, and perhaps limited lectures and demonstrations in person on

campus. Totally *web-based* courses use the Internet almost exclusively for course delivery. Students may complete the entire course via the world-wide without coming to campus. All lessons, assignments, lecture materials, and instructions are located on a course web site, although students may still be expected to complete tests in person. When instructors decide to develop web course materials for the first time, it may be a good idea for them to start with the basics and gradually add more features to their course web site before attempting to develop sophisticated or totally self-contained web-based courses.

Design Options for Web Courses

The remainder of this article deals with courses which are totally web-based. The current inventory of web-based courses is almost as varied as are conventional college courses in their use of technology, sophistication of design, and depth of content. In 1996, the U.S. Department of Education reported an estimated 25,730 distance education courses with different catalog numbers were offered by higher education institutions (U.S. Dept. of Education, 1996) and he number of courses has increased dramatically since then. Once the decision has been made to develop a web-based course, the next important decision is the instructional design model to be used for the course. There are many instructional design models which may be used including behaviorist, information processing, and social interaction models. One model which is well established and is suitable to web course design is the personalized system of instruction (PSI) model. The PSI model is based on behaviorist and cognitive psychology and encourages mastery of course content. The PSI model is best suited for courses involving skills or cognitive information. For courses which require group interaction, student-determined goal setting, or provide for unique experiences for the student, the PSI model is probably not appropriate. The major elements of the PSI model are widely used in print-based distance education programs and also in large group campus-based courses. The experience which has been gained with PSI in these applications is relevant to web-based distance education.

Basics of The PSI Model

Innovations in education usually have short histories. PSI however, is an exception to the rule and has commanded attention for three decades. The PSI model was first introduced by Keller and Sherman during the 1960s as a form of programmed instruction that employed a highly structured, student-centered approach to course design (Hambleton and Foster, 1998). The distinguishing features of a course based upon the PSI approach to course design were as follows (Keller and Sherman, 1974):

1. students proceeded through the course at their own pace;
2. students were required to demonstrate mastery of each component of the course before proceeding to the next, although summative assessment was still provided by means of a final examination;
3. the teaching materials and other communications between teachers and students were largely text based;
4. 'proctors' provided tutorial support and assessed the achievement of students on individual components of the course; and
5. lectures and demonstrations were intended to motivate students rather than to deliver core course content.

In recent years, the PSI model has been modified to include modern technologies and to rely less on text materials.

Background on Applications of the PSI Model

The PSI model has been used with a wide variety of academic levels, institutions and disciplines. The most common level for use of PSI is the college level but PSI courses also exist in secondary schools and in adult and continuing education. The PSI model has been widely applied to university courses with large enrollments due to the well know limitations of large lecture-based courses as well as economic necessity (Calahan and Smith, 1990).

The PSI model seems to be followed closely in most print-based correspondence courses (Moore and Kearsley, 1996). This is true even though many course authors may not be deliberately implementing a PSI course. Correspondence courses are usually self-paced with a time limit for completion. Correspondence courses are

usually divided into a series of lessons or modules, each including a stated list of objectives, specific directions to the student, discussion material, and a test or other assignments which students must complete to indicate mastery. Students are also required to pass one or more supervised course examinations. Proctoring is usually handled by the course instructor who answers questions submitted by students in writing, grades lesson assignments, and provides feedback. There are no face to face lectures in correspondence courses but this element of the PSI model is provided for by means of the course guide where the instructor supplements the text and provides guidance for the learner. Student evaluation includes both evaluation and feedback throughout the course and a summative evaluation. Over the past decade, correspondence courses which are entirely print-based, have evolved into individual study courses which may include video or audio tapes, visuals, computer materials, and world-wide web sites as well as printed textbooks and study guides. Texas Tech University is the largest provider of individual study courses in the United States, with enrollments which exceeded 46,000 for 1996-97 for high school, college, and non-credit personal improvement courses (Texas Tech University, 1997). The major elements of the PSI model are included in almost all Tech's individual study courses. Tech's individual study courses which are available on the web can be accessed at: www.dce.ttu.edu.

Research on PSI

There is a substantial body of literature spanning a thirty year period that attests to the broad effectiveness of PSI courses in terms of both student mastery of course content and student course evaluations (Kulik, et. al, 1979; Jacobs, 1983; Kulik and Kulik, 1989; Gibbs, 1992), Hambleton and Foster, (1998). Certain common problems associated with PSI have also been documented. A review of both the successes and problems associated with PSI can aid the web course developer. Some of the most important generalizations of this research are as follows:

Mastery Orientation

Of all PSI features, the mastery orientation seems the most important for academic performance. Studies have shown that when the mastery-over-small-steps requirement is held constant, final exam performance remains constantly high even when mastery criterion is set at a high level (Hambleton, 1998). Not only do students in PSI classes make higher scores and grades than students in conventional classes, but they also retain the material better than do students in conventional settings (Callahan and Smith, 1990).

Self-Pacing

The intent of self-pacing is to assure that those who are better prepared are never held back and may complete course requirements early. Other students are able to proceed at a pace, which suits their abilities or personal schedule. Self-pacing does not seem to be critically related to academic performance (Jacobs, 1983). However, it is a factor in producing favorable student attitudes. Some students prefer the option to finish early while others take advantage of provisions to take breaks from study when personal, academic, or work schedules demand increased attention.

Modules

An instructional module, or lesson, should consist of three basic parts: the presentation of original material, assessment, and feedback/redemption (Jacobs, 1983). The organization and format of modules is important since this is usually the primary communication between the student and instructor. The procedures of a PSI course are frequently novel to the student and are sometimes complex. Students are likely to become confused and anxious unless special efforts are made to anticipate these conditions. Clear, precise, and well-organized modules are essential to a successful PSI course.

Lectures

Since the role of lectures in PSI courses is minimized in a PSI course, they are usually given infrequently and attendance is optional in some courses. Their main purpose is to motivate students and to develop rapport between instructors and students. In some PSI courses, lectures have been removed entirely without adverse effects. Since there are usually no lectures in web-based courses, guidance, motivation, and explanation of course content provided by the instructor through the course study guide becomes extremely important.

Proctors

The use of proctors and emphasis on personal interaction distinguishes PSI from most other forms of individualized instruction. In campus-based PSI courses, proctors make frequent testing and immediate feedback possible and are in the position to encourage and interact with students individually. Proctors also function as tutors by clarifying objectives and explaining difficult concepts. Research has shown that field independent students generally achieve better academic success in PSI courses but that the use of proctors contributes more to the success of field dependent students when proctoring is a major course component (Jacobs, 1983).

A Model for PSI Web Courses

A sample PSI-based web course is EDIT *5340 On-Line Communications and the Internet* offered by Texas Tech University. The course URL is: www.dce.ttu.edu/dl/courses/edit5340.

A web-based PSI course syllabus will look similar to that of a conventional course and will include a course description, course objectives, a list of texts and any other required materials, course procedures and policies, and a list of assignments and grading procedures. Since the course is self-paced, there will be no rigid course schedule although a series of deadlines may be included. It is important to include specific procedures describing how the course operates including how assignments are to be submitted, how tests are to be taken, and how the student may find help and have questions answered. A set of frequently asked questions is included on the course web site. Students may also submit questions to the instructor via e-mail or they may call a toll free number which is available to Texas Tech students.

EDIT 5340 is divided into a series of lessons consisting of the following sections: Introduction, Module Objectives, How to Proceed, Discussion, Self-Help Exercises, Lesson Assignments, and Review Questions. In this course, introductory material and the first lesson are printed in a course guide which is sent to each student upon enrollment. The remainder of the lessons are stored on the course web site where students my read, print, or download them to their own PC. The main components of each lesson are as follows:

Introduction

The introduction presents an overview of the lesson and is about a half page in length. It includes a statement of the importance of the lesson, a brief overview of the material and activities to be covered in the lesson, and sometimes thought provoking questions which are intended to focus the student's attention and provide motivation. For example, the introduction to the lesson on finding information on the world-wide web from EDIT 5340 states: "*The web now has more than 1 million pages on-line! So if you're looking for information, you need help. Otherwise, it's a little like looking for a needle in a haystack. In this lesson, we'll look at some of the best ways of finding information on the web...*"

Lesson Objectives

These are measurable statements of learning outcomes that clearly state what the student is expected to know or be able to do after completing the lesson. For our lesson on finding information on the web, a sample objective is: *After completing this lesson, you will be able to locate specific information on the web using two or more web search engines.* It is important that the list of objectives be comprehensive enough to include all expected learning outcomes for the lesson and they should be clearly and unambiguously stated.

How to Proceed

This section is a step-by-step listing of what the student is to do in order to complete the lesson. Here's an example from EDIT 5340:

1. Complete and submit Lessons 1 and 2 before proceeding with this lesson.
2. Read the lesson introduction and objectives.
3. Read Chapter 5 of the textbook and the discussion material included in this lesson. Pay careful attention to the terms introduced and the procedures for constructing an Internet search using boolean logic.
4. For your own information, complete the Self-Help exercises included in this lesson. These are not submitted with the lesson assignment.
5. Complete the Lesson Assignment, including the review questions and applications exercises, included in this lesson.
6. If you have questions about the lesson or assignment, you may send an e-mail message to me or submit it to the class listserv.
7. Submit your Lesson 3 assignment via e-mail as described in the *Procedures for Submitting Assignments* in the *Course Introduction*.
8. Proceed on to Lesson 4 when you are ready.

These instructions are intended to specify precisely what the student is expected to do and the order in which the steps are to be completed. The intent is to leave little room for possible misunderstandings.

Discussion

This section might be thought of as a substitute for the class lectures. The purpose here is to supplement the textbook, not to repeat it. Important concepts and principles can be pointed out and explained. Important information that is not included in the text can be added. Points that the student may find confusing can be explained and the importance and application of the lesson material can be stated in order to motivate the student. Clear and concise writing is important here to avoid misunderstandings.

Self-Help Exercises

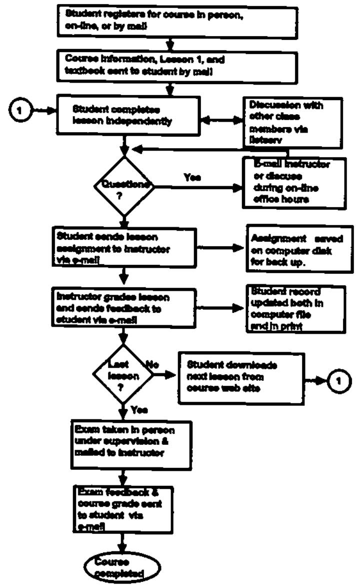
These exercises are designed to provide practice and reinforcement for the student. These exercises are optional and are not submitted or graded. Such activities as answering review questions from a textbook, defining key terms, or accessing Internet web sites containing supplementary information may be included in Self-Help exercises.

Lesson Assignment

The lesson assignment may include any assignments which allow the student to demonstrate mastery of the lesson objectives. In EDIT 5340, the lesson assignment consists of a set of review questions and a set of application exercises. The review questions are a set of multiple choice questions, which are designed to measure the student's mastery of the lesson objectives. It is especially important that questions be worded well and that there be exactly one justifiably correct answer. Questions are designed to measure concept attainment and an ability to apply the information contained in the lesson. The applications assignments require the student to demonstrate the appropriate behaviors specified in the lesson objectives. In the web search lesson, one assignment is for the student to conduct an Internet search on a given topic using the *Yahoo* search engine. Specific instructions are given including diagrams, and computer screen, and examples as appropriate. The assignment section also specifies exactly what items the student is to submit to the instructor.

Course Operation and Practical Considerations

A description of the operation of the sample course described here is shown in Figure 1: A Model for Online Guided Study (Price, 1997).



A Model for On-Line Guided Study

Lessons are downloaded or printed by the student from the course web site. Course lessons are stored on the web where they can be printed or downloaded by students. Lessons are much easier for the instructor to update than are printed lessons. Assignments are submitted via e-mail. After grading, feedback on assignments is sent to the student via e-mail. Assignments are usually graded and returned within 2 working days.

A common complaint concerning individual study courses is the lack of interaction and personal contact with the instructor and other students. Many students attribute the feeling of isolation associated with individual study as one of the primary reasons for not completing courses. The Internet can help here by providing a means for the student to communicate with the instructor via e-mail. Also, a class listserv (an automated program which distributes e-mail) puts students in contact with one another. Students can send questions, suggestions, and ideas to the class via e-mail in this manner. Students also read the postings of other students and respond. The listserv also provides a means for the instructor to send announcements of general interest to the class.

The lack of access to library resources and information is another common problem associated with conventional individual study courses. Therefore, many Internet resources were incorporated into the course lessons. Students learn to find and retrieve information from a variety of sources such as Tech's on-line Library Information System and the world-wide web using their web browsers and other Internet tools such as FTP and Telnet.

Course exams are taken in person with a supervisor present. Exams are scheduled at a suitable location near where the student lives or works.

From the instructor's point of view, the lack of feedback from students about the course is another common problem associated with most individual study courses. Since the instructor and students may never meet, it is difficult to judge whether instructions and assignments are clear and whether course content meets student needs. However, with on-line guided study, the continuous communication via e-mail helps the instructor to realize when changes in the course are needed.

Conclusion

With proper planning and attention to instructional design, web-based courses can provide a convenient and instructionally sound method of course delivery. The PSI model is a proven model which can be applied to many web-based courses.

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Transforming the Graduate Learner from Traditional to Web-based Instruction: Integrating Internet Technologies to Enable the Paradigm Shift

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Abstract: With the primary goal to facilitate change and a paradigm shift in students' thinking about distance communication , a distance delivered course was taught in seminar format on information and communication technologies. By using traditional and methods to introduce the technologies and practices, the paradigm shift was enabled. Several strategies were employed to facilitate this change: namely, scheduling two face-to-face meetings, using an instructor team approach, empowering students to establish their own rules of "netequette," establishing controversial topics for debate, encouraging teamwork activities, promoting highly–creative web page development as term projects. The effort was successful as observed by students' interaction through their newly-learned computer technologies.

Introduction

Graduate students in education continue to request courses and degree programs delivered via some distance format. Most graduate students in the College of Education are full-time professionals who have difficulty participating in the traditional, face-to-face, evening or weekend extension courses that involve travel to a site. It is also more common to hear potential graduate students express inability to block out weeks of their summer time to attend on-campus courses. Therefore, more courses in graduate programs are requested as delivered via distance in some way. The recent growth of the Internet and the World Wide Web (WWW) has led many students to request distance delivery of courses via the Internet and WWW. The convenience of being able to take a graduate course from their home computer has intrigued many of our public school professionals.

However, historically, many learners are not prepared to make the paradigm shifts required to be a successful student in the virtual setting. And, in many cases, students find themselves dropping out or performing below their expectations. Often students are unable to make the change from the expectations associated with traditional face-to-face instruction to the demands of the virtual classroom. They find that the lack of the familiar face-to-face structure with more directed instruction is sorely missed, and the new arena of the self-motivated, self-directed learner is one for which they are not prepared. In addition, the technology expertise required for successful distance communication is insufficient, resulting in high levels of anxiety or frustration.

Background

Distance education is not new, starting with correspondence courses delivered by mail in this country being advertised in the 1700's (Willis, 1993). Electronic means of distance delivery in the U. S. did not begin to expand much until the 1980's. By 1989, the efforts to expand distance education by a variety of electronic media was widespread across the country (1989). What was considered as substandard practices just a few short years ago by many officials in higher education and implemented by only a few institutions, is now a very real solution for most all higher education institutions, not only in this country but also throughout the world as well (Keegan, 1986).

Because of the interactivity of the Web, the opportunity exists for designing a higher order of instruction instead of the programmed instruction or the simple correspondence approach. An increasing number of institutions are recognizing the variety of media supported by the Web and the availability of personal computers and are seriously making efforts to use this viable, dynamic medium for distance learning (Moore and Kearsley, 1996).

There is an array of software pre-designed for instruction on the Web. However, many are costly and cumbersome to use. Most Web-based commercial software frequently dictates instructional designs that do not provide sufficient opportunity to enable students to have a successful experience. The structure built in to most course software packages creates an intimidating and formidable atmosphere for the beginning distance learner. As an alternative, utilizing a variety of strategies including face-to-face instruction, email, Web conferencing, student empowerment for setting course structure and direction, web page resources, the Internet, and team teaching could create a paradigm shift that would facilitate a successful distance learning experience. After all, distance education is about change (Moore and Kearsley, 1996).

Procedure

In selecting and designing a distance-delivered course for the Web, we wanted to insure that students would have a highly positive experience. With this in mind, we established the following objectives to guide us in the selection of content, instruction design and delivery methods:

1. The course had to include debatable issues that held a common interest for students.
2. The course would be team-taught to add interest, broader perspectives, and more individualized attention.
3. The technology tools had to be relatively simple, easily available, flexible in structure, and low-cost.
4. Facilitating the paradigm shift was established as a major goal.

Strategies that Enabled the Paradigm Shift

Since the course was titled "Seminar: Information and Communication Technology", the goals of the course required that a major paradigm shift take place for

all learners to be successful. Most graduate seminars, when taught face-to-face, cause little challenge for teachers to become engaged in communicating their views. Our course, requiring use of the Internet, e-mail, "chatroom" software, and web development software created new challenges that required more enabling strategies. Almost all of the students enrolled in the class had limited or no experience with a distance delivered class using asynchronous conferencing, and some had very little experience with use of the Internet and email, complicating the issue even more. That, coupled with the fact that most of the students were non-traditional with high anxiety levels about success with the technology, presented learner requirements that we had to address. Also, another problem that didn't surface until the course began, were "netiquette" issues. Therefore, a major shift in students thinking about acquiring information and communicating in class sessions, had to be enabled in such a way that the technology would become transparent.

The first strategy was to establish some traditional structure that was familiar to the students. The traditional components selected were some face-to-face meetings and establishing scheduled dates and times for the on-line sessions. The first session of the class was scheduled as a face-to-face format to enable everyone to get acquainted and develop positive relationships with the instructors and each other. This meeting served the purpose of establishing a comfort level that prepared the students for the changes that followed. The regularly scheduled times for the on-line sessions provided the students with concrete events to motivate them to prepare and keep on-task during the course. It also provided times when they knew they would have the opportunity to interact with other and when they were assured someone would respond to their communication efforts.

One key component in this strategy was to schedule a face-to-face meeting at the beginning and near the end of the course. This event established a camaraderie that was maintained through the distance-delivered sessions that followed. At the face-to-face meetings, the technology tools were taught and practiced. The interactions that occurred, the visual images developed, and the confidence level established through practice among peers, set the stage for continued positive learning during the on-line sessions. The second session provided reinforcement for the new skills learned and strengthened the camaraderie among the students.

Strategy two was to begin practice with email, a technology with which everyone had at least some level of experience and expertise. The instructors sent emails to each student a minimum of once per week. Activities were also scheduled where students had to email with each other to finish the work. All assignments and notices about the next class were communicated by email with a web site as a backup where the same information could be retrieved. Even when telephone calls were received, the students were encouraged to check their email as well to answer the questions expressed in the calls.

To further strengthen the skills to communicate effectively by email, small group projects were assigned between sessions. Students, therefore, knew they had to communicate with each other several times, refining their skills of setting up address book lists, establishing files for saving information, and sending attachments or pasting information into email messages. They also sent all correspondence and web site contributions by email to the instructors. To reinforce this shift in communication, the instructors responded to email promptly, sometimes daily with certain students, to develop the habit.

Strategy three was to create and maintain a web site for the course. The intent was to encourage students to use the site for supplementary information. Ownership in the site was encouraged by posting contributions from students and giving credit for the

source. One part of the site was to create a set of links to URL's that the students found in their searches that benefited others. To "force" the paradigm shift from traditional instruction practice, no hard copy was mailed out to the class members after the first face-to-face class session. Midway through the course, the site became a source from which the students could navigate to other sources of information that were of interest. This particular strategy was most successful, established strong feelings of ownership, and led to the students requesting instruction in web page development which we substituted at the end of the course.

Strategy four arose out of necessity during the first session: the need to establish "netiquette" rules for communicating in "chatrooms". Through actual situations, we worked with the students to develop rules for courtesy that encouraged conversation electronically rather than discourage members to be silent. Also, rules were established to actively promote contributions from the "silent types" rather than ignore. We also encouraged the students themselves to police each other when members made mistakes rather than place the burden entirely on the instructors.

Strategy five was to select topics for discussion that involved common interests, yet at the same time promoted controversy. Challenging issues, for which no easy answers were apparent, were selected for total group and small group discussions. Since all members of the class were public school educators, the topics that fit these criteria were easy to select. These topics were sent out as emails to students to prepare for discussion for each scheduled on-line meeting. The web site was also used to communicate all meeting agenda, class assignments, and supplementary information.

Another feature that later identified itself as a key strategy was the team teaching approach. At the beginning, during the face-to-face session, we recognized the advantages of two perspectives, yet at the same time compatibility, enhancing the instruction of new technology and being able to respond to students' fears of the technology. While one instructor was directing the instruction, the other was facilitating the practice and application of the technology. Also, for that first face-to-face meeting, we met in a networked computer laboratory where the distance technologies could be simulated. This environment necessitated the team teaching approach.

Later, during the on-line conference sessions, we found it necessary for one instructor to focus on the technology difficulties that arose with certain students while the other led the discussion. On two or three occasions, when several problems arose with technology, we would assign one of the students to serve as leader of the discussion while both instructors aided students in troubleshooting particular problems. This particular strategy, although not planned initially, became one of the best enabling strategies to accomplish the paradigm shift we were hoping for. These experiences prepared the students to accept responsibility for their own learning, sharpen their problem-solving skills, accept leadership roles, and better appreciate the need for following "netiquette" rules.

The seventh strategy, one that had a powerful influence of the paradigm shift, was to empower the students to set some of their own rules, to be involved in choosing how they would learn, and to recommend and choose their major project for the course. A great deal of latitude was given to them in planning how they would format and submit assignments. Students were encouraged to collaborate in doing their work for the course. An outcome of this strategy is that students practiced their newly learned skills by working together in teams through distance technologies. All of them were highly motivated to develop their skills in developing web pages because of the interest in the Internet.

Distance technology tools used

The course is a graduate level, 3-credit class called "Seminar: Information and Communication Technology" offered in the Spring of 1999 through the College of Education at the University of Wyomng in Laramie Wyoming. The purpose of the course was to teach communications technology, comupter multitasking, web page design and development using issues in Vocational Education as the forum for discussion. The real uniqueness of the course from the student's perspective was that the software the student used in the class was dowloaded for free from the Internet.

The process that we used centered around a website we developed with Claris HomePage at http://ed.uwyo.edu/AgEd/edas5870/index.html. The site included the course syllabus, class schedule, assignments, materials for further reading and web links. The web conferencing software was a free download called ICQ at http://www.mirabilis.com . We also coached the students during the first face-to-face session to download and configure the software for their respective computers. This software enabled us to establish a separate forum for small group discussions as well as total group conference. We also helped students establish E-mail addresses by using MSN HotMail provided by Microsoft at http://lc2.law5.hotmail.passport.com/cgi-bin/login. With this tool we were able to send topics for discussion and reactions to individual student's work and questions. By asking the students to set up a separate email account, it was easier for them to manage mail that was solely for the purpose of the class (which served well for the instructors also).

The final piece of software we used towards the conclusion of the course was the 30 day trial version of Claris HomePage from http://www.claris.com/products/try filemaker.html . This is a fully functional webpage development tool with a very easy learning curve. With this tool our students were able to develop instrutional websites which we later posted on our website. By meeting as a group initially and again toward the end of the course, we were able to help the students develop fairly advanced skills in using Internet, email, WWW, and working together in teams via distance technologies.

Results and Implications

The last face-to-face session represented examples that summarizes best how the strategies contributed to a paradigm shift that enabled distance communication and learning. At the request of the students, we prepared instructional exercises to download and work with trial versions of Claris Homepage. The students became so motivated by the prospect of designing web pages for their respective school use that everyone wanted to work either individually or in teams to create web pages as term projects. The location of the face-to-face meeting was in a computer laboratory facility with a server and access to the Internet. We quickly noticed that during the course, the students were still using electronic communication with each other as well as oral communication. At one point, three students were multi-tasking, creating different components, searching and downloading information, and assembling their final product in a common file on the server. In the weeks that followed, all of the communication between the students and instructors was by email. All but one student were able to attach and send their final project to us by email so that we could post their web page project on our web site.

Given that our most important objective was to facilitate a major paradigm shift held by the students about communicating with each other, this course was successful. An additional accomplishment was that the technologies used in the course were available as free trial downloads that the students could obtain on their home computers.

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An Examination of the Net Generation: Using Doctoral Students in Web Based Courses

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Abstract: This paper is designed to assist graduate level professors with On-line teaching and will describe the balance needed between effective teaching and learning practices. A participatory model will be presented which includes web-enhanced instructional strategies and delivery techniques that include multi-sensory approaches using the internet.

Introduction

It is a delicate balance between teacher content control and student's active participation in a learning environment in graduate level courses. For the past three years, at the University of Central Florida in Orlando, the doctoral level courses have been web-enhanced. Now some courses are totally on line. In this type teaching and learning environment instructional considerations have been renewed. The focus of this session will be to describe the changes that have occurred and how doctoral students have provided input into web enhanced instruction.

Computers alone won't do the trick. They are necessary but insufficient for moving our thinking into new heights of effectiveness. We still have to learn best how to use this technology. The students are the most powerful forces for change. Absorbing content knowledge was the old way of learning. Now, learning how to navigate and how to learn means learning how to synthesize, not just analyze. Engaging in information and communicating with fellow students on the net allows students to construct higher-level structures and mental images. The shift from teacher-centered to learner-centered education does not suggest that the teacher is suddenly playing a less important role. A teacher is crucial and valuable in the learner-centered environment. Because along with the learner, the teacher is now creating the structure of what is to happen in the course.

Campus Support

The Office of Course Development and Web Services was developed at the University of Central Florida in June of 1996. This office was formed following the appointment of a Provost for Information and Technology. The Office serves the following purpose:

- Helps faculty integrate technology and media to transform the learning process
- Produces multi-media courseware, software, and databases
- Produces learner support for succeeding in technology-mediated classes

The Office of Course Development and Web Services trains the faculty in the use of WebCT. WebCT (short for World Wide Web Course Tools) is a commercial tool used at UCF to facilitate the creation of entire on-line courses or to simply publish material to supplement existing courses. WebCT is completely web-based. There is no Software to install other than an Internet browser on the computer used by students and faculty.

The Web CT Academy is divided into six courses:

Freshmen Level
General overview from a student's views, including logging in, navigation, forum, chat, quizzes, calendar and checking grades.
Sophomore Level
The instructor's view of administration of a course, including forum creation and maintenance, student and grade management, student tracking, and help function.
Junior Level
Higher level of course administration, including overview to quizzes, reviewing And grading quizzes, course calendar and glossary.
Senior Level
How to design and develop and grade quizzes
Masters Level
Masters Level is for those instructors who wish to maintain their won courses on Web CT, including file management, path editor, and course design feature in Web CT.
Ph.D. Level
The Ph.D. level requires knowledge of HTML. In this class, the instructor will learn how to upload/download materials and graphics.

Without the support of the University's Office of Course Development and Web services the web-courses would not be a reality.

Teacher- Learner Collaboration

The initial discussion with the doctoral students about putting the course on line was accomplished through a "class meeting." Students like to know the latest advances and changes in the schools curriculum. Fortunately, when it was explained that the university was moving to web-enhanced and on-line courses in the doctoral program their

natural curiosity was aroused. The course syllabus information was posted on the web. Then, during the first class session, the students moved to the computer lab to see the page and to practice how to log on. The next step involved seeking their input. Without having the content knowledge of the course, we discussed a format design that would be consisted with each new topic to be learned. The focus of the course is on instruction. The course represents the instruction side of the curriculum and instruction doctoral program. The book selected for the course is Models of Teaching by Bruce Joyce and Marsha Weil.

The group through the class meeting agreed upon the format for the web page. Each student was assigned an instructional model that they would word-process and submit for course credit.

The format for each instructional model is as follows:

Learning Objectives
Purposes and Assumptions
Additional Resources
Additional Links

The learning objective section identifies the outcomes that will be reached by students as they browse through the web page. The purposes and assumption section of each model includes a description of the theorists associated with the model, a summary of the model parts, and the date the model was developed. The additional resource section of each model lists hard copies of related materials and the additional links section lists URL addresses the students might browse.

When students are allowed to generate their own goals in collaboration with their teacher they become motivated to learn. Goals are best when they are:

1) created by the learner
2) concrete and specific
3) due on a specific date
4) self-assessed often
5) re-adjusted periodically

Role as Catalyst, Not Teacher

The belief system that allows for collaboration with students and is indeed a new model for teaching is advocated by Eric Jensen in his book Super Teaching. The old model of teaching was: I *Teach, Students Perform, I Assess*. In today's model the focus is

different: *I'm a catalyst for Student Learning & Student Self-Assessment.* The negotiation process for course formats using the web is representative of this new thinking. As the teacher, you are willing to examine the integration of technology and you establish a positive learning environment that will maximize the student's potential for learning.

Web-Page Design Enhances the Learning

How much did you learn and retain from high school or college? Usually the answer is, "just enough to get my degree." Everything else you learned, you chose to because it was fun. Our brain is genetically programmed to learn the behaviors needed to be learned for your perceived survival. If we want to encourage and develop better thinking skills for students, then we need to focus on learning not, teaching or instruction. How does web-design assist with learning potential? There are several ways.

Prior exposure to information speeds up learning. The brain has a waiting room that stores information to be learned. If the information is not utilized over time, it lies unconnected and random. But if other parts of the puzzle are offered, the understanding and extraction of meaning is rapid. The access that students have to content offered through web-design exposes them early to the information. Pre-exposing learners weeks in advance will maximize their potential for encoding the skills to be learned.

Other means for pre-exposing learners include using web-design include:

- Course description posted on web in advance to the course
- Talking with past students from previous cohort groups
- Using colorful peripherals in the web-design
- Use of power point graphic pages

The use of pre-exposure with positive visual suggestions like color-coding key items facilitates greater recall and successful encoding.

Posted Focus Questions

Focus questions were used to stimulate discussion between students. Each instructional model that was assigned had a focus question. The student was then responsible for answering the focus question. In addition to the response to the question, the student was required to add new information to the page or respond to an another student's question or response. Suggested additions to the page included citing authors, journals, curriculum guides, or web-sites, or related URL addresses.

When students are learning from one another the learning environment is changed as represented in the following quote:

WE LEARN:

10% of what we read
20% of what we hear
30% of what we see
50% of what we both see and hear
70% of what is discussed with others
80% of what we experience personally
95% of what we teach to someone else

The students are responsible for presenting one of the instructional models as a formal presentation during our regularly scheduled class time. This means they must research the instructional model, prepare a power point summary of the model, and then teach the model to their classmates.

Continual Renewal of Web-Design

Each semester as the course is taught, a new group of students will add information to the web-page course design. The power point presentations will be added to enhance the visualization aspect of the design. The power point material will enhance the design, will help students encode visually, and will stimulate and motivate learners.

This paper has explained the role that doctoral Students played in web-course design at the University of Central Florida. The success of this endeavor is based upon the campus support that is provided as well as a philosophical position that allows students to focus on their own learning.

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The Internet Learning Forum: Designing and Building an Online Community of Practice

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Abstract: This paper reports an effort to create opportunities for teachers' professional development using the web and video technology. In view of the lack of critical reflective discussion among teachers in current teacher professional development programs, we address the problem of how developing Web and video technologies may be useful in providing innovative and effective professional development opportunities for pre-service and in-service teachers. Developed from situated cognition and community of practice perspectives, the Internet Learning Forum (ILF) is a new community model for professional development. Using the video demonstration as the anchoring point, participants engage in discussion that helps them examine their own assumptions about teaching and learning, reflect on their practices, and exchange information with other members in the community.

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mathematics are reflective practitioners who continually evaluate the effects of their choices and actions on others (students parents, families, and other professionals in the learning community) and who actively seek out opportunities to grow professionally" (1996, p. 12). Under this standard, teachers are asked to "advocate and model improved practices for the teaching of mathematics among colleagues through professional development opportunities, post-graduate course work, and the sharing of professional resources" and "draw upon professional literature, colleagues, and learned societies as supports for reflection, problem solving, new ideas, sharing experiences, and participating in workshops and courses related to mathematics" (1996, p.12).

Teachers are also asked to "foster relationships with school colleagues, parents, families, and agencies in the larger community to support student learning and well-being" and "plan instruction based upon knowledge of subject matter, students, the community, and curriculum goals" (1996, p.13). In addition, they are required to be current in their reading of professional documents and "align with curriculum standards, goals, and essential skills as outlined in the Indiana Department of Education Mathematics Proficiency Guide, National Council of Teachers of Mathematics Curriculum and Evaluation Standards of School Mathematics, Professional Standards for Teaching Mathematics, and Assessment Standards for School Mathematics" (1996, p.10).

The current demands for professional growth and standard-based credentialing requirements in Indiana and nationwide create pressing needs to evaluate the present situation in professional development programs and examine whether the existing programs are able to meet these needs.

The Project

The Internet Learning Forum is a research project in the first year of a three-year grant from the National Science Foundation (Barab, Moore, Duffy, & Cunningham, in preparation). This first iteration of the ILF focuses on Indiana math and science teachers of grades 6-12. The research agenda reflects the interdisciplinary aspect of the project, converging at the intersection of pedagogy, technology, social informatics, and learning theory. An interdisciplinary approach, reflecting this intersection, characterizes the research carried out to address the following research questions:

1. How can networking and electronic technologies be used to represent and facilitate the sharing and evolution of teaching practices?
2. What are the taken-as-shared meanings that emerge in the ILF communities and how do those meanings evolve and diffuse into classroom practices?
3. How do the ILF members structure themselves into communities and how do we promote boundary crossing?

As this project is only in the first year, this paper will focus on the design and early implementation of the ILF based on the theoretical foundations of building a community of practice. Three design principles guide the development of the ILF:

1. Visiting the Classroom -- An important aspect of becoming a community member is being able to share practice and see what other teachers are doing. Since live visits to classrooms are often impractical, the web (via video streaming and conferencing) offers a unique opportunity to not only visit a variety of teachers at times that are convenient for the teacher, but to engage in professional dialogue with other colleagues.
2. Foster Ownership and Participation -- In order to be an effective professional development system, participants must have a high degree of ownership and participation in the ILF. In effect, the ILF serves as a knowledge network for participants allowing them to build the community to best suit their needs.
3. Focus on Inquiry -- Our goal is to foster inquiry, both an inquiry pedagogy for the classroom and teacher inquiry into his or her practices. The focus of the ILF classrooms will be on sharing inquiry based learning environments. Teachers using the ILF will be engaged in a reflective process and one of our goals is to make that process explicit.

The Design

The ILF consists of a variety of participant structures, all related to virtually visiting the classroom of other teachers. A prototype of the system was developed in the Spring of 1999 to provide a proof of concept. A capture of the prototype home screen can be seen in Figure 1.

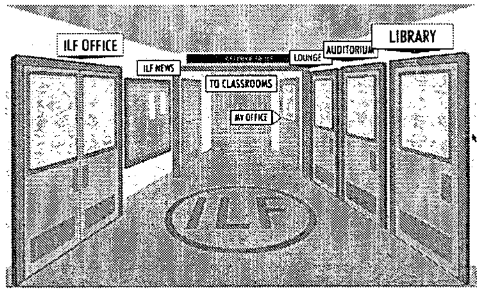

Figure 1: ILF Prototype Entry Screen

Upon entering the ILF the user is taken into a virtual school building - an environment that is familiar and inviting. From this entry page, several doors and hallways are featured. TO CLASSROOMS is the most prominently featured and entering this hallway takes the user to a listing (as well as search and browse functions) of math and science classrooms they can visit. In addition to the TO CLASSROOMS space, there are also four other virtual spaces designed to support professional development needs. The ILF OFFICE is the place where new participants can secure a password (the site will be password protected) and all participants can get help with technology, or with the use of the ILF or they can make suggestions. The LOUNGE is where teachers can participate in or establish either synchronous (chat) or asynchronous (web-based conferencing) dialogues with other teachers on a variety of pedagogical and practical teaching issues. The AUDITORIUM is the place where special events can occur. Generally, these involve the use of asynchronous discussions with plans to include a white board and reference resources. It also provides the opportunity for video-casting live or canned presentations for discussion. Any member of the community can hold a workshop, experts can be brought in, or, there may be synchronous discussion of specific issue. The LIBRARY is a place where teachers can go to access reference materials of interest, including references on teaching resource materials (software, other classroom artifacts like the graphing calculator, manipulatives, sensory probes), state and national standards, grants, applied research and theory, relevant state initiatives, and other materials the teachers identify as relevant. Additionally, users have a personal space, MY OFFICE, in which she can store bookmarks to resources and classrooms that are of personal relevance and return to those at a later visit. When a teacher enters the TO CLASSROOMS hallway, the list of classrooms to visit (with grade, topic, etc) will be available along with a brief summary. The nature of this space will evolve as the number of videos grows. Once a classroom is chosen, the teacher will enter an area like that shown in Figure 2. It is this classroom space that is the heart of what we are trying to achieve with the Internet Learning Forum.

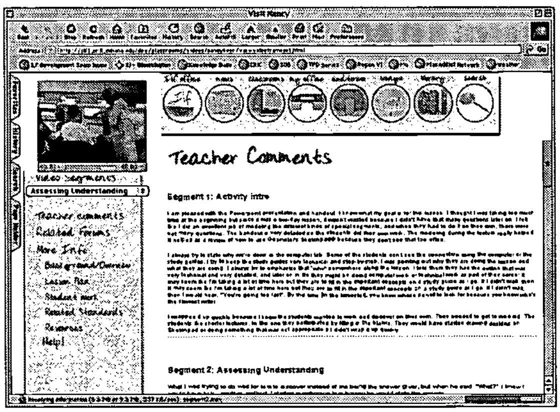

Figure 2: ILF Prototype Classroom Screen

The video of the class is the focal point. Additionally, there is commentary by the teacher in the video classroom on the context of the video as well as what is important to observe. Discussion forums are attached each lesson where teachers can discuss the use of the material and extending the instruction. The goal is for this discussion to help build a web of learning, extending the inquiry in the topic/lesson being observed to related inquiries that build understanding. Other resources provided include lesson plans, links to related standards

documents (both content and practice standards), resources, and student work. Finally, there are links to related classrooms – videos of teachers who tried the lesson or who have related lessons.

Implementation

Currently, the website is being seeded with teachers who have been recommended as good models of student-centered teaching. Teachers are videotaped then reflect on their practice as they watch the video. Several segments, which highlight the arc of the lesson and showcase various teaching strategies and/or reflections are chosen. Additionally, teachers share lesson plans, student work, and are asked to help make connections between the lesson and both state and national standards. Initially, the ILF team is acting as a production team in the filming and editing of the videos. Eventually, we anticipate teachers will produce and organize their own videotaping, content selection, and commentary/reflection with only guidance from the ILF team. The first several "seed" teachers will serve as a model for what other teachers will do on their own later.

Additionally, the design of the site is undergoing multiple stages of user-testing which focuses not just on usability issues, but issues regarding community-building as well – bringing to the forefront issues of gatekeeping, ownership, and content integrity. Two advisory boards are working in partnership with us on the ILF. The Participant Advisory Board consists of eight classroom teachers who are providing initial, seed content for the website, as well as being involved in the design and testing process. The Research Advisory Board is made up leading researchers around the country and is serving to advise and guide the research agenda of the project. Also, a review panel reviews each lesson to ensure that the lessons being submitted to the ILF is conceptually correct.

Conclusion

While still in its infancy, the Internet Learning Forum seeks to research and development systems of support for building a community of teachers. Its design builds (and continues to evolve) from a situated cognition perspective that suggests that teachers will learn best when learning in authentic contexts and in collaboration with others. Although this model is specifically designed for pre- and in-service teachers in Indiana, it has implications for professional development more generally. Based upon the design principles stated above, the ILF will be a resource for math and science teachers where continuing professional development becomes an integral and essential component of their identity as teachers, where the culture of sharing among fellow practitioners, and nurturing of newcomers is as natural as planning a lesson and marking an assignment.

Teachers sharing and learning online - an innovative professional development model

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Abstract: "MSTelementoring" is an innovative, online professional development project for K-12 teachers in central New York State. The focus of the project is on changing teacher practice to more inquiry methods in math and science and technology. Teachers from both rural and urban districts support each other's learning as a sustained community meeting first in a face to face summer workshop then moving online during the year to reach each other in the context of their daily practice. Using a Web-based telementoring tool and threaded discussion educators, mathematicians, scientists, and K-12 teachers correspond with one another exchanging reflections, identify areas of difficulty, and get support from each other over the year which intimately connects their learning to what is going on in their classroom. This has proved particularly important for teachers isolated in rural districts and for those with limited resources from inner city schools.

Introduction

For teachers to create a shared vision of teaching and learning as outlined in the national math and science standards, they must be able to reach one another in the context of their work, as they use materials, guide students, and assess work in their daily practice[1] (Loucks-Horsley, 1997)

"MSTelementoring" is an innovative, online professional development model for K-12 teachers in central New York State's Syracuse and Onondaga-Cortland-Madison Board of Cooperative Educational Services region. It provides sustained assistance, focuses on changing teacher practice to more inquiry methods in math and science, provides an online telementoring group for sharing and learning, and supports teachers in their daily practice. Online communications plays an essential role in this project. A Web-based telementoring tool, threaded discussions, and a Web-based "Exchange" (http://www.ocmboces.org/iss/mstsite) link educators, mathematicians, scientists, and K-12 teachers, to form an online learning community where participants are in touch with one another, identify areas of difficulty, and get support from each other over the year. Adding the online component allows teachers to participate in professional development over an extended period of time and to intimately connect their learning to what is going on in their classroom. This has proved particularly important for teachers isolated in rural districts and for those with limited resources from inner city schools.

Goals

The MSTelementoring model aims to: 1) broaden and deepen teacher's knowledge of inquiry-based mathematics and science 2) help teachers understand the components of good student work and the ways in which students learn mathematics and science concepts, 3) help teachers recognize and analyze effective instructional strategies, 4) build collaborative teams of MST teachers, 5) help teachers use telecommunications technology, and 6) develop a sustainable professional development model that helps teachers become experts and see themselves as professionals.

Activities

Activities in this project are structured around collaborative work teams. Teachers participate in summer institutes where they are immersed in inquiry experiences through many mediums: hands –on experiential problem solving, viewing and discussing videos of classroom practices, getting acquainted and becoming familiar with the structured telementoring environment called MentorCenter which they will use over the year. Over the course of the year, participants work on MentorCenter assignments to get acquainted with each other, and to reflect on their experiences in their own classrooms.

Online Professional Community

A major goal of this project is to develop online professional communities of teachers as a way to engender ongoing teacher learning. The importance of professional community in the lives of teachers has become a necessity in an environment of change - curriculum reform, standards, and technology innovations. Using online communications during the Summer Institute and afterwards, we develop a community of learners around discussions of shared practice and reflection. We primarily use the two online environments, 1) Web-based telementoring tool, Mentor Center, with structured tasks that are created by project researchers and 2) an informal threaded discussion where everyone can initiate a topic or respond. In both environments we have participants exchange math and science curriculum, accounts of their practice, reflections on their growth, and requests for support. They also respond to colleagues requests and provide feedback to enhance the quality of their mutual learning.

Project elements

1. MentorCenter Assignments:

The sharing online covers a wide-range of content, perspectives, and self-reflection. Over time we have also seen changes in individual's engagement and commitment to their team and to the project.

Examples:

Below is an example of a supportive exchange between two high school chemistry teachers. They are discussing the value of the online community and communication with colleagues as a way to sustain their own growth.

> **HS Teacher #1** - "Collaborations with colleagues is a primal resource. Colleagues within my own building, within the MSTelementoring group as well as within the state...Ideas generated by others augment those of my own. Feedback on activities both mine and others, provide a platform for personal growth. The impact on the learning of my students will be a function of my movement closer to the Inquiry Approach whenever possible."
>
> **HS Teacher #2** - "I too think Telementoring has been a good tool for communication and learning. Mainly because of MSTelementoring I have probably communicated with you more both on and off line this year than I have in any two or three years combined."

2. Internet Curriculum Assignment:

Teachers are asked to take their ideas about inquiry and add the potential of the Internet in the form of research, communication, and/or publication and apply it to areas of interest in their curriculum. Below are several examples as described the teachers themselves of their project plans

Example #1: *Community through global migration and seasonal change.*

Our third grade curriculum for social studies revolves around the concept of community. We study world communities, comparing and contrasting them with our own, looking at what makes a community unique, what influences the people and their lives, etc. In science we learn about life in plant and animal communities. Throughout the year we learn about how climate and landforms affect life in a community. The Journey North, an Internet-based learning adventure, engages students in a global study of wildlife migration and seasonal change. With global classmates, they predict the arrival of spring from half a world away. Students have available to them up-to-the-minute news from around the world, and they are able to report observations from our own hometown. The Journey North seems to be a very powerful vehicle for engaging students in real and relevant data collection with respect to community. To be able to track a particular animal, the emergence of spring tulips, the break-up of ice, provides a meaningful context in which to talk about/teach about/explore about life in a community.

Example #2: *Course 2 Internet Relay Project*

High School students from four districts work on different aspects of interrelated Math problems. Partial solutions will be e-mailed to the next group of students. These solutions will be evaluated by the receiving students and used as input for their part of the problem. As they finish, they will e-mail their work and results to the next group, and so forth. The "last" group will finish the problem and verify their work and solution with the first group. Once completed and verified, certain problems may generate a follow-up set of questions pertaining to the finished product. These questions will be addressed by each of the groups of students and will be e-mailed to each other for discussion and verification.

3. Threaded discussion

The threaded discussion provides a more informal environment for project-wide discussion. It lends itself to sharing and learning on more immediate issues in the classroom and with students - ideas about content, dealing with classroom dynamics, sharing interesting resources, issues about school environment.

Below is part of an exchange where one teacher asks advice on how to get his students to participate in class discussion, and another is responding from her own experience.

> **Teacher # 1** (8th grade math teacher) asked - "It seems for some reason this year's group of students is lacking in the participation category. When I can get the students to ask questions they seem to understand how to ask and talk to each other, but I am having the hardest time engaging them. I will take any suggestions on this topic."
>
> **Teacher #2** (2&3rd grade special ed teacher) added -..".I present the question and let pairs or groups discuss it. Then we share with the group and try to see how many ideas we can generate. When an idea is presented that isn't "quite right" I try to capitalize on what is right and then ask the class if they could add more to the idea. That way the group giving that answer feels validated for what they did offer and yet learn how they might be able to improve on their idea next time. I am not sure of the success of this at your level, but this seems to help build confidence to be freer to give their solutions for my level."

Key Issues

Different participants have expressed difficulties in finding the *time* to spend on project tasks, having ready *access to the Internet* either from a computer at school or at home, and obtaining *administrator's support*. Although the project requests that administrators give their participating teachers 4 hours of release time

during the week, just a few provide this option. Some of the creative administrators have assisted teachers by removing duties to "free" up time and encourage the use of prep time. One school provided a stipend for a teacher's working after hours; another provided a substitute which one teacher used in the morning and another teacher in the afternoon.

But with all the distractions and the pace of the school day, teachers have told us that they work at home at night or on weekends. Some teachers have found the opportunity to earn graduate credits an incentive to work on their own time. To support them, we have a partnership with a higher education institute, SUNY/Cortland, to provide 6 graduate credits for a small fee. Approximately one fourth of our teachers have registered. The online discussions have provided an avenue for teachers to share not only their problems obtaining administrators support but also their different solutions.

All participants were promised by their administrators to have or obtain by the fall access to the Internet from school. This also has proved difficult as we have found teachers who have computers in the classroom but no Internet access. In this case a visit from project staff raised the awareness with administrators and the Internet provider and within several weeks the teachers were connected. We are finding that when there is an Internet access problem we must address each participant's technology needs individually.

We are also trying to influence administrators by bringing them more into the project. We have run an administrators' session in the summer and are beginning to design an ongoing online model to work with administrators over the year.

Closing

We are now in our second year of the program and have found the interest in the online professional development model steadily growing. Many teachers coming into the project understand the need to be in continual communication with an online professional community of colleagues. Many administrators are beginning to understand that the changes demanded by curriculum reform require some way for teachers to have ongoing professional development and support.

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Incorporating Standards in Web-based Classroom Instruction

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Abstract: This paper considers the advantages of incorporating learning standards into web-based classroom instruction. State education departments throughout the nation are vigorously promulgating new and more stringent learning standards and their accompanying assessments to stem the tide of unsatisfactory student performance. The Internet is a powerful and attractive learning tool that has the potential to motivate even the most reluctant student. This paper will illustrate how a specific instructional tool, a WebQuest, can effectively deliver standards-based instruction. Examples of outstanding WebQuests are described in detail.

National Standards

The current emphasis on standards-based education began in 1983 with the publication by the National Commission on Excellence of its landmark document, "A Nation at Risk." This report heightened the awareness of the education community to the weaknesses in the American school system and ignited a national debate on ways to rectify the problems highlighted in the report. Subsequent education summits in 1987 and 1996 led many states to establish content area standards (Marzano, 1998). The Clinton administration responded by enacting the Goals 2000: Educate America Act in 1994 which seeks to produce national educational reform by supporting states' efforts to improve student performance (Stedman, 1993). The Act emphasizes educational goals, standards, and assessments as essential elements that must be addressed to improve the state of education in the country (*Goals 2000:* Reforming Education To Improve Student Achievement, 1998). Portions of the Goals 2000 funds made available to states are allocated to an aggressive grants program. Monies from these grants are targeted to promote systemic educational improvements at local levels through programs that address standards-based instruction and assessments, with particular emphasis on technology and collaboration with colleges and universities (*Goals 2000:* A Progress Report, 1995).

Recent reports have indicated that although improvements have occurred, as a nation we could be defined as "still at risk." American students continue to fall short in critical areas such as mathematics and science when compared to their counterparts in other industrialized nations (A *Nation* "Still" at *Risk*. An Education Manifesto, 1998). Research suggests that school principals throughout the country have made little progress in advancing the use of technology and have failed to relate technology to the National Education Goals articulated in the Goals 2000 legislation (Lunenberg and Irby, 1998).

New York State Standards

Encouraged by educators throughout the nation, today 49 states are currently promulgating rigorous learning standards for K-12 education. New York State's standards are broad statements that define specific competencies and serve as guides for curriculum revision, instructional practices, and assessment instruments. Standards are defined for the following content areas: English Language Arts; Languages Other than English; The Arts; Social Studies; Mathematics, Science and Technology; Career Development and Occupational Studies; and Health, Physical Education and Home Economics. The State distinguishes between a *content standard* that addresses knowledge and skills in content areas and a *performance standard* that indicates how students demonstrate knowledge and skills. These standards are articulated at the elementary, intermediate, and commencement levels. For example, a content standard of the Mathematics, Science and Technology Standard #2 on Information Systems is as follows: "Students will access, generate, process, and transfer information using appropriate technologies." A corresponding performance standard at the elementary level is: "Use newspaper or magazine index in a library to find information on a particular subject." An intermediate-level performance standard is: "Compose letters on a word processor and send them to representatives of industry, government agencies or museums seeking information on a student project." A commencement-level performance standard is: "Join a Listserve and send electronic mail to other persons sharing mutual concerns and interests." These standards seek to improve student achievement from the basics of mastering factual material to acquiring higher order skills such as the ability to solve problems, access and integrate information, apply knowledge to known and novel situations, read and write across the curriculum, become technologically literate, and work cooperatively and independently.

The New York State Assessment System is just as critical as the new learning standards. This system has been designed to replace the existing assessments and to align with the new learning standards. The new assessments must be performance-based, but they can take various formats. They can consist of traditional sit-down, timed tests that have been the staple of prior assessments, or they can take the form of journals or student portfolios. The first assessment was administered in English Language Arts to fourth graders throughout the state in January 1999. A series of assessments in various content areas and grade levels will be phased in over a number of years. The results of the fourth grade test were mixed, with low scores reported in many districts, notable several schools in New York City.

The State has moved to hold districts accountable for meeting standards and New York City Commissioner of Education Rudy Crew has taken these directives seriously. Several district leaders have lost their jobs based on their students' poor performance. Thousands of public school students were forced to attend summer school and to pass tests before being promoted. It is evident that these problems must be addressed through a collaborative effort on the part of teachers, parents, administrators, and teacher preparation programs (Sewall, 1994). It is equally evident that a promising solution path lies in the development of standards-based instructional models in content areas that can creatively and effectively enhance high order thinking skills in our students.

The Internet in Education

The challenge of creating these models within the curriculum content in the elementary and secondary school classroom is a formidable one for many of today's teachers. Many educators have discovered that the power of technology can be one promising means for meeting this challenge. Most schools in the US now have the technology to connect to the World Wide Web as part of regular instruction. According to *Technology Counts '99*, the annual report on educational technology conducted by *Education Week*, more than half of US schools are connected to the Web, and there is one computer for every 5.7 students (Fatemi, 1999). The Web can be a natural vehicle for delivering standards-based instruction to students. Most students are excited about the Internet and are comfortable using it. As such, activities that integrate the use of the Internet are highly motivating for students. Mastering computer technology, including appropriate use of the Internet, is itself one of the required learning standards. Because it provides such a wealth of material in other content areas as well, the Web is a rich resource that teachers can exploit to structure instruction in all curriculum areas.

WebQuests

The WebQuest concept was created in 1995 by Bernie Dodge at San Diego State University. An essential element of a WebQuest is that it provide an inquiry-based activity, using Internet resources (Dodge, 1995). Typically, students begin by reading the WebQuest page, where they are assigned a task that they must complete in several steps. The WebQuest contains links to sites that contain relevant information, often primary sources, that they need to use to complete the project. Because the links provide structure, students are not merely surfing in an unsupervised fashion but rather are visiting sites the teacher has chosen. This screening of sites both ensures that the material is valuable and addresses concerns that educators and parents may have about appropriateness of content. The task is usually a group project, requiring students to use higher order thinking skills such as role playing and problem solving to create a product which may be a multimedia presentation, a brochure, or a performance for parents or classmates.

Iona College Summer Institute

Recognizing that teacher preparation programs must assume an active role in preparing teachers to successfully address the issues of integrating standards and technology into the classroom, Iona College conducted a Summer Institute in Educational Technology with the theme, "Using WebQuests as a Tool for Standards-Based Instruction." This institute was funded in part by a grant through the Goals 2000 program mentioned earlier. The purpose of the Institute was to use technology to meet new standards through development of WebQuests. Participants studied existing WebQuests and evaluated them using a standard instrument. They received instruction in using Netscape Composer as an authoring tool. Keynote speakers discussed topics such as educational theory and standards. Brochures containing the new New York State learning standards in all content areas and grade levels were made available to all participants. In turn, students were required to include a statement of which learning standards were being addressed by their projects. Assessment is an essential part of the new learning standards, and state-wide grading is accomplished by using rubrics which describe characteristics of various levels of achievement. Institute participants were also required to create grading rubrics as part of their WebQuests.

The participants in the Summer Institute produced a number of outstanding WebQuests, all of which can be seen at the course website, www.iona.edu/cs/SummerInstitute/WebQuests.htm . The grad levels spanned from second to twelfth grades, and subject areas included Social Studies, Chemistry, English and Language Arts, Mathematics, and others. Following are overviews of a few of the projects.

"Celebrating Hispanic Heritage" is a WebQuest whose theme is "Proud to Be Me." Miriam Blake, a principal at a school in the South Bronx with a large number of Hispanic students, created this project. Her objective was to help students develop a pride in their cultural heritage and a better understanding of others. Resources include sites for maps, information about each of the countries in Central and South America, recipes for traditional foods, and other references. Teams of four students each select a country, interview a native of that country, construct a project board to display facts about the geography and culture of the country, give oral presentations, make an audio tape of traditional music, prepare a food dish, and prepare a computer-generated flyer inviting parents and grandparents to attend a cultural day celebration at the school. The grading rubric gives clearly-defined descriptions of performance levels for each of the subtasks. The WebQuest addresses New York State learning standards for eighth grade in Social Studies and English Language Arts. The Social Studies Standard that is addressed is Standard 3: "Geography: Students will use a variety of intellectual tools to demonstrate their understanding of the geography of the interdependent world in which we live--local, national, and global—including the distribution of people, places, and environments over the earth's surface." The English Language Arts Standard that is addressed is Standard 1: "Language for Information and Understanding: Students will read, write, listen, and speak

"Teenage Drunk Driving" was created by Andrea O'Neill, a teacher of ninth grade at Santa Maria School. Her project, subtitled "The Road Not Less Traveled," presents a scenario in which students plan an intervention for a 16-year old friend, Bobby, who is planning to drink and drive. The task is to prepare a presentation for the annual Students Against Drunk Driving Day at the school which will persuade Bobby

not to drink and drive. Keeping a journal of all activities, students study ads, create a poster, conduct a survey, and create a music video, skit, or commercial to be used in the intervention. Resources include links to sites with general facts about drunk driving accidents, alcohol advertisements, state penalties, Teen ADD, National Highway Traffic Safety Administration statistics, and others. The grading rubric describes various levels of achievement in each of the components of the project. New York State standards addressed are in English Language Arts, Health Education, and The Arts. In English Language Arts, Standard 1 is: "Language for Information and Understanding: Students will read, write, listen, and speak for information and understanding." The WebQuest also addresses Standard 3: "Language for critical analysis and evaluation :Students will read, write, listen, and speak for critical analysis and evaluation." Standard 4 is: "Language for Social Interaction: Students will read, write, listen, and speak for social interaction." In Health Education, the activity addresses Standard 3: "Understand and be able to manage their personal and community resources: Students will understand the influence of culture, media, and technology in making decisions about personal and community health issues. They will know about and use valid health information, products, and services. Students will advocate for healthy families and communities." In the Arts, the WebQuest addresses Standard 1: "Creating, Performing and Participating in the Arts: Students will actively engage in the processes that constitute creation and performance in the arts (dance, music, theatre, and visual arts) and participate in various roles in the arts."

"Issues of Intolerance and Racism" was written by William Sherlog of Rice High School in Harlem. This WebQuest addresses New York State Social Studies Standard 5: "Civics, Citizenship, and Government: Students will use a variety of intellectual skills to demonstrate their understanding of the necessity for establishing governments; the governmental system of the United States and other nations; the United States Consitution; the basic civic values of American constitutional democracy; and the roles, rights, and responsibilities of citizenship, including avenues of participation." Its theme is "Too Much Meanness Messing the Millennium.". Students begin by examining the attitudes expressed by Tupac Shakur, Jay-Z, and Martin Luther King, Jr. They study and contrast these with reactions of people in six other occurrences involving prejudice or discrimination, referred to as "Mean Moments". Resources include the web pages of rap artists, speeches and writings of Dr. Martin Luther King, photographs and writings about the Molly Maguires, cartoons from Punch magazine, original sources about the Know-Nothings, an essay and other writings on Sacco and Vanzetti, readings on the case of <u>Korematsu v. United States</u>, the Port Chicago mutiny, and the Trail of Tears. The task involves individual reading and reaction, followed by group research on one of the "moments of meanness", construction of a graphic organizer, and preparation of a music video for the class. The grading rubric covers levels of performance for the essays, charts, lists, and video.

"Tomorrow's Investors: A WebQuest for Social Studies in Grades 10-12" was written by Albert J. Spiegel, a preservice teacher. In this eleven-week project, teams of three students play the role of industry analysts. They are required to monitor an industry and to choose a company in that industry. Learning activities include visiting the company's website, following the stock prices daily, seeking out news stories about the company, and following news reports about the economy. Students must prepare and deliver an oral presentation about the company and construct spreadsheets depicting the stock's performance. This WebQuest addresses New York State Standards for Education in Social Studies and English Language Arts. In Social Studies, it addresses Standard 4: "Economics: Students will use a variety of intellectual skills to demonstrate their understanding of how the United States and other societies develop economic systems and associated institutions to allocate scarce resources, how major decision-making units function in the United States and other national economies, and how an economy solves the scarcity problem through market and nonmarket mechanisms." It addresses English Language Arts Standard 1: "Language for Information and Understanding: Students will read, write, listen, and speak for information and understanding." It also addresses Standard 3: "Language for critical analysis and evaluation: Students will read, write, listen, and speak for critical analysis and evaluation." In Mathematics, Science and Technology, it addresses Standard 2: "Students will access, generate, process, and transfer information using appropriate technologies."

Conclusion

Standards-based education and assessments are receiving nationwide attention. Relating

technology to educational goals can be a daunting task for teachers. The WebQuest template is an effective means of addressing both learning standards and technology integration. The rich resources of the World Wide Web can be used for developing standards-based instruction across the curriculum. We have described how training in the development of WebQuests can enable teachers to develop instructional projects that address standards while making effective use of technology.

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Using WebQuests to Construct Learning

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Abstract: Developed in 1995 by Bernie Dodge and Tom March at San Diego State University, a WebQuest is an inquiry-oriented activity that requires students to use the Internet to find information and solve problems. This concept has gained the attention of a growing number of educators nationwide. This paper discusses what WebQuests are, the critical components necessary to develop one, how to locate examples and templates, and how they have been used in the author's classes at the graduate and undergraduate levels. Student perceptions are included.

Introduction

Many authors cite the need for, and the desirability of, integrating communication networks such as the Internet into the learning process (Bitter & Pierson 1999; Forcier, 1999; Jonassen, Peck, & Wilson, 1999; Ryder & Hughes, 1997). However, classroom teachers often complain that time spent on the Internet is risky business. Irresponsible use of the web is a genuine concern. Not only can learners waste precious instruction time surfing the web but also access to questionable information abounds. Additionally, anxiety, related to proficiency testing, limited access to and knowledge of computers, and restricted connect time, increase teacher resistance to integrating the Internet with curriculum. WebQuests counter these barriers by offering a structured format in which students participate in the retrieval of information to construct learning. This model actually saves instruction time by directing students to pertinent web sites, previously approved by the teacher, for information gathering. Since the content design of a WebQuest is only limited by the creativity of the teacher, skills required to meet curriculum standards can easily be addressed.

The Model

Developed in 1995 by Bernie Dodge and Tom March at San Diego State University, a WebQuest is an inquiry-oriented activity that requires students to use the Internet to find information and solve problems. This concept has gained the attention of a growing number of educators nationwide. Yoder (1999) suggests the flourishing use of this model of instruction is because WebQuests "are directly relevant to the curriculum and (they are) interesting and motivating to both teachers and students; they add spice to a lesson and direct a more responsible use of the Internet". Watson (1999) adds that WebQuests provide the practicality that is needed in the classroom for students to obtain information and use that information to form a basis to debate issues and form opinions.

Dodge (1998) explains that WebQuests may be either *short term* or *long term*. Short term WebQuests last approximately 1-3 class meetings with the instructional intent being knowledge acquisition and integration while long term WebQuests last from 1 week to a month, depending on the depth of information required. In long term WebQuests, the instructional goal is extending and refining knowledge. This requires the learner to analyze a large amount of information and convert it into a form (product) that others can respond.

Critical Components

Dodge (1999) suggests that in order to achieve efficiency and clarity of purpose, a WebQuest must contain six critical attributes. These attributes are introduction, task, process, resources, evaluation, and conclusion and are explained below.

1. The **introduction** presents the learner with some background information for the activity. It should motivate the learner to want to know more.
2. The **task** explains to the learner what is expected at the completion of the activity....what is the expected outcome.
3. The **process** is a detailed, step by step, description of the procedure needed to accomplish the task.
4. A collection of **resources** needed to accomplish the task are presented. The majority of these should be resources from the web even though other resources are acceptable.
5. Guidance to the learner can include tips on how to organize the information once it is gathered and how the activity will be evaluated. **Evaluation** rubrics are often a good source to guide the process.
6. A **conclusion** brings closure to the activity. This section may include a summary of what has been learned and/or some ideas for extending the activity.

Optional Components

Dodge (1999) explains that a WebQuest may contain several optional components. These elective attributes are explained below.
1. WebQuests may be designed for **collaborative groups**.
2. WebQuests may be in a **single discipline or multidisciplinary**.
3. **Motivational elements**, such as role playing or simulated situations, add effective results.
4. **Teacher resource pages** can provide other teachers with beneficial information such as suggested grade levels, class time allotment, pre-requisite knowledge required, proficiency outcomes/standards met by the WebQuests, etc.

Addition to Teacher Education Courses

This model was recently introduced to graduate students in the Master of Education in Classroom Technology program at Bowling Green State University as a part of the *Networks for Learning* course. This graduate program is more fully described in Brownell & Brownell, 1998 and Brownell, Haney & Sternberg, 1997. The *Networks for Learning* course involves an intense exploration of Internet services including the World Wide Web. The course, more fully described in O'Bannon & Brownell, 1999, is designed to enable teachers, through hands-on-projects, to use the services on the Internet to enhance teaching and learning. The culminating project in this class involved design and development of a WebQuest. After research of both online and print literature and class discussion, teachers designed a WebQuest appropriate for the student populations they are currently teaching. It should be noted that all students (22) had previously completed courses in multimedia/hypermedia design. Seven exemplary WebQuests developed in this class are available at http://www.bgsu.edu/colleges/edhd/edci/obannon/webquests.html. At the present time, teachers are in the implementation stage of these projects. Findings will be presented at the conference.

In addition to the model being part of the *Networks for Learning* course, the author introduced the concept to undergraduate Secondary Social Studies majors enrolled in a *Microcomputer in the Classroom* course. This course, the only computer course required of majors at this time, has staggering expectations. Due to time constraints, undergraduates did not design a WebQuest but rather researched both print and online literature and shared in online discussion of their findings. There were 3 overall themes found in these discussions.

Access to reliable web resources
Students agreed that students using the Internet safely is a major concern at the schools where they are currently in methods practice. However, they felt that WebQuests not only presented students with "safe" web sites but also saved valuable classroom time.

One student wrote:

WebQuests are a fantastic way to enable students to work with and utilize the vast amount of resources on the Internet. There is so much out there, that looking for certain bits of information can be very challenging and frustrating. WebQuests seem to provide a bit of a solution to this problem.

Another agreed with this notion by saying:

How to incorporate the Internet into the classroom appropriately is a concern for everyone in education. WebQuests allow teachers to monitor what their students are getting into online. Sometimes Internet research can be daunting, and WebQuests take away the meaningless challenge of finding relevant information students can use for their projects.

Another student wrote:

It(WebQuest) helps guide them through the internet so they're not just searching aimlessly and getting confused because of it. Further, WebQuests also cut down on time that students would have to use on projects because sites are provided for them instead of having them search for informative and reliable sites themselves.

Increases higher order thinking

Students liked the idea that WebQuests offered opportunities to challenge students to think.

It is not often enough that we challenge our students with assignments that span the upper levels of Bloom's taxonomy. What a great tool for classroom use.

Other comments reinforced the combination of technology and higher order thinking:

Because students need to keep up with technology, this is a great way for it to be done where they have to think critically along with using their technological skills to do it.

Increases Motivation

Preservice teachers thought that WebQuests provided motivation factors for Social Studies students.

I feel that WebQuests would be useful to social studies teachers for a number of reasons. First, these projects require that students go beyond just fact finding. Students must deal with "real world" ideas and problems. Many times Social Studies comes off as being just people and dates. WebQuests can help deal with this problem. Secondly, WebQuests are relevant to social studies curriculum because they allow students to analyze a variety of sources and utilize critical thinking to come up with solutions to problems. This is partly what social studies is all about.

It(WebQuest) makes the Social Studies classroom more diverse and captivating to students who often need motivation. They offer students an escape from the same old routine, and in the process, motivate and encourage them to learn. It brings students out of their desks taking notes to a computer where they can experience education at a new level.

They also wrote that students' working with real life problems was a motivator.

I also like the fact that students are working to solve real life problems. This makes learning much more tangible and interesting for students. Overall, I feel that WebQuests are a great way to add to student learning.

Conclusions

Although access to the Web is relatively simple, integrating it into the curriculum to enhance teaching and learning is not. There are a number of valid concerns that teachers have regarding the use of the web. Among these concerns are accessing questionable information, wasted classroom time, and being able to meet expectations of proficiency tests. WebQuests provide a viable solution to these concerns. As with other methods of teaching, this too, requires planning. The planning can be quite time consuming however teachers are finding out that using WebQuests to construct learning is a good idea.

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The Web Institute for Teachers: Engaging Teachers in Developing Web-Based Curriculum

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Abstract: This paper describes the theory and practice of the Web Institute for Teachers, a professional development experience held at the University of Chicago during the past three summers and planned to be held in summer of 2000. The Institute is based on the principle that teachers should be at the center of curriculum development and that the best way to teach this process is to engage them in it. The authors, including the director of the Institute along with two teachers who were originally learners and are now "mentors" in the Institute, describe their experiences and indicate some ways in which the Institute can be improved.

Introduction

This paper describes the Web Institute for Teachers, a professional development experience for Chicago-area teachers conducted by the Graham School for General Studies at the University of Chicago. During 1999, 76 Chicago area teachers participated in the Institute. If we include the Institute's precursor, The World Wide Web for Teachers: Tools and Techniques, a summer seminar offered in 1997 and 1998, the Institute has trained more than 120 teachers, and will be revised and expanded for summer of 2000. (See http://cuip.uchicago.edu/wit for more information.)

The Web Institute for Teachers (also known as WIT) has as its primary purpose to develop the capacity of school teachers and librarians to incorporate the World Wide Web into their teaching. The audience of the Institute has included Chicago public school teachers, primarily, but also teachers from Chicagoland private and suburban schools. The design of the Institute is based on several principles:

1. Teachers should be involved in developing curriculum that is specifically designed for their students in their classrooms;
2. Teachers often need training in curriculum planning, design, and development (since most of them use pre-packaged curriculum or are responsible only for submitting lesson plans rather than curriculum);
3. It is fairly easy to develop web-based curriculum provided that teachers have experience with simple HTML editors; and
4. The best way to learn how to develop web-based curriculum is actually to develop it. In keeping with these principles, the Institute includes lessons in curriculum theory and development and web design.
5. Each participant develops a web-based curriculum module (usually as a member of a team) under the guidance of trained "mentors," who are school teachers who have already

participated in the Web Institute or similar experiences. Mentor training is also hands-on, in that potential mentors develop web-based modules for teaching the concepts and skills to be taught during the Institute.

This paper includes detailed descriptions of the Web Institute curriculum and implementation, and also showcases several curriculum modules developed in the Institute. In addition, the paper offers some suggestions for others who seek to do professional development for teachers, based on our experiences participating in and teaching in the Institute.

History

For many years, the Graham School of General Studies (formerly the Office of Continuing Education) at the University of Chicago has offered a series of "Summer Seminars" for teachers. These seminars traditionally involved professors at the University introducing teachers to high-level academic material and activities related to various school subject areas. Among the more popular offerings have been "Shakespeare," "Foundations of Science," and "Calculus." In 1997, the Graham School, in cooperation with CUIP (The Chicago Public Schools/University of Chicago Internet Project) decided to offer a summer seminar for K-12 teachers on the use of the World Wide Web. Robin Burke, a Research Scientist at the Department of Computer Science at the University, was to teach the seminar. During the Spring of 1997, at a meeting of Computer Professionals for Social Responsibility, Burke gave a presentation on the work of CUIP. Attending that presentation was Craig Cunningham, then assistant professor at Northeastern Illinois University, who was interested in the curricular opportunities afforded by the Web. Burke and Cunningham talked after the presentation about the need to offer teachers not just technical training but also training in how to use the Web to enhance teaching and learning. It was decided eventually that Burke and Cunningham would co-teach the summer seminar, to be entitled World Wide Web for Teachers: Tools and Techniques. This four-week seminar (meeting for four hours a day) was offered free-of-charge to 22 selected applicants, with the financial support of the Chicago Public Schools and a grant from the Howard Hughes Medical Institution. . The seminar proved to be very popular and successful, and so it was offered again in 1998 to 20 teachers, along with a more advanced version of the course, called the Advanced Practicum in Web-based Instruction, which included 7 participants, 4 of whom had participated in the prior year's seminar. The Advanced Practicum became the basis for the 1999 Spring Mentor Training Seminar, described below.

In the Fall of 1998, Burke moved to Southern California, and planning commenced for a third offering of the summer seminar. Rather than repeat the format of the previous summers, it was decided to expand the seminar into an "institute," which would offer the possibility of multiple learning options, thus addressing the problem that participants in the seminars come in with a variety of skill and experience levels. An institute would also allow for many more participants, as many as 120 depending on funding, and would be taught by as many as twelve "mentor teachers" who would have previously completed training at a similar level. In order to ensure the success of the first Institute, a "Spring Training" component was added in which mentors would work together to design the lesson plans and "special topics workshops" for the Institute. (The Spring Training was designed utilizing the same "hands-on" engaged learning model utilized for the Institute itself.) Funding was secured from Hughes to pay mentors an "honorarium" for their participation in the training.

The decision was also made to charge tuition for the Institute. The Graham School figured the cost per participant at approximately $1000, and so tuition was set at that level. However, funding was secured, from Hughes, CPS, and other sources, to provide for tuition remission for some participants from CUIP.

Curriculum

Curriculum can be defined as "a plan for a sustained process of teaching and learning" (Pratt 1994, p. 5). The primary assumption of the Web Institute for Teachers is that teachers should spend considerable time and effort *planning* curriculum, whether or not learning is to utilize the World Wide Web. In keeping with this assumption, the director of the Web Institute has created a comprehensive "Curriculum Guide" that serves as a blueprint for the institutional structure and instructional practices of the Institute. (See Cunningham 1999). The structure and elements of the Curriculum Guide closely follow Pratt's suggestions.

Elements include: aim, rationale, goals, audience, prerequisites, subject-matter, detailed objectives, instructional plan, materials and facilities, and assessment and evaluation. The implementation of the Institute in 1999 closely followed this Guide.

The aim of the Web Institute for Teachers is to provide teachers with the training and experiences necessary for them to be able to design, create, and use web-enhanced curriculum modules with their students. By "curriculum module," we mean a plan for a set of related teaching and learning activities, together with the materials necessary to implement the plan. These differ from "lesson plans" in that multiple activities have been sequenced in order to foster growth. A module is similar to what has traditionally been called a "unit." (By "web-enhanced," we mean a curriculum that utilizes the World Wide Web for some of its resources, activities, or delivery.) A "complete" web-enhanced curriculum module includes both the curriculum plan and a set of web pages (called a "curriculum web") to support the teaching and learning envisioned by the plan.

In order to meet this aim, it is necessary for the Institute to focus on two diverse sets of subject-matter: curriculum development and web design. While participating teachers generally feel more comfortable with curriculum development topics, it is our experience that they need conceptual and procedural reinforcement. Therefore, we included activities which introduce certain key concepts (curriculum, objectives, assessment) and require participants to prepare a "guide" to their own curriculum modules that include the same elements as the WIT Curriculum Guide. For some teachers, this required that they work "backwards" from their usual lesson planning procedure. Rather than list learning objectives ("standards") *after* they developed their activities, teachers were asked to consider their broad and specific goals before they worked on their instructional plan and even before they began working on the web pages to support that plan.

The basic approach throughout the Institute was that the best way for teachers to learn curriculum development was to *engage* in it. We therefore tried to implement the eight indicators of engaged learning described in (Jones et al. 1994). However, we also wanted participants to think about what they were doing, and so offered reading materials and discussion topics that fostered reflection on the process of development and on how the participants could make their *own* curriculums engaging. We constantly asked the question: "How can this curriculum be made more engaging" and emphasized the special features of the Web that foster engagement, including its interactivity, hypertextuality, multimediality, searchability, and "open" system. (See Kahn 1997, p. 11 for a complete list of these features and how they affect learning.)
Because the computer proficiency and experiences of WIT participants varied widely, the curriculum related to web design had to include very basic introductory materials but allow for an almost unlimited range of depth. This challenge was met, in part, by including very simple step-by-step lessons in simple web page design with Netscape Composer, and also by developing a set of self-paced "special topics workshops" relating to more advanced topics such as colors, frames, graphics, sound, JavaScript, and animation. Participants could access the workshops through the WIT web site, or they could sign up for sessions in which a mentor would guide them through the workshop or offer additional assistance.
The Institute also included a tool designed to encourage participants to explore advanced topics on their own. Rather than simply send them to search engines to seek random web resources, a database--called a "Web Tank"--was developed that contains more than 700 web resources, described in detail, searchable on a variety of fields, and expandable by participants or mentors. This database can be accessed at http://cuip.uchicago.edu/wit/99/curriculum/webtank/.

Instructional Plan

Professors Cunningham and Burke were the "instructors" for the World Wide Web for Teachers seminar in the summers of 1997 and 1998. While many participants benefited from their special expertise, some participants thought their instruction was too theoretical, aimed at too high a level, and less based on personal experience than it might have been. This led to the decision for 1999 to have practicing teachers provide the instruction in WIT. Those teachers who had participated in the 1997 and 1998 seminars provided an ideal pool of trained, experienced teachers for this role. To ensure that these mentors would both know the content and deliver it in engaging ways, a "Spring Mentor Training" program was developed. Mentors participated in the same hands-on program that participating teachers would. Each mentor took primary responsibility for development of one or more "Special Topics Workshops" that

would be offered during the Institute. These workshops incorporated the same structures and elements as the modules that would be designed during the Institute. (For a list of these workshops, and links to the curriculum webs, see http://cuip.uchicago.edu/wit/99/curriculum/specialtopics/index.htm.) Fifteen teachers participated in the Spring Training; of these, eight were selected to mentor in the Institute. (Of the remainder, four chose to "mentor" in a second Institute offered in collaboration with the Chicago Public Schools Department of Learning Technologies, one was chosen as Assistant Director of WIT, two decided to participate in the Institute as learners, and one was selected as Congressional Fellow.)

One hundred and eight people applied for WIT 1999. Of these, 80 were selected for participation. These participants were loosely grouped according to their prior experiences, and assigned to four "homerooms." Each homeroom had two mentors. Most of the time during the Institute was spent in homerooms; however, participants also came together as a large group for weekly plenary sessions led by the Director and including a variety of speakers, and for a weekly lunch. Several time slots during the four-week Institute were devoted to "Special Topics Workshops" during which participants could choose topics of interest to them. Wednesdays were designated "flex days," in which participants could choose to work on their modules at home or in the labs at the University on their own schedules.

The first week of the Institute was devoted to acculturating participants to this curriculum development approach, and to fostering the formation of teams who would work together on their modules. The ideal team size was thought to be three or four, but we allowed teachers to work in smaller or larger groups. Several Chicago-area museums offered to work with teams that wanted to base their modules on museum resources, and several teams chose this option. Teams began writing their curriculum plans, and searching the Web for suitable resources. During the first week, mentors also offered optional sessions on basic computer operations, for those participants who needed brushing up on system operations.

The second week of the Institute was primarily devoted to learning how to create web pages using Netscape Composer, and how to publish these pages to the CUIP server. Composer was chosen because it is widely available, is free, and easy to learn. (Some drawbacks of this choice include the inability to create frames or deal with scripting, and the focus on individual pages instead of web sites.) Teams put their curriculum plans on the Web, and began sketching out the structure of their curriculum webs.

The third and fourth weeks of the Institute were largely devoted to work time. Participants worked individually and in their teams to complete their modules. The Institute ended with two days of "demonstrations," in which teams showed others in their homerooms what they had done.

Sample Modules

WIT 1999 resulted in the development of 30 modules. A complete list can be found at http://cuip.uchicago.edu/wit/projectdatabase.htm. Some of these modules were incomplete at the conclusion of the Institute; some of the incomplete modules have since been completed on participants' own time. Several of the modules are "exemplary," in the sense that they incorporate all the elements of a complete curriculum, are well designed in terms of navigation and appearance, and include truly engaging activities for the learner. A sampling of modules across the range of quality include the following:

- Web Basics for Teachers (http://cuip.uchicago.edu/wit/99/teams/it5/it5index.htm) is designed to support teachers as they learn how to create their first web site. Activities and topics include an introduction to the Internet, searching, creating a simple web page, graphics and multimedia, and additional resources.

- The Portrait Gallery (http://cuip.uchicago.edu/wit/99/teams/portraits/frontpage.htm) introduces upper elementary students to the role of portraiture through history and leads them through the development of a "technological self-portrait.

- Bronzeville: Engine of Progress (http://cuip.uchicago.edu/wit/99/teams/bronzeville/welcome.htm) is a visually-appealing collection of activities and information about Bronzeville, the south side section of Chicago that was the center of African-American culture in the 1920s, 1930s, and 1940s, and is now experiencing a rebirth. (This module demonstrates, we think, the importance of developing curriculum that appeals to the interests of a particular group of students in their local situation.)

- Pizza Garden (http://cuip.uchicago.edu/wit/99/teams/pizza/) explores the relationships between plant biology and nutrition as they relate to eating pizza. It is aimed at the 3rd grade. Because this team

included a computer teacher with web development experience, it's look and feel is more professional than some of the other modules, and it also includes more resources.

- CulturEconomics (http://cuip.uchicago.edu/wit/99/teams/cultures/frontpage.html) is designed to introduce Conversational Spanish students to cultural and economic issues in the Spanish-speaking world.
- Isreality: A Journey Through Israel and Its Regions (http://cuip.uchicago.edu/wit/99/teams/israel/homepage.htm) is designed to introduce students in 4th through 9th grades to Israel through a virtual tour. It includes a wealth of pictures, graphics, and information about Israel, as well as some online games. Developed by teachers who teach in Jewish day schools in the Chicago area, the module was motivated by the fact that many American Jewish students have little or no familiarity with Israel as a country.

Improvements for 2000

As we prepare for WIT 2000 for next summer, we are tinkering with the curriculum and structure in order to serve our participants better. We are concentrating our efforts in two areas: formative and summative assessment and the problem of participants' wide range of skills coming into the Institute.

In order to help the participants produce better projects--projects that rely on sound curriculum planning and use the principles of good web design--two of the WIT mentors have developed a WIT Web Curriculum Project Assessment for use in WIT 2000. The assessment includes both a rubric and questions for reflection. The rubric addresses specific topics related to web authoring skills: page presentation components (these include technical elements, navigability, design, mechanics, and credibility), WIT curriculum guide components, and a group component. The questions will give teachers an opportunity to reflect on the differences between their web curriculum and more traditional non web based curriculum.

The WIT Curriculum Web Assessment will be an on-going tool for teachers to use throughout the Institute. It will be distributed to and discussed with the participants prior to its use and will become part of the learning experience. Teachers will be asked to evaluate their own work, the work of their curriculum team, and that of their peers. In addition, mentors will also evaluate the web projects. The assessment scores will likely change as teachers' expertise with curriculum web authoring skills increases.

It is expected that the WIT Curriculum Web Assessment will assist mentors as they make instructional decisions concerning both individual participants and their homerooms. The assessment scores will alert both mentors and participants to the skills that must be taught for the successful completion of the curriculum web projects. Participants in the Institute may use the assessment to guide their choice of special topic workshops - it will be apparent which skills need more attention as teachers work through the assessment. Likewise, the focus of the special topics workshops may also be driven by the assessment results. (The draft WIT Curriculum Web Assessment is available at http://cuip.uchicago.edu/wit/99/beta/rubric2.htm.)

As we mentioned above, there is a great range of computer capabilities among teachers who participate in the Institute. To address the needs of those teachers who are computer neophytes, there will be a week long Pre-WIT training offered in 2000 that will teach basic computer skills. Some participants will be accepted to the Institute on the condition that they participate in this Pre-WIT. During this week, mini lessons on topics such as file management and saving documents will be offered. As a result, it is expected that teachers will be able to devote more of their energies during WIT to learning Composer and writing their web curriculum and spend less time "catching up" on basic computer skills.

Suggestions for Others

Based on our experiences during the past three summers, we have some suggestions for others who wish to conduct professional development to help teachers produce web-based curriculum.
First, to foster the kind of engagement that produces ownership and quality, it is imperative that participants have a reason for which they are developing their web-based curriculum. Participants should learn by developing curriculum webs that will serve their specific students, rather than engaging in a purely academic exercise.

Second, selection of competent mentors is extremely important. Mentors must also be calm, confident, and comforting in order to help their fellow colleagues achieve success. Possession of these qualities guides mentors to know when to push, stand back and produce more concrete exemplars to help participants get to the next level. Mentors who've have experienced the same trials and tribulations themselves keeps participants confident.

Third, having mentors working in pairs makes quite a difference. As a team, one mentor can present while the other assists their participants. Having someone right there helps the comfort level of those feeling unsure. Mentors also see different signs of both stress and success. Since adults find this experience stressful, having two personalities there is often helpful when trying to calm or push a participant forward. Modification is easier when two mentors see the same needs of their students.

Fourth, since groups will vary in their abilities and needs, mentors should have final control over instruction and should even modify the Institute curriculum where necessary. Mentors must guide, circulate, encourage, redirect, clarify, validate, facilitate, question, observe, model, motivate, watch and trouble-shoot. Mentors develop their own instructional web pages, giving them the capacity to modify them as needed. The following page shows how Ellen and Frada modified a page as needed.: http://cuip.uchicago.edu/wit/99/beta/july13.html.

Fifth, participants must have enough time to feel comfortable with both the equipment they are using and the necessary software. Learning about curriculum, software, hardware and page design will otherwise become too overwhelming. There is more data to process than ever before. We think four weeks is a good compromise between trying to fit too much into the Institute and taking up too much of the summer.

Sixth, it is important to stress careful and reflective curriculum planning. Because teachers--especially veteran teachers--think they know all about curriculum development, they may want to jump right in and start developing web pages. This is a mistake, because there is a tendency to keep a given web structure even if it later proves cumbersome or distracting to the learning that is intended. Spending a few days developing a good set of specific learning objectives and planning activities that build toward these objective will pay off in the long run.

Seventh, participants need to know that they are never alone. A participant listserve provides an adequate avenue once the class ends. Some participants wanted to form a users group so they could continue to share their successes and failures. Others were content on just talking to their team or fellow colleagues at their school.

Finally, we're very interested in hearing from others who are conducting similar professional development experiences. Please email us.

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A Virtual Learning Environment for the Improvement of Cognitive Processes

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Abstract: the project is aiming at building a virtual learning environment based on Internet. It consists of an online course for improvement of cognitive processes. The program involves theoretical and methodological basis for the study of cognitive processes. The project framework is basically the Triarchic Theory of Human Intelligence of R. J. Sternberg. Potential participants are University graduates and University teachers coming from different sciences. As an interactive way of teaching and learning both designers and users are considered critical agents to develop the virtual learning model. The main features of the project are: using Internet for designing, implementing and monitoring materials, acquaintance with non traditional means of learning such as on line lectures, searching and reading by WWW, assignments and testing through electronic ways, producing a software. The availability of a virtual learning environment in Spanish and the model design according to some local peculiarities may be considered an innovation.

Introduction

This paper presents an advancing report of the project *"Building Virtual Environment for the Development of Cognitive Processes"* (1999-2001).[1]

The project combines contributions from Computer Science -online courses and multimedia applications- and Cognitive Psychology - problem solving and applying cognitive strategies in varied situations and virtual contexts.

Objectives and activities included in the project can be summarized as follows:

- Building a virtual learning environment for the displaying of cognitive processes (objective)
- Training University graduates in an online program (objective)
- Developing a model for the designing of the virtual environment.
- Instructional design
- Initial validation
- Programming the prototype (HTML; selection a courseware)
- Piloting the prototype with the population target via Internet (N=10)
- Content validity
- Final version of the prototype

[1] The Project is financed by the National Scientific and Technical Research Council (CONICET)

Background

The spreading out of the cognitive processes is considered a priority and a requirement both for University teachers and students. As a privileged source of producing knowledge, the University claims fostering and putting into practice high mental abilities.
Cognitive Psychology provides conceptual frames, procedures and instruments for the development and improvement of human cognition. Among them, the Triarchic Theory of R. J. Sternberg (1986, 1988) offers a theoretical basis, a methodology and a program which have received wide recognition .
The Triarchic Theory identifies three kinds of intelligence: analytical, creative and practical. As the author states (Sternberg, 1986) metacomponents are the crucial elements of analytical intelligence and also in the whole theory. Creative intelligence is mainly related to solving new problems and claims knowledge and cognitive abilities.
Taking into account a statement made by Sternberg, the project is based on the idea that nobody may help people to know the cognitive processes in other people if previously has not tested oneself.
During the last five years the authors have introduced selected parts of the Triarchic Theory into training courses for University teachers coming from academic units of the National University of La Plata, Argentina (Malbrán, M. 1996; 1998). The courses presenting the theory, focusing on the metacomponents and solving problems and designing of projects to apply the theory to different content areas. It also included an exploratory study of implicit theories of intelligence following Sternberg´s procedures.
The courses adopted the usual face to face system. Notwithstanding, in the course of 1999, the e-mail was introduced for tutoring and enrichment. This experience showed the potential value of the e-mail for learning and teaching: participants made efforts to access and to become familiar with the e-mail, it allowed a better time distribution for course activities and it enhanced in the participants interest for using the e-mail as a teaching device in University contexts.
Following this line, a further step is designing an online program.

Design

The question of validity

Some questions about the model design are related to the control of ecological and content validity. Face validity is also important.

Ecological validity considers the presentation of the program, the selected tasks and the way of interaction. One advantage of this program lies in the use of Spanish. Few people in our Argentina master English as to follow instructions, pose problems or chat in this language. Besides, due to idiosyncratic beliefs, tasks must sound local that is not taken literally from another cultural context. We are trying to select illustrations coming from different areas, away from the classical problems in the field such as the "Duncker Tumor Case" or the "Hanoi Tower". As a result of the experience collected from postgraduate courses a set of materials is available.
An aspect related to the program presentation lies in the icon selection. The symbols should clearly identify the program. A potential sources are popular characters coming from the humor literature, local advertising and popular sayings. Another possibility is to use abstract signs.

Content validity refers to the selection of the relevant aspects of the Triachic Theory according to the aims of the program. The program focuses on the metacomponents and solving problems. Some experience about applications of the metacomponents in activities such as to write a scientific paper, an essay, a test or during tutorial tasks have collected by the authors.

Face validity. The program does not pursue to "teach" cognitive processes, but to foster and improve the existing ones. In this sense, this is not a learning device itself. Materials must take into account this characteristic.

Initial validation control consists of the consultation of experts on Computer Science and Cognitive Psychology.
Piloting the program with graduates students and University teachers is planned.

The question of strategies

Evidence collected in the courses and objective tests shows the limited knowledge University teachers and graduates have about the use of INTERNET. According to this the initial part of the program is aimed to the development of strategies to use INTERNET applying some aspects of the Triarchic Theory.

Favoring familiarity with INTERNET and the displaying metacomponents and solving problems includes the following strategies:

1. *Searching*
   Becoming aware of what is the aim or how to formulate the task.
   Searching strategies may involve subdividing the task into subtasks, that is, considering alternatives for searching such as e-mail, author's name, key words, institutions, nets, etc.

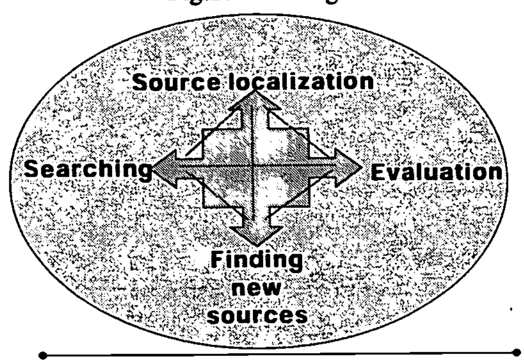
2. *Source localization*
   Monitoring the performance. Demands identification of relevant sources connected to or sending to other sources (alternatives, complementary, enriching; new), detecting mistakes, reorienting the search, etc.
   Monitoring also involves considering other sources that may lead to change the searching, to reformulate the task, to modify the objectives, to follow a different sequence or path.

3. *Evaluation*
   Assessing the results of the entire task, the extent up to which the desired information was obtained and planning future action.

4. *Solving new problems*
   An initially less familiar task (netsurfing in INTERNET) is progressively changing into a more automatized one. Some elements or subtasks are more liable to automatization than others.

Feedback between searching, monitoring and evaluating the performance resembles the model of Sternberg (see Figure 1)

Figure 1: Strategies



The instructional design of the program includes:

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- Organizing the content sequence
- Giving prompts
- Making corrections
- Fostering self-action (for instance, identifying mistakes)
- Promoting search
- Evaluating the mastery of INTERNET
- Choosing relevant activities
- Helping the monitoring
- Collecting formative information

A draft of the program will be presented in the sessions.

Gradually the novelty gains adherents and is seen as culturally valid. The ordinary question "How do you know it ? or "How do you find it out? began to be answered "I found it out in the INTERNET", "I looked for it in the INTERNET"

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Comprehensive Examinations Via E-Mail

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Abstract: This paper will examine the electronic administration of the written comprehensive examination for the Masters Degree in School Library Media Services from James Madison University. Prior to the fall semester, 1998, all students traveled to the main campus in Harrisonburg, Virginia to take the three hour exam. Beginning in November, 1998, four students were sent the exam via e-mail and returned their responses via the same method. The following paper will include a comparison of the two methods of administration, the results of a seven-item questionnaire and a review of the James Madison University Honor System.

Introduction

James Madison University's College of Education and Psychology has offered a library science program, leading to teaching licensure by the Commonwealth of Virginia's State Department of Education since 1926. This entry-level program was based on an undergraduate degree with 24 hours in library science. In 1975 a Master's degree program in education was initiated with a major in school library media services. In 1989 a restructuring of the teacher education programs throughout the state was undertaken. As a result, the undergraduate library science program was discontinued and the restructured program moved fully to the graduate level.

A significant number of students enrolled in our program have been residents of Northern Virginia. Most live and work in Fairfax, Loudoun and Prince William Counties. Since the travel time required to reach the JMU campus in Harrisonburg is approximately 2 to 2 ½ hours, a remote site in Manassas Virginia was established in 1992. Courses were offered in the evenings and on weekends at this site. Most students would take the majority of their courses at this site with only 6 to 9 hours taken during the summer in Harrisonburg.

Since 1989, all students seeking licensure in school library media services have taken a comprehensive examination during their final semester prior to graduation. Prior to the fall of 1998, all students took the comprehensive examination on the JMU campus on a Saturday morning between the hours of 9:00AM and 12:00 noon. Students could choose the word processing program with which they were most familiar. Clarisworks, Word Perfect and Microsoft Word were the three programs from which they could choose. The decision to administer the test on computer versus paper and pencil has been supported by a significant amount of later research (Hinken, 1993). In the fall of 1998, in response to student requests, the faculty of the library science program decided to administer the comprehensive exam via e-mail.

The Study

Six students took the comprehensive exam during the fall of 1998 between November 12th and 18th. Two students took the exam on campus in the traditional manner and four took the exam via e-mail. Results of the exams were compared and there were no differences between the two groups. Since that time the examination has been exclusively administered electronically and there continues to be no difference between the two administration methods.

The exam given in the fall of 1998 consisted of the following three essay questions:

1. Increasingly, telecommunications based networks (such as Internet, Dialog, VAPEN, etc.) are being used by teachers as well as students. First, discuss the reasons why schools should allocate resources to support this type of endeavor. Second, describe some of the issues/concerns that arise when using telecommunications-based networks. Third, discuss how the use of this type of resource impacts the

school library media specialists' roles as teacher, curriculum development consultant and instructional technology specialist.

2. A parent has asked that books or other media be removed from the library media collection. Discuss your plan for handling challenges to materials, both before and after a complaint is received. Be specific in discussing the content of relevant policies and procedures you would use.

3. Information Power, guidelines from AASL/AECT, outline a new role for the library media program in the school. Writers such as Eisenberg and Turner have also provided new models for the role of the school library media specialist. Discuss your philosophy of the role of the school library media specialist and compare/contrast it with that developed in Information Power and by authors such as Eisenberg, Turner, Leortscher or others.

All students received passing grades for the exam, receiving numerical scores between 93 and 98. Since that time all students taking the comprehensive exam have achieved similar scores with no failures. Both administration strategies resulted in comparable scores. The decision to use the essay format was based on the desire to measure writing ability as well as factual knowledge of the field of library science despite previous studies which indicated that standardized tests may also be used as comprehensive examinations (Gothberg and Aleamoni, 1988).

During the fall of 1999 a questionnaire was sent to the twenty-six students who had taken their comprehensive exam via e-mail. The following seven questions were sent to them, also via e-mail:

1. Comparing the "old" way of taking comps on the JMU campus with the "new" method of taking them via e-mail, which do you feel would be LESS stressful.
2. If you had had a choice, which method would you have chosen?
3. What was the primary POSITIVE element in taking the exam in your home?
4. What was the primary NEGATIVE element in taking the exam in your home?
5. Did you religiously adhere to the three-hour time limit? (Please explain if the answer is no -- for example, some may have taken a break between questions and come back to complete the remaining one(s) -- not taking over three hours to complete the entire test)
6. Would you recommend that this testing method be continued for students taking comprehensive exams in other fields of study as well as SLMS?
7. Are there any refinements you would recommend if your answer to #6 was yes?

Findings

Twenty-two students responded to the survey, four having either moved or changed their e-mail address since taking the examination. All stated that they preferred the e-mail administration strategy over the on-campus method.

Many stated that they were aware of the previous groups of students who had driven to campus, many on Friday evening and spent the night at a motel, prior to the Saturday morning examination. They indicated that they were grateful for the opportunity to save both time and financial resources. Twenty students reported a lower level of stress due to the fact that they could determine the time and location for their examination. Every student indicated that they would recommend this administration strategy for future comprehensive examinations.

The primary negative reaction concerned the technology itself. Sixteen students indicated a concern that their responses would be "lost" and that there was no way of knowing that their e-mail replies were received at the university. I should state that all students' replies were noted with a further reply indicating that the answers had been received in good order. Finally, questions regarding the honesty of the students during the examination were raised. Upon matriculation all students become part of the JMU honor system, both at the undergraduate and graduate level.

The following four honor code violations are related to the administration of tests. There are thirteen additional specific violations cited which include other acts of academic dishonesty.

The James Madison Universtiy Honor Code

Students shall observe complete honesty in all academic matters. Violations of the Honor Code include, but are not limited to, taking or attempting to take any of the following actions:

1. Using unauthorized materials or receiving unauthorized assistance during an examination or in connection with any work done for academic credit. Unauthorized materials may include, but are not limited to, notes, textbooks, previous examinations, exhibits, experiments, papers or other supplementary items.

2. Copying information from another student during an examination.

3. Rendering unauthorized assistance to another student by knowingly permitting him or her to see or copy all or a portion of an examination or any work to be submitted for academic credit.

4. Obtaining prior knowledge of examination materials (including by using copies of previously given examinations obtained from files maintained by various groups and organizations) in an unauthorized manner.

Questionnaire item #5 addressed this concern. All twenty-two students indicated that they had strictly adhered to the honor code and took no more than three hours to complete the exam and that they used no outside materials for assistance. Several did indicate that the temptation to use notes was a concern but that they did not violate the code in any way.

In conclusion, we feel that the administration of comprehensive examinations is a viable testing method which should be considered in other programs. The savings in terms of time, stress and money are considerable. The element of trust was also appreciated among the group of students used in this study.

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The Technical Helpdesk for CalStateTEACH: The "ER" for a Distributed Learning Teacher Credential Program

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Abstract: This paper will discuss, primarily from the perspective of the helpdesk provider institution, issues involved in establishing, managing, and operating a high quality, user-friendly, technical support center to meet the varied needs of a widely dispersed student population working towards obtaining their teaching credentials. Since the "helpdesk" model is not well understood by many who are not directly involved, a hospital emergency room is periodically used as an analogy, with regard to many of the challenges and issues involved. It is hoped that, in addition to being of general interest, this paper may be of help to others concerned with establishing technical support services in distance learning environments.

Overview of the CalStateTEACH Project

On April 28, 1999, California Governor Gray Davis and CSU Chancellor Charles Reed unveiled the CalStateTEACH Program. The Governor said, "There has never been a point in our history where we needed teachers more. The CalStateTEACH program is the first and most important step to honoring my commitment to making sure that every teacher in every classroom in California is fully credentialed and every student has the benefit of the best teacher possible."

The CSU publication, *STATELINE,* described the program as follows: "CalStateTEACH offers a new approach to earning a California teaching credential by addressing the problems of working teachers with scheduling difficulties, family commitments and limited time. Accepting applications for September 1999, CalStateTEACH is a visionary program that puts a credential in reach of the 15,000 California elementary teachers now working with emergency permits by combining print material, tapes (audio and video), email and the Internet and periodic Saturday seminars with visits to elementary schools from CSU faculty."

The article continues, " Modeled after the successful British Open University, the CalStateTEACH curriculum was designed by a team of 30 CSU faculty members from virtually all CSU campuses to prepare working teachers to meet California classroom standards. Offered in four stages over an 18-month period, beginning teachers will be supervised by a CSU faculty member who will be available for advice and support, visiting their classrooms to observe them in action. Partnering with school districts throughout California, a veteran teacher from the credential candidate's own district will also serve as a mentor.

"CalStateTEACH recognizes that a working teacher has little time to commute to his or her closest CSU campus. Unlike traditional campus-based courses, CalStateTEACH will be centered at its five

regional centers throughout the state. CalStateTEACH supports independent learning, where students can study at their own place and time, without the need for class attendance. Using email and the Internet students can receive and submit assignments, question professors and discuss the program in special chat rooms. Although the delivery technique is innovative, the rigorous nature of the credentialing process is not. Assignments, due dates, and testing are all elements of CalStateTEACH. Applicants are expected to commit at least 12 hours per week to complete the program successfully. The CalStateTEACH program is the equivalent of 39 semester units. Participants who complete the program will receive a Multiple Subject teaching credential (elementary) with an emphasis in Cross-cultural, Language, and Academic Development (CLAD), as well as immersion in a technology-rich learning environment. The key to the CalStateTEACH program, says Chancellor Charles B. Reed, is that it combines independent study at home via the Internet with personalized supervision by school-based mentors and visiting specialists from Cal State campuses."

The CalStateTEACH Technical Helpdesk

Selection of CSU San Marcos as the Statewide CalStateTEACH Helpdesk

All participants in the CalStateTEACH program must have access to a computer and the Internet, and are expected to make frequent use of the course website (based on a customized version of the WebCT course management system) and other computer-based instructional materials. They are expected to use email to communicate with other students and with a CSU faculty member who serves as a mentor for each group of 18-20 students. With the on-line aspects of the program being very significant, and students with different levels of computer experience scattered geographically all over the state, using a wide variety of computers and Internet service providers, it was critical to have a single helpdesk to serve as a source of help and support when needed.

A request for proposals was sent out to CSU campuses and other possible providers of helpdesk services. California State University, San Marcos was selected on the basis of its experience and reputation, to provide this "Emergency Room" service to the several hundred participants in the CalStateTEACH program. As a university committed to innovation and excellence in technology, San Marcos had for several years placed a very high priority on providing campus computer users with a very nurturing and supportive "high-tech, high-touch" environment. In addition to having the highest level of technical competence, both professional and student assistant helpdesk staff prided themselves on developing positive interpersonal relationships with the faculty, students, and staff who they served. Indeed, it is not unusual for users to bring cookies, brownies, and candy to the helpdesk. When asked what were the factors that led the CalStateTEACH program to select CSUSM for helpdesk services, one evaluator commented that this "calorie metric" was certainly an indicator of the high esteem in which its customers hold the helpdesk support staff!

CSUSM saw the opportunity to meet an important statewide need by serving new clients with very high quality support as a "win-win", since we could also increase the hours of service to our local campus constituencies. We could do this using existing staff and facilities, with funding from the CalStateTEACH used to add a new staff position, increase student assistant hours, and make investments in our internal telecommunications resources.

Restructuring the CSUSM Helpdesk to Serve our New Customers.

While the CSUSM Helpdesk had worked diligently over the years to continue to improve customer service, this had been entirely in the context of serving local faculty, staff, and students. In this environment it had been possible to solve customers' problems in a variety of ways; by telephone, email, walk-in service, visiting the client's office, or even, on occasion, by making "house calls", when someone had a particularly challenging problem in remote use of their home computer. Clearly these options would not all be available with the geographically dispersed population we would be servicing in the CalStateTEACH environment, so we needed to find ways that we could provide excellent service to remote users.

Although program participants would be provided with a "Technology Quick Start Guide" and some technology orientations at workshops to be given at the regional centers, it was expected they would

look to the Helpdesk for the majority of technical help needs as they worked on assignments, and they would need this in a timely, responsive, and "user-friendly" way. Consequently a major emphasis was placed on providing as long hours of coverage as was feasible (Monday-Thursday 8am -10pm, Friday 8am - 7pm, Saturday 9am - 5pm, and Sunday 1 pm – 9pm). While not quite the 24 hours/ 365 days availability of a hospital emergency room, these hours seemed likely to meet the needs of most students most of the time.

CalStateTEACH students would be utilizing a great variety of computer hardware and software, and would be receiving Internet services from a host of different providers so rigorous training was provided for all professional and student assistant helpdesk staff who would be answering calls at any time. Helpdesk staff was provided with the same materials students would receive so that they could become familiar with them, and anticipate the kind of calls to be expected. CSUSM experts on particular topics, for example WebCT, presented workshops to helpdesk staff. In general, as with the medical ER environment, having a superbly trained staff, "ready for anything", was the goal.

Another priority was to put in place a sophisticated communications infrastructure that ensured that if the person receiving the call was unable to solve the student's problem, they could escalate it to an appropriate expert. When to escalate a trouble call is a complex issue, depending on the workload at a particular time, the expertise available on the spot, and how critical the problem involved. Again, like the hospital emergency room, the helpdesk has to be very responsive and flexible, and must sometimes make difficult "triage" decisions among competing demands on time and expertise.

A very important, and often overlooked, aspect of providing helpdesk support is being supportive and empathetic with the client at the other end of the phone. Students are calling the helpdesk because they are suffering from some problem, and just like patients in a medical situation they need to be treated with compassion and caring. The CSUSM Helpdesk staff has a reputation for good "bedside manner" with local users, and is making every effort to treat their new CalStateTEACH clients in a similar fashion.

Metrics: Information Contributing to Continuous Improvement.

The CSUSM/CalStateTEACH Helpdesk keeps track of all calls by means of a proprietary software package, *Remedy Action Request System*, which, in addition to facilitating day-to-day management of the operation, provides a wealth of data that can provide valuable information to inform tactical and strategic decision-making about resource allocation to improve service effectiveness and efficiency. As staff members receive calls, work on them, and pass them on to others if needed, all relevant information is recorded in the *Remedy* system. It is possible to review logs and identify frequent problems (this may suggest, for example, a communication to all students who have not yet encountered this problem), sources of calls (it might be that some problems are regional and this information could be helpful to local CalStateTEACH staff), or if a problem relates to specific hardware or software (informing decisions about continued use).

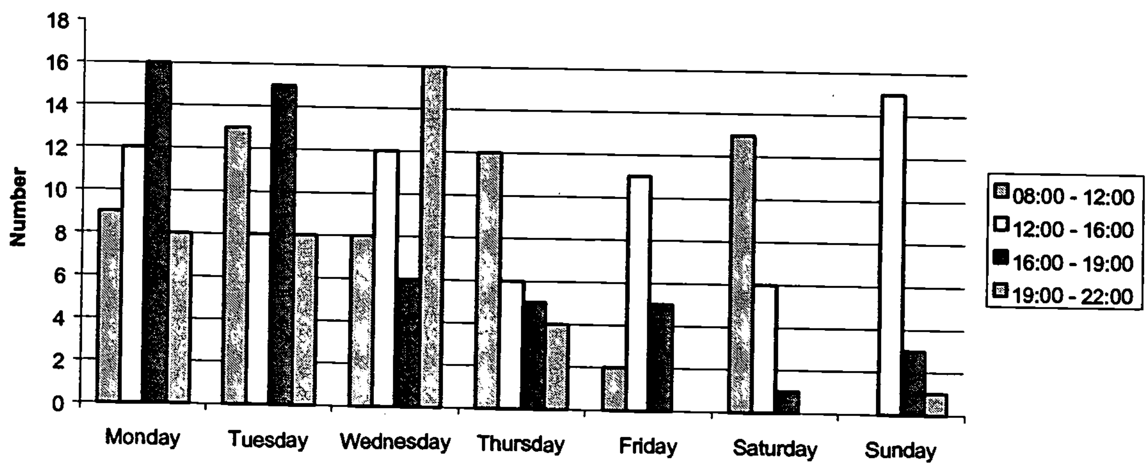

Figure 1: CalStateTEACH Helpdesk calls by time blocks and day of week, for month of September 1999

An almost infinite variety of metric reports can be generated from the *Remedy*, or other helpdesk system database. Figure 1 shows one example used to review times of greatest use of helpdesk services in a particular month (September 1999). While it is too early in the program to generalize, this data might suggest that keeping the operation open on Sunday evenings is not cost-effective.

Issues and Challenges

Given the very short timeline under which the CalStateTEACH Helpdesk program was implemented, it has to be considered a very successful venture. Hundreds of calls have been received and responded to with strong praise from students, faculty, and CST management. The focus has always been on meeting the needs of students first, and in order to accomplish this a very collaborative organizational culture has evolved, with the recognition that all involved in delivering CalStateTEACH instructional and support services have to be continuously innovative and flexible.

New challenges come along almost daily, and several issues are still not completely resolved. One example is that CSUSM technical staff has made themselves available, via cell phone and pager, beyond regular working hours to provide information to helpdesk staff when calls have been beyond their scope, and we have still to work out appropriate compensation strategies to deal with this on a regular basis. A second one would be that, while policies and procedures are under development, we are still operating for the most part in an ad-hoc way; as the program evolves and we accumulate more data, we expect to be able to develop more systematic approaches to dealing with situations that may occur frequently. Thirdly, while we have enjoyed good communications among the numerous entities involved in this very complex and innovative distance learning initiative, we need to even further improve both intra-group and inter-group communication. Another major challenge is developing and implementing an automated system whereby students will be able to find answers to frequently asked questions (FAQs) 24 hours a day, 7 days a week. This is well along but has yet to be installed.

But perhaps the greatest challenge is recognizing that when we are involved in such a dynamic effort as using sophisticated technologies to deliver education and support learning at a distance, we will probably be in a state of "continuous chaos", no matter how well we plan. Working and managing in such an environment calls for people who are flexible and agile, who thrive on change, and who have a high tolerance for ambiguity. Fortunately, this project has demonstrated that the CalStateTEACH project has attracted just such champions.

Lessons Learned, and Some Possible Future Directions

Although it is very early to start making predictions for a program that has barely started, it may be that already we are learning some lessons that will contribute planning for future years of this innovative instructional program, and for others considering how to provide better support for distance learners.

First, based on the kinds of questions received by the helpdesk, it seems that, from the student's perspective, there is not a clear line between "technical support" questions, and seeking other help vital to their success in learning. While we can "pass off" non-technical questions to others (e.g. faculty, administrators), there may be added value to the learner and economies of scale to the program, in considering the scope of the helpdesk in broader terms than previously envisioned.

Second, there is an enormous amount of data collected in the operation and management of the helpdesk function. While this is primarily to streamline operations, provide performance metrics, and inform tactical decisions concerning the helpdesk function itself, there are ways that this data could provide useful information to the broader instructional program. Particularly if the scope of questions handled by the helpdesk is expanded, analysis of data may lead to information that could lead to continuous improvements in curriculum, instructional delivery, and student support services.

Lastly, we are already finding in the CalStateTEACH program that helpdesk staff has much more to contribute to the project than answering students' questions. Because they are on the "front line" with students for over 80 hours a week, they gather considerable insight into what is working well, and not so well, and they are being consulted more and more by both administrators and faculty seeking advice on making changes and improvements. As this program evolves, and as other similar programs with a major

distance learning component are created, early and ongoing involvement of the helpdesk provider may contribute significantly to quality and effectiveness of all aspects of remote teaching-learning programs.

Talent Detection and Development Using the Internet.

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Abstract

In this paper will be applied a survey to identify the uses of the Internet and the detection of the talents and learning style preferences of the users. Based on these characteristics detected will be developed a software capable of training thinking skills and information strategies required and implied in talent development program. It will be applied three instruments, one is the *Survey of the Internet Uses and Abuses*, (Lewis and Ingham 1998) and the *Tel- Aviv Activities and Activities and Accomplishments* (Milgram 1994) *Productivity Environmental Preference Survey Inventory* (Dunn, Dunn, Price, 1993) In a web sever will be developed a program where any user will have access and it will have controlled the users´ performace and will give him feedback on his talent strengths and learning style preferences. In the web server will be installed other software programs to detect and develop different kinds of talents.

Purpose of this research

The principal objective of this research is the detection of the Internet users' talents and the development of software that will help them to train their thinking, decision making and information processing skills.

A comparison will be done between the Mexican sample and all the other samples that will have access to the Web Site. This will determine the talent domains and learning style preferences and uses of the Internet of the different samples.

In the first phase the learning style preferences and the area of creative domain will be determined. The subjects will receive feedback on their strengths and weakness to learn and the potential areas of creative talent.

A group of professors involved in improving their teaching will designed special units to help their students to improve their learning, based on the learning styles preferences.

The learning outcome assessment in each subject will help professors in the evaluation of the impact of their redesigned courses.

In the second phase, the professors will work together with a group of cybernetic engineers to design a matrix of the WEB tools (chat, e-mail, Newsgroups).

In the third phase, the materials developed the WEB tools will be applied and evaluated by the professors and engineers. The evaluation criteria will be the impact on the learning outcomes under the two scenarios: the WEB tools and the one without them.

Subjects

A sample of Mexican subjects that will access to the web site and a representative sample of Mexican undergraduates from La Salle University, Mexico City Campus. (N=500).

Subjects will access to the web site and will answer the questionnaires and surveys. The surveys and questionnaires have been adapted to the Mexican population. The Survey of the Internet Uses and Abuses. Consists of 38 questions divided into three groupings: a) Background data including age, sex, high school attended, major, amount of experience with the Internet as a whole, E-mail, The World Wide Web (WWW), Chat, Games and downloading software. Time units will be converted from a range variable to an ordinal number system and c) Academic self-reporting of semester grade point average. Self-report date will be verified internally. Data will be analyzed using regression analysis procedures.

Procedures

The sampled subjects will be administered by Internet with three different surveys and will be assessed in their talent strengths and learning styles preferences. Based on the detection of these preferences and talents, software will be developed to train thinking, decision making and information processing skills.

The program will develop use Java and HTML language, this URL will be up and you will find using the principals web searches, as yahoo, altavista, etc.

Results

Results for Learning Style

The Learning style preferences of the Mexican Talented and in comparison with other samples, differences and similarities.

Results for Creative Performance

The measures of creative performance of the Mexican Talented in the samples will be compared using discriminant analysis procedures (*stepwise).*

Results for Creative Performance and Learning Style
The measurement of creative performance of the Mexican Talented will be compared with the results in other samples by their learning style preferences and the measurement of the software capabilities.

It is expected that the talented users of the samples will prefer to learn by specific perceptual preferences.

It is probable to find different learning preferences and talents in the samples. The possibilities of using these learning preferences in the software that will train thinking, decision making and information processing skills.

Results for Online Activities
The World Wide Web, Chat, game playing and downloading activities will be analyzed as variables and its correlation.

Internet Influence on Academics
The analysis of the correlation between the variables and the accumulative and semester grade point average will be found.

Time spent on the Internet
Subjects will be asked about time they loose on the Internet when they should be doing other things. The results will be reported and analyzed to find out interference between the use of the internet and the academic performance.

Learning outcome using WEB tools
At least to environments will be evaluated, one without WEB tools implied, and the second with the WEB tools. The comparison will demonstrate the impact of the WEB tools in the learning outcome.

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TELECOMM: PRESERVICE APPLICATIONS

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This millennium year brings a good crop of eight papers on the application of telecommunications in pre-service teacher education. Practice is described in North America, Israel and New Zealand. In some ways the crop does not provide the field with answers to the gaps that exist in our knowledge. One paper identifies a major gap with the following question: "Can an electronic forum provide the context in which teachers begin to understand their practices, professional growth and development?" The answer from this paper is yes; their pilot web enhanced community appears to indicate that telecommunications can support teacher development. Over the years, our annual SITE conference has seen many such reports and early evaluations. Therefore I suggest that this year's crop is a small sample of the practice that is now out in the field. For this reason I my section introduction suggests topics for discussion at SITE'00, so that we may advance the field together.

In other sections of this SITE Annual you will see indications that such activities are also taking place on other continents, where resources and access to the technology permit. I suspect that the UK is seeing a particularly strong upsurge in the application of telecommunications in response to country's ICT National Curriculum for initial teacher training and the Lottery funded training for practicing teachers. Similarly the USA's new program for preparing tomorrow's teachers is also likely to make significant use of telecommunications. Therefore we are likely to see much more in-depth research on this topic in future conferences, as the support for research catches up with the demands of national and local governments on both sides of the Atlantic.

A more integrated approach

The strongest paper in the section comes from the award winning University of Virginia Curry School of Education. It is not surprising that greater depth of action and reflection can be achieved when an organization has progressed to a more integrated approach with technology in programs of study.

A WebQuest competition for teacher education was promoted at last year's SITE'99 conference so I am particularly delighted to see a report of their use by Sarah Fernald and Philip Molebash in the University of Virginia's Curry School of Education. I am also delighted to see Curry's steady move towards an even more integrated model of technology in teacher education, one that aims to introduce technology in the context of the students' discipline. I can remember discussing with Glen Bull the dilemma of technology versus content, when I visited Curry about a decade ago, and I told Glen then about our work in Project Intent in the UK (Somekh and Davis, 1997). Fernald and Molebash provide an excellent overview of the structure of their course and its reasoning, including the way in which a technology foundation is built and the way in which the students can be supported to strengthen their own critical thinking skills as they create WebQuests for future pupils. Access is also provided to the students' productions on the Web.

Elaine Hoter also used the Internet in pre-service teacher education, this time in a course for teachers of English as a foreign language studying in Israel. Like others before her, Hoter pairs up student teachers to teach pupils on-line. Interestingly, classes in one school in Israel and one in the USA are the partners, probably relating to practical issues of access to use of the web. Hoter rightly describes her course as one that thoroughly integrates technology into the pre-service teacher education program and she is to be applauded for setting an excellent model. The paired assignments are available online. Of particular interest is how such courses can be more widely implemented. A discussion of the effects of using technology in language teaching might also be a stimulating point for the SITE conference, given the challenges that new technologies post to literacy of all sorts (Soetaert, 1999).

Addressing needs for site based support

The use of telecommunications is often based on the need to increase belief by appropriate use of technology to reduce isolation. Several papers come from this angle. Clive McGee and Russel Yates tell us the story of implementing site-based elementary teacher education in New Zealand's University of Waikato, to serve their island's more rural community. Their need in New Zealand was to overcome teacher shortages where local people 'suitable for teacher education' are unable to move to the university city for full time study, due to their local commitments. Many communities will feel such a need, and this article provides a good

model for others to follow. McGee and colleagues used research of previous programs where student teachers were based mainly in schools where they were developing professional practice to inform this new program. They therefore set clear expectations for carefully selected partners with attention to team building and communications. McGee and colleagues evaluated their program through 39 interviews with school principles, students and supervising teachers. Using the factors identified, McGee and Yates present nine guidelines for others, which they suggest is developing a theory. The first guideline notes the need for staff to believe in the merit of the program and the last guideline is that all parties need to clearly understand the roles. Between these are several guidelines relating to access and comfort with the modes of communication between the various partners and participants. This guidance will be useful beyond the use of telecommunications, as the majority of it applies wherever partnership and mentoring occur in teacher education. For this generalization I draw upon the considerable research on partnership and the training of mentor teachers that has taken place in the last few years in the UK.

Vicky Cohen decided to tackle the isolation of students and to influence their beliefs while on their teaching practice by creating a web-enhanced package to support their developing practice and research. Cohen describes a pilot for 10 students of what appears to be an additional facility for students to study together while geographically dispersed in the field in schools. The success of the pilot as shown by the pre and post assessment forms is interesting. Perhaps we could ask how the pilot could be afforded on a larger scale for all students and staff. Perhaps Cohen can confer with other teacher educators around the world to consider ways that more mature examples have been able to increase the efficient and effective use of telecomputing resources and faculty and student time in order to support the scaling up of such pilots.

Early approaches to research

William Bower describes a questionnaire evaluation of the Web by pre-service student teachers of music. The use of two questionnaires to gain numeric information from the small class of 12 students is a bit puzzling because qualitative data could have provided much richer evidence for Bower's 'case study'. However for a researcher new to this field this is entirely understandable. I also find his use of psychologists' terminology of 'subject' rather than 'student teacher' uncompromising and so I encourage authors in our field to use the terminology that best describes their case, rather than one that distances them artificially as a researcher. In addition Bauer does not tell us that he is the students' instructor, although it is likely because he has given his affiliation as the School of Music. The study shows that the student teachers welcomed the use of the Web in their music methods class both for access to information and to their classmates through a newsgroup. There was a significant enhancement of this welcome and ease of use for student teachers who had access to the web outside their class. I hope that Bauer will provide a richer picture of the resources and interaction during his presentation at the SITE conference using the work of the class and their instructor.

All of the papers in this section could have asked Beate Baltes question "What is happening in the virtual classroom?" In order to provide the start to an answer Baltes contrasts student teachers interaction between a course called Educational Foundations presented in two modes using the same resources: face to face in college and online. Exerts from the students interactions with the instructor and presented, although the author does not indicate how they have been selected nor analyzed nor the differences between the two cohorts of pre-service student teachers. The contrast is clear: on-line students have communicated more and less dependant on their instructor. To find out more of the context we must wait for Beale's presentation at SITE. An examination of the issues of comparing two different groups of students should be very interesting as well as looking at the issues relating to access and participation.

Sue Espinosa takes the question further by qualitatively examining online communication modes through the reflective diaries of her student teachers as they use synchronous chat and a listserve during their course. Sue starts with somewhat of a literature review, including a recent book by Palloff and Pratt as well as the updated stalwart text by Roxanne Hiltz which was entitled *'The virtual classroom'*, Roxanne's trademarked the term. Espinosa's evident uses qualitative evidence from student reports with quotations that provide a rich picture of the students' views and context. Clearly both forms of communication are valued and each comes with its own issues, which have already been reported in the literature. During the SITE conference perhaps Sue will also share with us how these modes can be used to complement each other and tasks such as the required assessments. We may also consider the ways in which a teacher educator may also best research her preparation and management of such a class using these on-line communication modes.

On-line communities

Lynda Colgan, Nathalie Sinclair and William Higginson provide an ambitious paper that reports the start of long-term research of elementary mathematics teachers who form a community over the Internet. They created the community through on-site workshops to encourage beginning teachers to experience the joy of mathematics and 'build a positive emotional relationship with mathematics'. This core community was then the core for an on-line community called Connect-ME, which includes users who have left

Ontario and are in their first jobs in many locations around the world. Sinclair and Higginson share with us their ambitious plans for both design and research. They recognized that they have only just started and are somewhat disappointed at the lack of use of the Web site. Perhaps the discussion of their paper will bring together a number of Web site and on-line community designers, researchers, and users and so help to refocus the next stage of this rich development. We may be able to get better use by creating a tapestry of web sites that intersect in complementary ways. For example, the Educational Research Forum that I lead (on http://telematics3.ex.ac.uk/erf) might enhance the value of Connect-ME and vice versa Alternatively, there may be confounding issues such as that users get lost as web sites grow and they are unable to recognize users that they met before. Indeed Web site designers have very little feedback on changes of users' interests with time. Perhaps Colgan et al's introduction of a common experiential base and need for community interaction is a way forward.

Concluding remarks

I hope that the authors will forgive me for provoking discussion at the SITE'00 conference and hopefully beyond. We are at an exciting stage in teacher education with increasing demands and challenges. Policy makers around the world have understood at last that it is important to ensure that beginning teachers have good experiences and models for their own teaching with technology (Davis, 1999). The Web has ensured some sort of common software standards and ease of interaction. We now need to move to a more mature understanding through research and what Linda Colgan and her colleagues call 'the empirical knowledge-base.' I look forward to conferring with you on these topics and building more intersecting and complementary communities of practice across the globe. I also look forward to receiving more papers on this topic at the SITE conference and their further development for publication in the three journals in this field: Journal of Technology and Teacher Education, the Journal of IT for Teacher Education and the Journal of Computing in Teacher Education, all of which now have an editor in Iowa State University Center for Technology in Learning and Teaching.

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Using WebQuests as an Introduction to Methods

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Abstract: This paper describes the University of Virginia, Curry School of Education's approach for using WebQuests as an introduction to methods courses. EDLF 345, *Introduction to Educational Technology*, provides preservice teachers with fundamental technology knowledge specific to relative content areas. After eight weeks of building upon skills, students then use their technology knowledge to create content-specific WebQuests. The WebQuests offer opportunities for preservice teachers to explore content resources and organize information within a technological context. Provided is a discussion of some of the potential connections that are made during WebQuest planning and the implications of these connections on future methods courses.

Introduction

The Curry School of Education at the University of Virginia is nationally recognized for its integration of technology into content methods courses (Perry, 1999). In applying content-specific uses of technology, preservice teachers move beyond traditional drill and practice uses of technology and instead integrate higher level thinking skills and inquiry with technology. Methods professors utilize a variety of technology tools in their courses and require that incoming students have foundational knowledge of how to use these tools. A challenge therefore exists in now to adequately prepare preservice teachers for their content-specific methods courses. Prior to taking methods courses, students enroll in EDLF 345, *Introduction to Educational Technology*, a two-unit course designed to strengthen technology skills specific to content areas. During the 1998-99 academic year, the Curry School began separating the students in EDLF 345 into separate sections tailored to the needs of different content areas—Elementary/P.E & Health, Secondary Math/Science, and Secondary Humanities. By placing students in an introductory technology course with their content peers, the instructors are enabled to focus on technology tools most often used the content area methods courses. Consequently, preservice teachers begin to cooperatively explore instructional methods as they produce materials within their content area. As a culminating cooperative project, teams of students are required to create a WebQuest related to their content area.

Course Objectives

While the primary objective of EDLF 345 is to ensure that preservice teachers have a foundation level of technology expertise in content-specific contexts, a secondary objective of the course is for participants to begin producing instructional materials that integrate technology into their content area. An additional goal of the course is to improve self-confidence in applying technology to teaching. In order to meet these objectives, the instructors of the course plan hands-on activities that allow for exploration of technology tools while simultaneously requiring students to apply the tool to their specific content area. Out of class exploration is facilitated through the completion of weekly competencies. These competencies provide course participants with open-ended opportunities to explore application possibilities while developing instructional materials compliant with Virginia Standards of Learning. Participants also cooperatively present produced materials to their peers in class, giving other class members ideas regarding appropriate application. The WebQuest project assists in meeting course objectives on all fronts. Participants utilize the majority of skills acquired during the competency portion of the class, integrate

technology into their content area, and improve self-confidence as a result of completing a large and professionally functional project.

Course Participants

Students at the Curry School of Education earn a bachelor's degree in an academic major in addition to a Masters in Teaching through the Curry School's five-year teacher education program. The majority of the students enrolled in the class are in their third year at the University and have a firm understanding of their content area, as they have completed many courses towards an academic major. These same students, however, are often lacking knowledge regarding teaching methodology, as content methods courses are not offered to these students until the second semester of their third year. Entering EDLF 345 with limited understanding of educational methods leaves room for the instructors to gradually expose students to practical teaching applications of the technology learned in weekly classes. To stimulate discussion on teaching methods, the course instructors introduce technology applications using content specific examples of the applications use. By doing this, the instructors hope to model appropriate uses of technology within a specific content area that course participants will in turn model to their future students.

Many of the students in EDLF 345 participate in a three-week technology course offered through the Curry School. This course, EDIS 288 *Field Experience*, is required of all second year students applying for admission into the Curry School. Here, students develop basic, prerequisite technology skills over three class meetings (approximately six hours of technology instruction). Topics addressed in the field experience course include desktop publishing, web search strategies, evaluating online instructional resources, and multi-media presentations. As students enter EDLF 345 with this technology foundation, the instructors are then able to concentrate on applying these technology skills to specific content areas, therefore, better preparing students for upcoming methods courses.

Building the Technology Foundation

To provide preservice teachers with a foundation level of technology expertise in content-specific contexts, the instructors reinforce a variety of technology skills including: desktop publishing, spreadsheets, databases, creating multimedia presentations, paint programs, digital imaging, and web design. Each skill includes an introduction with a hands-on activity followed by student-generated suggestions for practical application within the context of the classroom.

Technology skills and weekly competencies build upon each other week to week and are capped off with a three-week long WebQuest project. A WebQuest is "an inquiry-oriented activity in which some of all of the information that learners interact with comes from resources on the Internet, optionally supplemented with videoconferencing" (Dodge, 1997). While researching and creating WebQuests, preservice teachers are addressing the recent technology/content dilemma, as presented by the Institute for Research on Learning. There, researchers have found

> "...a pattern where the technology is front and center stage, rather than the academic content ... the learning about the technology often takes over, and it is only after several rounds of integrating technology with content that content emerges in strong ways." (The Secretary's Conference on Educational Technology, 1999)

In EDLF 345, preservice teachers work cooperatively in groups of three or four to plan, revise, and present a WebQuest project that complies with the current Virginia Standards of Learning (or other similar state requirements). This constructivist approach requires that preservice teachers be accountable for content knowledge first, while secondly incorporating the technological skills taught during the first eight weeks of the course. As they share in the experience of creating useful WebQuests, they are exposed to and participate in a variety of teaching methods covered in detail in their methods courses. WebQuests ultimately prepare preservice teachers for their future content methods courses on two fronts. On one hand, WebQuests require a high proficiency working with a variety of technology tools. For example, preservice teachers utilize online resources to compile the majority of their information. From here, they construct

instructional web sites leading the user through a variety of tasks involving technology. In order to construct an effective WebQuest, the preservice teachers use many of the technology skills learned during the first eight weeks of the course, including: desktop publishing, digital imaging, creating multimedia presentations, and of course web design.

WebQuests additionally give preservice teachers a "jump start" on the content they will cover in their methods courses. During methods courses, class participants become intimately familiar with the Virginia Standards of Learning. EDLF 345 gives these students their first exposure to these standards. This is accomplished by having students address individual standards in their weekly competencies and culminating with the WebQuest, instead of merely requiring students to read and memorize standards in their content area. Also, WebQuests typically incorporate more than one standard, and often they incorporate standards from more than one subject area, thereby making interdisciplinary connections.

The WebQuest Connection

As beginning preservice teachers have not yet created structured lesson plans, WebQuests provide an opportunity for students to begin thinking about the components of planning a lesson while addressing each of the various levels of Bloom's Taxonomy (Ellis, 1995). As the goal of WebQests is to encourage inquiry-based learning, teachers are then required to prepare activities which move away from the traditional drill and practice models of technology use and instead promote higher-level thinking skills within tasks. While creating WebQuests, preservice teachers are faced with issues such as addressing higher-level thinking skills, preparing for varying student responses, and evaluating completed student work.

Preservice teachers, while developing higher-level thinking activities within the WebQuests, simultaneously strengthen their own critical thinking skills (Clarke, 1990). In asking the WebQuest's audience to make higher-level "connections" while completing the tasks of the WebQuest, the preservice teacher must consider in advance the intent of the activity and how these connections will assist in meeting the overall objective of the project. Additionally, the teacher must also consider the diverse responses the students may give when completing tasks, allowing for variability among student groups and how to accurately evaluate these responses.

While planning WebQuests activities, students also consider classroom management issues such as time and environment constraints, clear and concise directions, and the appropriate organization of content materials, all of which are covered in more depth during methods courses. These realistic technology issues challenge preservice teachers as they prepare to integrate technology within their own classrooms. WebQuest preparation encourages preservice teachers to be conscious of realistic management issues within the classroom while preparing content-appropriate material which strengthens higher-level critical thinking skills.

Discussion of Student-Produced WebQuests

The WebQuests for the fall 1999 semester are available at the following URL: http://curry.edschool.virginia.edu/curry/class/edlf/345/students.html.

In this year's sections of EDLF 345, a higher emphasis was placed on the content of the WebQuests than during the previous year. Course participants required very little technical assistance in the production of their WebQuests. This was in part due to two previous competencies that required the students to create a "favorites" web page and an instructional web site. These competencies can also be found at the URL above. Generally speaking, the WebQuests are technically sound and are well developed. It is expected that as a result of taking methods courses, students will be able to build upon the knowledge developed in EDLF 345 and be capable of producing WebQuests richer in content. However, the authors believe that the experience of creating WebQuests in EDLF 345 prior to taking methods courses is essential to this process. Had the class been a stand-alone technology course, students would be technically capable of producing a WebQuest in subsequent methods courses, but would not be experienced in linking this technical expertise with content-area knowledge.

The Next Step

Curry School of Education faculty are currently exploring the possibility of fazing out EDLF 345, *Introduction to Educational Technology*, and instead providing technology-based introductory methods courses for each content area. These courses would focus on core technologies for specific content areas, but would be more focused on content than EDLF 345 currently is. A pilot course for math and science preservice teachers was implemented this year and will provide necessary data to further evaluate this possibility. The trade-off in this procedure is that preservice teachers will be provided with less of a foundation of technical skills as they enter methods courses, making it necessary to continue to build on this foundation in methods courses. As methods faculty across all content areas adopt more uses of technology into their courses, the math and science model started this year is likely to expand into other content areas. For now, WebQuests serve as an important bridge, connecting technology proficient EDLF 345 students to their content-specific methods courses.

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The Effectiveness of Preservice Teacher Training Through the Internet

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Abstract: This paper discusses a collaborative model developed for a distributed learning course in which preservice teachers learn and teach through the Internet. In this model the preservice teachers, who are learning to be teachers of English as a foreign language, act as mentors for EFL pupils to help improve their literacy skills, while, at the same time collaborating with the pupils to carry out joint assignments. Their combined efforts are published as webfolios on the Internet. This model aims at giving the preservice teachers teaching practice through the Internet, in order to prepare them for effectively incorporating TML into their future classes. This paper will present initial results from the study as to the effectiveness of this type of course. Initial data will be presented which seems to point to a change in the preservice teachers' perception of how they see their role as teachers.

Introduction

Many educational professionals are concerned about the effectiveness and quality of preparation preservice teachers receive in integrating technology mediated learning (TML) into their future classroom practices (Beisser 1999). There is a tremendous disparity in the technological preparation of preservice teachers, many of whom feel unprepared for their future task of creating new instructional environments (Persichitte, Caffarella & Tharp 1999). New teachers often feel bewildered by the new options open to them and fail to capitalize effectively on the new technologies. One prime reason for this is that most university faculty are neither modeling the use of technology nor requiring students to use technology in the preservice phase (Blanche, Matthew, & Thomas, 1998; Bauer, 1998; Drazdowski, 1995; Vagle, 1995; Wetzel, 1993). As the Office of Technology Assessment (1995) reported to the US Congress, most technology instruction in colleges of education involves teaching about technology as a separate subject, not teaching with technology by integrating it into other coursework to provide a relevant model for instructional use. This description is also applicable to teachers colleges throughout the world.

Research shows us that even when the new teacher has computers with Internet connections available in their classrooms they are not effectively utilized, being used in the main as a word processor or for operating pre-packaged learning ware. Pelton and Pelton (1996) studied the correlation between teacher attitude and the acceptance of technology. Their research led them to conclude,

"Although many teachers believe computers are an important component of a student's education, their lack of knowledge and experience lead to a lack of confidence to attempt to introduce them into their instruction. This lack of confidence then leads to anxiety and reluctance to use technology" (p. 167).

Research also shows that personal confidence building should be an essential part of a technology course. Knowledge about computers and technology do not guarantee that a teacher will integrate technology into a course of study. A key component is attitude. "Educators need to strive to light a fire and motivate preservice teachers to understand the influence educational technology can have in their lives and classrooms: (Gunter, Gunter and Wiens 1998).

In order to raise the confidence and computer competence level of the preservice teachers, a new model was developed based on the "learning by doing" theories. In this experimental based model preservice teachers participate in a distributed learning course while simultaneously teaching pupils through the Internet.

Background

Technology Integrated Models

Aside from designs for general computer literacy courses (Leh, 1998), a number of models exist for teaching distributed learning courses. Mason (1998) divides the existing types of on-line courses into 3 categories: the content+support model where there is a "strong division between content and support" and the online activity is about 20% of the course; "the wrap around model" in which tailor made materials are wrapped around existing materials and online activities amount to 50% of the course; and the integrated model which consists of collaborative activities, learning resources and joint assignments. As Mason says, in this third model the distinction between content and support dissolves and a learning community is created. In addition to Mason's three models, there is also "anchored instruction" in which technologies are taught through a theme or anchor" (Bransford,Sherwood, Hasselbring, Kinzer & Williams, 1990, Bauer, 1998).

A typical online component found in courses in the teaching colleges seems to be of the type shown in the diagram below. However in many cases the content is the technology.

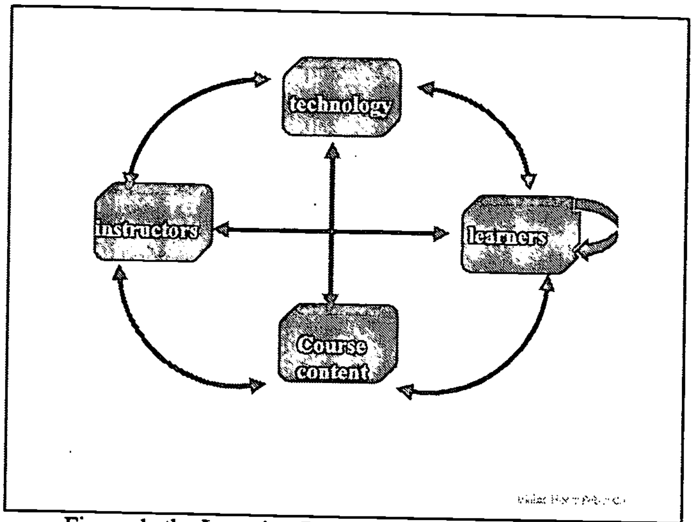

Figure 1: the Learning Process in a standard TML course

Changes in Concepts

Today with changes in technology and pedagogy we envisage "a new teacher" prepared to carry out various roles in the technology enhanced classroom. This new teacher is no longer the sole source of experience and information for the learners. It is no longer enough to teach preservice teachers how to be computer literate, (using email, searching the net etc), nor is it sufficient to merely teach students about integrating technology and about the tools of the Internet. Rather, they have to experience and practice actual teaching using TML themselves as both learners and teachers in a protected setting, before they can be expected to manage a classroom in the age of technology. We have to prepare our preservice teachers for the challenges of the age of technology where we can expect to find computers in every classroom. Teachers have to know when and how to appropriately integrate the technology. "Teaching training programs must recognize the need for training in technology, taught across the curriculum" (Beisser 1999). The national curriculum in the UK for Information and Communication Technology (ICT) aims, in particular, to equip every newly qualified teacher with the knowledge, skills and understanding to make sound decisions about when, when not, and how to use ICT effectively in teaching particular subjects. ... It is the responsibility of the initial teacher training provider to ensure that the ways trainees are taught to use ICT are firmly rooted within the relevant subject and phase, rather than teaching how to use ICT generically or as an end in itself. (DfEE/WO, 1998, Annexe B) The standard courses don't seem to prepare the teachers for this future.

Description and Implementation of the Model

The new model was developed in the framework of a course in teaching advanced literacy skills. After piloting the course in 1996, the course was given twice in 1997-8 to two groups of preservice teachers, and with revisions is being taught in 2000.

Project Participants

The 1997-8 project involved two separate classes of preservice teachers. One group consisted of 18 university graduates from Anglo-Saxon countries who as new immigrants to Israel were retraining to be English teachers. The other group of 9 consisted mainly of 2nd and 3rd year students studying towards a B.Ed degree specializing in TEFL with the addition of a few mature students returning to complete their B.Ed degrees. The course ran for a semester course involving 14 meetings of 4 weekly academic hours. At the time the course was given, few students had access to Internet connections from home, thus block time was needed in the computer room at the college. The students also had computers available to them outside of class time for the purpose of practice and to complete assignments.

Each group of preservice teachers teamed up with a different group of EFL learners. One group consisted of ninth graders in the Gymnasia junior high school in Jerusalem Israel, and the other group consisted of foreign visiting students at Snow College Utah USA. Each preservice teacher received a pupil partner for the duration of the course. Each pair collaborated through the Internet to complete joint assignments working through the various modules of the course.

Course Rationale

Each of the 8 modules of the course consisted of 2 topics, one always in the realm of the topic area, which was teaching advanced literacy skills. This included, for example, the skills and strategies of skimming, scanning, summarizing, differentiating between fact and opinion, and vocabulary development. The second topic of each module was learning about a tool of the Internet. This included email, advanced searching, use of database, MOOS chats and IRC etc. Each module had collaborative assignments that ensured the preservice teachers and the pupils became familiar with and competent using the various tools of the Internet while working in the content area. The pupils practiced their English and developed their literacy skills with the help of their on-line partner who became their buddy and mentor. The preservice teachers got to learn about literacy skills through the on-line bibliography of the course, learn and practice the tools of the Internet, and also to put their new found knowledge to practice on their personal pupils.

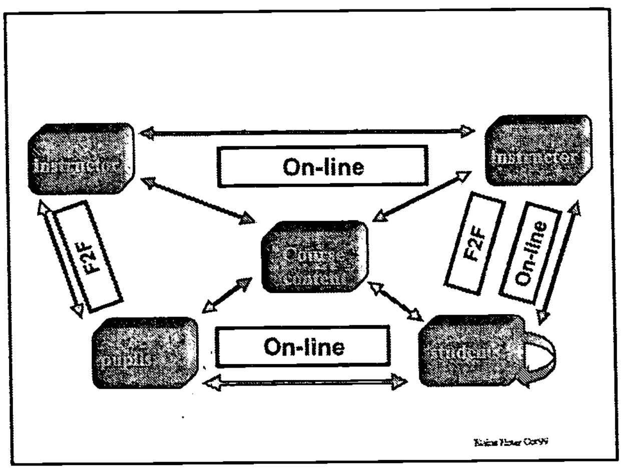

Figure 2: Interaction in the New Model

The course, as depicted in figure 2, is classified as a distributed learning course because all the work on the content area was mediated through the Internet as were the discussion groups. The class meetings were spent individually completing assignments on the computers. The F2F component was the component in which the technology was demonstrated discussed and technical problems were sorted out. Today with the advancement in technology, fewer technical problems and the availability of Internet connected computers off campus, the actual amount of class meetings could be drastically reduced. In 1997, however, the student all felt that they needed the support of the F2F meetings.

The EFL pupils also met with their class teachers for 4 hours a week for the semester. Their class time was spent working on assignments through the Internet and the F2F component, which was also devoted to teaching the tools of the Internet. Both the instructors of the EFL classes worked online with the instructor of the preservice teachers to discuss the course development as well as to solve technical difficulties. There was minimal intervention by the instructors in the course content area and in the ensuing interaction between the preservice teaches and the EFL learners. The instructors interacted with the preservice teachers in the form of comments and feedback to reactions to the reflective dialogue journals.

Course requirements

The preservice teachers were required to communicate on a weekly basis with their EFL partner throughout the course giving feedback and encouragement while working together and helping their partner in carrying out joint assignments. In addition the preservice teachers had to read and relate to a bibliography on the Internet site and were required to take part in the class online discussion group. They were also required to write a weekly reflective dialogue journal with the class instructor in which the preservice teacher reflected on the process they were going through and the critical incidents observed along the way. The EFL pupils had the responsibility to prepare an online webfolio of the pair assignments, (examples can be fund at http://www.macam98.ac.il/~elaine/eti/Mod8.htm)

The assignments were all geared to encourage communication, foster collaboration, develop proficient language use via process writing, widen students' horizons and develop a sense of a learning community. For example one of the initial writing assignments was for each pair to write a bio-poem about each other. In order to carry out the assignment the participants interview each other, thus encouraging asking and answering questions via email communication.
(http://www.macam98.ac.il/~elaine/eti/Mod2.htm#A fun writing)

Collection and analysis of Data

Data was collected throughout the course in order to examine the process the preservice teacher goes through while taking the course. This included pre and post assessment tests on motivation to using technology (based on Warschauer 1996) on the subject matter, attitudes and teaching beliefs. An end of course questionnaire was carried out as were follow up interviews a year and a half after the course on use of technology in teaching. Data was also collected during the course via the analysis of dialogue journals, emails with pupils and contributions to the discussions. The data is in the process of being analyzed, but initial results of pre and post tests in course content and use of technology show a marked improvement in many areas. Ironically enough the participants from the retraining course who did not show improvement in the content area (teaching literacy skills) have left the teaching profession, some to work in the computers field.

Initial analysis of the follow up a year and a half after the course shows that when the teachers have access to computers with their students, they are integrating the tools of the Internet in their EFL teaching and some have become the school leaders and "experts" in this domain. However, many of the teachers lack basic computer equipment in the schools, so apart from using the Internet from home for material and interaction with colleagues, haven't been able to apply their knowledge in the classroom. One very positive item of feedback is that all participants said that they would use parts

of what they tried out and practiced in the course in their own teaching and 35% said that taking the course changed the way they teach.

Summary

Obviously this model suggested is not the answer to all the issues of teaching how to integrate technology in the schools, but it does allow preservice teachers to acquire and practice the skills in a supportive environment while obtaining first hand teaching and learning through the Internet.

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Innovation In Using Telecommunications In Pre-Service Teacher Education And The Impact Upon Distance Learning Student Teachers

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Abstract: A teacher education program at the University of Waikato provides for student teachers to do most of their study away from the university. The Internet, several block university weeks and study in local elementary schools are the main sites of learning. Data from interviews about the effectiveness of the school-based component are reported. The responses of principals, tutor teachers and student teachers revealed several major issues: teacher workloads and university expectations on teachers, support for student teachers, organisational requirements, colleague relationships, benefits for tutor teachers, power relationships and negotiated participation, and multiple demands and pressures on student teachers. An analysis of these issues provides the basis for a possible theory of school-based teacher education. Several propositions are advanced as the basis of an emerging theory that may impact on future policy development.

Background

In recent years there has been considerable expansion in teaching various academic courses electronically. To date much of the effort has been in designing course materials to make them more appealing to the students, often spurred by a desire to achieve a greater market share. Increasingly, attention is turning to what happens to the student teachers when they engage with course materials. How do they respond to the materials? Do they have needs that are different to other students? What strategies are needed to help them succeed?

Teacher education is a field that has extended into teaching with information technology (e.g. papers in conference proceedings of Teleteaching '98 and the 3rd International Open Learning Conference, 1998). Knowing how student teachers engage with materials is a matter of considerable importance for teacher educators and policy makers. Pre-service teacher education students have to learn a considerable amount of content that can be achieved through electronic means. But they need to learn much more that cannot be learned through Internet access, in particular, many aspects of a teacher's job in school-based settings. This paper examines the way in which course materials interact with the school-based practice of student teachers and their mentors.

The teacher education program discussed in this paper is offered by the University of Waikato, located in Hamilton, a regional city in New Zealand. The region of the university includes several small cities, numerous small regional towns and villages, and rural districts with low population densities. The motivation for this new form of delivery was primarily educational politics revolving round the issue of how schools in rural communities could overcome teacher shortages. Local leaders in teacher shortage districts have pointed out to the university that local people suitable for teacher education are unable to move to the university city for full-time study because of family and other commitments.

Confronted with the above issue, the university decided to offer an alternative form of delivery of teacher education to 'immobile' student teachers in local districts, principally through online computer communication. (Campbell, Yates & McGee, 1998; Yates, 1999). Advances in technologies associated with

distance teaching and learning aided this decision. Credibility was to be maintained by teaching the already-established degree and diploma in primary teaching.

It was decided to teach courses by a combination of delivery through Internet, school-based work in the home district and several short (one-week) blocks of attendance at the university for face-to-face teaching. The degree is made up of 21 courses or papers: three in professional practice (coursework and school practicum); nine in curriculum methodology and issues; one in each of human development, special education, classrooms with linguistic and cultural diversity, social issues in education; three content courses; and two options. Many of these courses, and especially the professional practice and curriculum ones, required practice in elementary schools.

The innovative aspects of the teaching are: (a) student teachers spend most of their study time at home, using information technology to communicate with their teachers at the university, and engaging in study group interactions with fellow student teachers via their computers; (b) attendance at the university for three separate weeks of face-to-face teaching per year; and (c) location in an elementary school to carry out coursework tasks and assignments.

These innovations were developed after reviewing international attempts in distance teaching. The 'home' or 'base' elementary school was willing to provide mentoring and supervision for a student teacher. For a small fee, a teacher in the school agreed to create teaching opportunities and provide feedback to student teachers on their classroom performance on tasks required by the university. All student teachers had to negotiate with the school and tutor teacher over times and dates to teach lessons in a subject currently being studied, for example, times to teach several lessons as part of the curriculum mathematics course. Every student teacher was expected to spend one-day equivalent in a school every week. International research focus on school-university partnerships has identified certain effectiveness factors. For example, Sealey, Robson and Hutchins (1997) showed that setting clear expectations, team building, communication and carefully selecting partners were crucial to success. Factors like this form the basis of a theoretical framework by which to assess the quality of the school-based experience, for the success of it relates to the broader issue of developing 'professional self'. School mentors and student teachers working together are crucial (Edwards & Ogden, 1999).

The response to this placement approach has been significant. Student teachers gained much from being placed in schools where mentors provided them with appropriate role modelling, advice and guidance and collegial support. Each of these aspects built on the course materials that were electronically accessed. The student teachers generally selected the schools for reasons such as geographical proximity, size and known approaches to teaching and learning. Most schools had only one student teacher placed in them but a small number had up to five student teachers. The university negotiated and supervised each placement by making a visit each semester and more frequent contacts through telephone and email.

In spite of these strategies the school-based part of the degree program was probably the most contentious component. University staff raised issues like: How could quality of school-based practice be maintained in remote schools? How could the quality of mentoring and supervision be assured? Could all student teachers be placed in quality schools and classrooms?

To answer these questions, the coordinator of this alternative degree delivery, called mixed media program (MMP) and the director of university teacher education embarked on a series of observations and interviews in a sample of MMP elementary schools. They interviewed a sample of school principals (N=12), tutor (supervising) teachers (N=12), and student teachers (N=15) in a variety of schools.

From the resulting data, the following issues were identified as the most pressing:
1. tutor teacher workloads and university expectations,
2. quality of support for student teachers,
3. organisational matters,
4. in-school colleague relationships,
5. perceived benefits and constraints,
6. power relations and negotiated participation, and
7. multiple demands and pressures on student teachers.

Using data collected from school visits and interviews, each of the above issues is discussed.

Tutor Teacher Workloads and University Expectations

At the commencement of the program all participants were advised of the expectations of the university, officially through letters, visits and some limited use of email from the university and "unofficially" by the student teachers in their weekly contact. The student teachers were asked to be responsible for transmitting the nature of the content in each course to their school, to assist building and consolidating the relationship between teachers and student teachers, and to ensure that the student teachers were clear about the nature of the task and able to explain it through written material and oral discussion.

It was found that all participants faced initial adjustment problems, for they were working in an unfamiliar situation. The student teachers were new to online learning. University teaching staff, all volunteers, had subject knowledge but no online teaching experience, and the school tutor teachers in schools were largely unfamiliar with the use of information technology. When interviewed, some school tutor teachers commented that they felt insufficient guidance had been provided and they were uncertain of what was expected of them. Some suggested that they believed direct contact on a regular basis should have been made between the university and the school, rather than having student teachers as the "messengers." It was also suggested that the school tutor teachers should have been provided with professional development similar to that provided to other teachers who supervised regular practicum placements for on campus student teachers. In contrast, some school tutor teachers were satisfied with the amount of information provided by the university and the way it was disseminated. They commented that their student teachers had been clear about their expectations and the nature of the tasks and that the process of having the student teachers explain was beneficial for all parties.

The reason for the variation in the reactions to student teachers can be explained in part by the attitude of the schools and partly by the effectiveness of the student teacher in developing their own independence. Some schools were more receptive to the task of providing an interface for student teachers between their course materials and the school based setting while other schools relied on what might be called an "official" line. These schools were less receptive to the idea that student teachers could be responsible partners in their own learning process and had to be told what to do.

Quality of Support for Student Teachers

The second issue that emerged about the school-based part of the program was the quality of school support for the student teachers. An important consideration was that the student teachers were placed in schools that until then had only limited contact with the university because of distance. Many tutor teachers were not experienced in tutoring student teachers and this added dimension to their work was unsettling for some. Attempts to provide professional development were frustrated by a lack of replacement teachers for tutor teachers while they participated. While some professional development with teachers was undertaken no real resolution has been achieved. However, an interesting side effect that became apparent was the way the tutor teachers gained professionally from their contact with the student teachers. Some principals commented on the enervating influence that enthusiastic and well-organised student teachers brought into schools, with new skills, initiatives and particularly ideas from their coursework. On their own, rural schools lack consistent contact of this kind. Suggestions such as liaison teachers based in some regions, a lead teacher fee being offered and other possibilities such as free call phone in lines have been considered, but not implemented at this time.

Organisation

It seems self evident that an effective program needs to be based on sound organisational procedures. In spite of this assumption, organisation was noted as another issue in the research. From the data it became clear that having clear guidelines reduced the amount of anxiety experienced by the school tutors. First the ability of student teachers to negotiate was integral to the success of the program from the student teachers' and teachers' points of view. Student teachers who were already known to the school generally found it easier to negotiate school access for their tasks. They did not have to establish their own relationships and credibility. However, there were some student teachers who were unknown to the school. As the program commenced some student teachers found difficulty but were soon able to establish strong relationships in the school.

As student teachers negotiated their school access several key factors arose. Flexibility was needed to provide classroom time for teaching by student teachers. They needed to fit in with the classroom program and teachers needed to make time for them to carry out their tasks. Student teachers who showed initiative in developing an effective time-line for each semester and communicated it to schools were able to achieve effective school - student teacher relationships. Last minute requests leading to tensions were therefore avoided. The way in which student teachers managed their time was further highlighted when they had employment that impacted on both themselves and the schools. The question of how much part-time paid work is possible while studying for a degree as a full time student, remains a problematic issue.

In-School Colleague Relationships

Establishing positive relationships between student teachers and school personnel was a major issue that emerged from the interviews. A key factor was continuing contact with the principal, tutor teacher and student teachers and this was crucial to successful school-based work. Effectiveness seemed to drop when contacts were spasmodic. The way in which the student teacher approached the principal was critical for a strong relationship and supportive principals resulted in student teachers being more positive and achieving better. In many cases the student teachers became integral parts of the school community. Actions such as inclusion in staff photographs and celebrations of high grades are examples of this. However, there was evidence that some principals inadequately consulted their teachers after negotiation between the principal and the university coordinator. Consequently the tutor teachers felt "dumped upon" and had a less positive attitude towards the program and the student teachers. Fortunately, this was a small minority and the overall view was one of a strong partnership between the schools, student teachers and the university.

Benefits and Constraints

A number of benefits and constraints emerged from the interviews, which is hardly surprising in a new program of teacher education taught through mixed media for the first time at a particular university. The first benefit and probably the most obvious, was that student teachers quickly became familiar with the realities of teaching. They were able to engage in the life of a school on a regular basis and readily develop relationships that are crucial to teaching. This seems to be a more "natural" path towards socialisation into teaching compared to university-based student teachers who spend less time in schools. On the other hand there are dangers of pressures to conform which reduce student teachers' initiative (McGee, 1996).

A second benefit was that student teachers introduced and shared new ideas with their tutor teachers and even more widely in the school. New Zealand schools have been exposed to major curriculum revisions in the last decade and the scope and pace of this has been daunting for many teachers. Even those who were strong in their professional development found that the added impetus from the student teachers, mainly in curriculum matters, provided numerous opportunities for sharing. Not only did the course materials add to the professional development of teachers but it was also significant that the student teachers were able to clarify their understandings and make links between theory and practice.

A third benefit was the way children were able to benefit from having extra teaching time from a student teacher. Although they were still in training, their increasing knowledge and skills meant that they were able to make a useful ongoing contribution to learning in classrooms and schools that is not always possible in the on campus program. Classroom life in New Zealand has changed a lot in recent years, and inclusive education policies have been implemented in a way that means that there is often more than one adult in a classroom. The student teachers were able to work successfully alongside teachers in a professional capacity.

A fourth benefit was to do with teaching approach. Achieving reflective practice in student teachers has been a major goal in teacher education for some years (Zeichner, 1993). The need for student teachers to systematically reflect on their practice is frequently discussed with teachers but some tutor teachers remain dubious about the practicality of this approach in the mixed media program. Teachers and principals, it seems, were gradually seeing the benefits of the tutor teachers developing reflective practice, behaviours that showed up in the quality of their modelling, feedback and support.

Finally, a side effect of this mixed media teaching, has been the way in which the student teachers have been able to demonstrate and use their information technology skills. While New Zealand schools have long been regarded as innovative, adaptation to information technology skills especially those for computer usage has been slow. Teachers have commented that because of the accountability demands that emanate from recent educational reforms, they have been very pressured for time to gain the required computer skills. Often the children in their classes have been more proficient. However, the introduction of student teachers into classrooms in the base schools provided some teachers with the opportunity to become more skilled. They achieved this by working with the student teachers who were not only willing to help them but often made contributions to the wider school community through their knowledge of information technology.

Taken as a whole the data showed that the school-based placements were largely successful. However, there were a number of constraints. The first was that the size of the school is important. Some schools are very small with only two or three teachers and the demands from a student teacher placement means that there can be extreme pressure placed on all teachers in the school. They may be very willing but they also need to cope with the normal demands of teaching. Thus, the approach has been to limit the number of student teachers placed in a school to match with its size. Small schools have been limited to one student teacher while the larger ones have up to five. It is difficult to match the need to be realistic with what a school can cope with against their enthusiasm and desire to be involved with a program, which is innovative and will bring rewards to their local education needs, by supplying more teachers.

A second constraint was teacher changes. The most crucial was several changes of principal where existing teachers had been involved in the program yet the new principals were not as committed to the program. This required considerable consultation with some schools to ensure that continuity was retained. Classroom teacher changes also effected continuing commitment. The final constraint was the student teachers themselves. They needed to be well organised, motivated and show initiative for their placement to be successful. This was generally true but some advice and guidance was necessary for student teachers who put their placements at risk by not showing these characteristics.

Power Relations and Negotiated Participation

Power relations and negotiated participation have been referred to in discussing the above factors. But it did arise as a separate issue. The way in which principals, teachers and student teachers interacted was dependent on the effect of power relations and the way the student teachers were able to negotiate their participation. Principals were generally welcoming of student teachers and regarded their participation in the life of the school as beneficial. However, there were some principals and teachers, who recognised the competence of the student teachers by giving them more responsibility than they should have had as student teachers, thus bordering on exploitation. Even if the student teachers were aware of their needs they found it difficult to negotiate in these circumstances. An implication is that all involved needed to be aware of their respective roles and to abide by them.

Multiple Demands and Pressure on Student Teachers

There were multiple demands on student teachers to carry out their various roles which, impacted upon their participation in school-based activities. Many had an economic need to be in part time employment, often for a considerable number of hours per week. Many had to balance the needs of being a student teacher with that of managing their own family life. It was not always recognised by schools which, surprisingly, sometimes lacked tolerance. In addition, the student teachers felt under pressure to achieve at a high level. Multiple expectations from school, the university and their own family, as well as themselves made balancing all the demands it very difficult to maintain their participation. A feature of this program is the very low drop out rate.

Taken as a whole, the findings were reasonably positive. Student teachers were gaining mainly beneficial knowledge and teaching experience. The data also revealed a number of matters that needed to be addressed to ensure consistent quality, for example, better techniques of feedback to student teachers and reconciling multiple demands upon both teachers and student teachers and providing exemplary models in the base schools.

Developing a Theory

From the emerging information about the school-based part of teaching a teacher education program described in this paper, and what is known about other attempts, it is now possible to identify several factors that might be included in a theory of this school based component. The theory might be called the theory of effective school-based delivery in teacher education. The effectiveness factors we have identified are:

1. The university teaching staff need to believe in the merit of the program.
2. The university teaching staff and tutor teachers need directed assistance in adapting their teaching to alternative strategies.
3. The available technology needs to be within the capabilities of teaching staff and student teachers.
4. Substitute means of communication between university teachers and student teachers and also between the student teachers are required to compensate for reduced face-to-face communication.
5. Student teachers require access to whatever technology is used and the skills to use it.
6. Student teachers' success in school-based coursework will depend on their capacity to become independent learners who are able to reflect and negotiate.
7. Effective elementary school placements require effective supervision, feedback and advice.
8. Multiple demands upon student teachers need to be rationalised to ensure adequate time is given to university coursework.
9. All parties need to clearly understand their roles in the school-based work.

As a starting point the above factors provide not only the chance to theorise about what might be an effective program, but a blueprint for policy development. For example, the second factor was developed from a feasibility study of international multi-media delivery systems. It was found that problems arose when tutor teachers were inadequately prepared. Being aware of this, steps were taken to provide funds and time for staff to develop course materials and computer usage skills. In 2000 we will be in a position to review the quality of teaching of the first cohort of graduates. The school-based part of their teacher education is sure to be a key element in the level of effectiveness in the graduates' teaching.

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USING THE WEB TO ENHANCE FIELD EXPERIENCES FOR PRESERVICE TEACHERS

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Abstract: This paper describes an ongoing project at Fairleigh Dickinson University in which preservice graduate students are required to take a web-enhanced Field Experience course. In Spring 1999, an initial pilot was conducted and pre- and post-assessment data were collected. Results show that all students found this course to be very beneficial and that there was increased proficiency in computer use, especially for those who were the most inexperienced. This type of course increases interactivity among field experience students and facilitates communication and involvement for all involved.

Introduction

Field experiences are one of the most important factors that promote professional development in preservice teachers. Research confirms that placement of preservice teachers into classroom environments facilitates reflective professional behavior whereby interns are more inclined to carefully think about and improve their own teaching (Boyd, Boll, Brawner, & Villaume1998; Metcalf & Kahlich 1998). Field experiences allow preservice teachers to participate in and experience as learners a wide variety of instructional approaches, styles, and techniques (Metcalf & Kahlich 1998), while also helping them to develop a coherent philosophy of learning and to connect their philosophy to classroom practice (Boyd et al. 1998). However, there are several attributes of Field experiences that are problematic. First, there is no consistent way to ensure that each intern will be placed in an exemplary classroom setting that is modeling the practices and methods that the university is promoting within its curriculum. Invariably, a few students are placed into classrooms which function as negative models--examples of what not to do in a classroom. Second, when interns are placed in a classroom, they are usually isolated from any type of continuous communication with the university instructor and other interns. This often leads to a feeling of abandonment, isolation, and, perhaps most serious, a period of missed opportunities to teach and reinforce important concepts about the classroom whether they be positive or negative aspects of teaching and learning. Third, because interns are in different classrooms, there is no common experiential base for them to develop into a community of learners sharing and developing a common core of beliefs.

These early experiences in a preservice teacher's education influence their beliefs about what it takes to be an effective teacher and how students learn best. The experiences that each intern is exposed to during this stage of professional development will greatly impact how he or she eventually teaches in the classroom (Laffey & Musser 1998). The research in the field of instructional technology suggests that one reason our schools are lagging so far behind in the use of instructional technology in the classroom is that teachers, themselves, were never taught using instructional technology, do not know how to use it, and are afraid of it. In addition, today's colleges of education do not adequately prepare teachers to use technology in their teaching (OTA 1995). Research further suggests that technology plays a significant role in changing the climate, culture and process of learning within the classroom, helping teachers shift from a lecture-oriented classroom to a project-oriented one where students collaborate in a more constructivist approach to learning (Cohen 1997; Becker & Ravitz 1999) This shift in instructional methodology supports what current learning theorists claim is the most advantageous way for students to learn, and, in fact, supports what educational reformers have been trying to accomplish for years without the use of technology. In essence, this means that teacher educators must start requiring the use of technology by their students as part of teacher certification requirements, and professors must model effective use of the technology within the instructional process. Many preservice teachers view computing as stressful and take a conservative view toward using technology in teaching, namely that they view technology as a potential interference in the teacher-student relationship and they do not perceive the relevance of using technology in the classroom (Laffey & Musser 1998). It is therefore essential that preservice teachers have positive experiences that model effective and comfortable use of technology within their own classes so that these experiences will positively influence their belief systems and encourage them to use technology as a future teacher.

This paper describes an ongoing project at Fairleigh Dickinson University in which preservice graduate students enrolled in the Master of Arts in Teaching (MAT) program are required to take a web-enhanced Field Experience II course that incorporates the use of technology as part of course requirements. This course is the second field experience required for New Jersey State Teaching Certification and the students must spend at least 30 hours in a classroom-- participating, teaching model lessons, and observing curricular trends that are being implemented. Traditionally, field students met with an instructor three times during the semester, but for the most part they were very much on their own. They went to their respective field placements and had little contact with other students, teachers or with the professor, resulting in a feeling of isolation that oftentimes pervades the teaching profession. This project was designed to develop a virtual community of learners who would share experiences, thoughts, issues and concerns with each other and with their professor on a continual basis. The course was also designed to help preservice teachers increase their proficiency in technology and influence their attitudes and belief systems about technology by requiring them to use technology as part of course requirements.

The Web-Enhanced Course

This instructor was initially given a summer grant from Fairleigh Dickinson University (FDU) to develop the web component of the course, Field Experience II. During the summer, the instructor learned Web Course in a Box (WCB), the authoring package that FDU uses to develop web-based courses. WCB provides an easy and comfortable environment for instructors to develop an effective and dynamic online environment. Each student requires a user name and password to enter this site, ensuring security and privacy, a very important feature for any distance course. Much of the development time was spent searching for links for student research and developing lesson plans that the students could access.

Part of course requirements for Field Experience II are that students must choose five curriculum trends to observe in the classroom out of 10 different trends listed in the syllabus. These include: Balanced Reading Approach, NCTM standards, moral and ethical teaching, higher level thinking skills/critical thinking, cooperative learning, reading and writing across the curriculum, multicultural education, constructivist classroom, integrating technology into the curriculum, authentic/alternative assessment, learning styles/Multiple Intelligences, and hands-on science. The students must then write a paper describing what the research states about each trend and compare what the research says to how each trend is being implemented in the classroom. To facilitate access to research and to introduce students to the unlimited potential of the web as a research tool, the course provides students with links to ten different sites which allows students to read research articles right on the web about each trend. This is supposed to supplement any other research the student has access to. Care was taken that each link to a curriculum trend was a scholarly article describing an overview of the research, and that the link was not just a description of a school using the trend or a "promotional" site proclaiming or disclaiming its merits.

In addition, two lesson plans were developed for the students. In Field Experience II each student is required to present a lesson to a university supervisor, the first time an intern is formally observed and evaluated. Many of the students are nervous about this and do not feel confident of their lesson planning skills. One lesson was developed on how to develop a lesson plan and provided models of different types of lessons in reading, math and science. Another lesson was developed on promoting literacy in the classroom. Both lessons were easily accessible and could be printed out or downloaded.

A Discussion Forum was developed for the students. This was designed to be a "threaded discussion", one in which students could leave messages and respond to other messages, and everyone in the class could follow along. For example, one area for discussion was "Issues in the Classroom" in which students could respond to any pertinent issue that arose while they were doing their field experience. One student responded that she was not happy with her teacher; her teacher was constantly yelling at the students and embarrassed a student in front of the whole class by yelling at her because she did not bring her homework to school. Other preservice teachers and the instructor immediately responded by confirming that this was not appropriate classroom management and offering advice as to how this could have been handled in a different way. All messages were left on the web for others to read and a continuing thread of responses and follow-ups developed throughout the semester. It became an exciting vehicle to establish an open line of communication with the students and to provide immediate feedback on varying issues of concern. Another area that was developed for online discussion was "Online Issues" which helped students who

were having difficulty accessing the web or sending e-mails. Again, it provided feedback and support for students who were having technical difficulty. Another area that was developed was "Being Observed and Evaluated Teaching a Lesson" which became a very active area as each intern was observed. Being formally evaluated was a stressful part of the course and this provided preservice teachers with continuing support and advice.

WCB is structured so that there are many links that are available to the students when they enter the course homepage. Students can view the syllabus that was put online, as well as any course requirements. Announcements such as paper requirements and student expectations for participating in the Discussion Forum are listed. A Schedule of class meetings and when assignments are due is also posted online. A very helpful link that WCB provides is a list of all students and their e-mail addresses. Any participant can then e-mail the whole class with one click of a mouse, or he/she can e-mail an individual student or the instructor. This facilitates online communication with the whole class and helps build a community of learners. One requirement was that that each student must e-mail the instructor and other students a minimum number of times. WCB also provides students with a help page, which provides documentation for using WCB. There is also an easy tool for students to develop their own webpages.

Results of the Pilot

In Spring 1999, an initial pilot was conducted in one section of the web-enhanced Field Experience II course. The first meeting of the 10 students was in a computer lab that had internet access. Each student was given a password and username at this session to ensure that each student could access the site without any problems. Each student's e-mail address was also entered and if a student did not have an e-mail account, he/she immediately signed up for a university account at this time. This first session involved covering all the different components of the course. The inexperienced users were given special attention and shown how to navigate the web. Each student was asked to enter a message into the threaded discussion forum so that they understood how to do this. The course requirements and syllabus was also discussed and arrangements were set up to meet two more times.

These next two meetings were not in a computer lab but were designed to discuss issues related to classroom curriculum trends. During these two sessions, problems and issues related to using the technology were brought up. If any student had a problem using the computer or accessing the website, he/she either e-mailed the instructor, or set up an individual appointment to meet with her.

During the pilot of this course pre- and post-assessment data were collected on the group of 10 students taking the course. Data was collected on students' proficiency in working with computers and their ability to use the web. At post-assessment time, data was gathered on how useful they found various aspects of the course and how often they used its various components. Table 1 (Tab.1) displays the results of differences between pre-assessment results and post-assessment results on selected items. Results are shown in percentage points which are based upon 9 students' responses (one student did not fill out a post-test). The ratings are based on 5 being the highest level of proficiency or use and 1 being the lowest. For example, on question number 1, at pre-assessment time, 44% of the students felt that they had a very high level of proficiency in operating a multimedia computer. At post-assessment time, 66% felt that they had a very high level of proficiency in operating a computer.

	Pre					Post				
Question:	5	4	3	2	1	5	4	3	2	1
1. I can operate a multimedia computer.	44	14	11			66	33			
2. I use the internet to access information.	55	33		11		88	11			
3. I use email to contact others.	66	11		11	11	88	11			
4. I use search engines to find information.	55	11		11	22	66	11		11	11
5. My overall proficiency in computers is:	11	44	33	11			66	33		
Aspects of the course I found most useful:										
a. Links to sites for research						22	44	22		
b. Threaded discussion						33	44		11	
c. e-mail to students						11	44	22		
d. e-mail to instructor						33	44		11	
e. Lesson plans						22	55			
f. Announcement/schedule						55	22	11		
Aspects of the course I used the most:										
a. Links to sites for research						66	22			
b. Threaded discussion						22	44	11		11
c. e-mail to students						11	11	55		11
d. e-mail to instructor						11	22	33		22
e. Lesson plans								33	44	11
f. Announcement/schedule						22	55			11

Table 1: Responses to Selected Items at Pre- and Post-Assessment in Percent

In looking at Questions 1-5 (Tab. 1), most students improved at post-assessment time in their ability to operate a multimedia computer, to access information using the internet, e-mailing others, and in their overall proficiency to use computers. Proficiency in e-mailing and accessing information using the internet increased the most. Interestingly, the above data shows that students did not really improve in how to use search engines; this is because the research links were provided and students were never directly taught how to conduct searches. Perhaps this needs to be covered in the future and should be included as part of course requirements.

In looking at the items that students rated on usefulness and frequency of use, students found the links to research sites, the threaded discussion, e-mail to students, e-mail to the instructor, and the lesson plans to be somewhat useful, while 55% found the announcement/schedule to be very helpful. They used the links to research sites the most (66% responded that they used it a lot), while the e-mailing was not used as much as anticipated. Few students said they e-mailed the instructor frequently. Another surprise was that the students found the announcements/schedule component of the course as valuable and used it quite a bit. To the instructor, this was one aspect that was not seen as a significant part of the course, but as a nice "add-on." Perhaps this means that students need to be encouraged to use e-mail more frequently as a means of communication between students and the instructor.

Students' written comments at post-test time reflect a very positive reaction to the course. What is interesting is that the inexperienced students seemed to find the course the most beneficial. One student who rated her overall proficiency in using the computer as 3 and never knew how to e-mail or use the internet to access information before the course began wrote: "As a result of taking this web course, I learned many new things regarding computers. I learned how to use the internet and find websites, how to e-mail and correspond with others. I am very happy that I now know how to do these things so that I can integrate them into my teaching. Ultimately, this class assisted me in becoming "computer literate.' I am no longer confused when using the computer…" Another student wrote, "I really enjoyed my Field Experience II. This course did not compare to any other because of its web access. This is a vital tool both in education and in our personal lives." All the students wrote positive statements of this sort and echoed the student who wrote: "The benefit of using technology in Field II was that I felt more involved in the class since I could go to the webpage and discuss things and look for things on the page."

Discussion

Using the web to enhance Field Experience II for our preservice teachers has been very beneficial. The pilot of the course has shown that students react very positively to the use of the internet in their educational process. Using the web in this way has benefited the students and the program in many ways. First, it has helped to expand the amount of interactivity required of the students while they are participating in a field placement. By interacting online, a community of learners develops into a support system and students learn how to share important concepts, issues and concerns among each other. Second, a web-enhanced course has helped to shape students' belief systems about what effective instruction can be all about. They are not being taught about technology, but they are using it as a viable tool that is a part of course requirements. Hopefully, they are learning that technology can be used as an integral part of the classroom. Third, it encourages communication among all participants. What this pilot revealed is that some students are reluctant to use e-mail and discussion groups and need to be constantly encouraged and reminded to reach out to other students and to the instructor. Others, use e-mail frequently and effectively, asking for feedback and seeking comments and assurance. Perhaps having students paired together for the semester as e-mail partners would help. Third, this type of course has helped the students become more computer proficient. By using technology within a field placement course instead of learning about it in a computer course, students are forced to improve their skills. The inexperienced and unconfident students benefit a great deal from this experience. Lastly, Both instructor and students seem to enjoy the new challenges and potential this type of course offers to the educational community.

Researchers are now focusing on the benefits of using technology in teacher training. In addition to being incorporated into traditional theory and pedagogy classes, technology can enhance field placements as a powerful means of communication. It allows students to reach across traditional boundaries to communicate freely with other classmates, with their professor, and with teachers. Technology not only becomes a means to model effective instructional strategies, but becomes an integral tool that binds the class together. A new sense of community develops whereby students who do not ordinarily talk to one another in class, find common interests in an on-line community. Inadvertently, literacy skills, communication skills, and computer skills increase as this tool is used. Incorporating technology into field placement classes is a powerful tool for promoting communication and higher level thinking skills in future teachers.

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Pre-service Music Teacher Attitudes Toward Web-Enhanced Learning in a Methods Class

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Abstract: This case study involved subjects (N=12) in a college music education methods class who utilized various web-based tools and resources to complete assignments and carry out other course related matters. Subjects were given a questionnaire at the final class meeting to explore their attitudes toward the web tools and resources used in the class. Overall responses toward the technologies utilized were positive. Subjects with home Internet access (who could therefore access course materials from home) did not indicate that the time they were required to use the computer for the class was excessive, while subjects who couldn't access the Internet from home tended to be of the opinion that too much computer time was necessary ($p \leq .05$). Furthermore, the more Internet experience a subject reported, the less likely they were to state that online learning was impersonal ($p \leq .05$).

Introduction

School reform is a topic currently receiving a great deal of attention by both those in educational circles and the general populous. The nature of this reform is being fiercely debated, but many people believe technology needs to play a prominent role in any changes that are made (U.S. Department of Education, 1997). In particular, the Internet is being touted as a viable means of delivering instruction (Pierian Spring, 1997). Higher education institutions are expending resources to move courses online, with some projecting that over 800 college degree programs would be Internet accessible by 1998 (Schlumpf, 1998). Commercially, vendors are moving to fill needs in this area by marketing an increasing array of products to expedite online instruction (Gray, 1998).

Studies examining online learning at the collegiate level have begun to be conducted (Roberti and Davis, 1998; Charp, 1998; Deal, 1998; Kubala, 1998). At present, the primary research emphasis has been focused on aspects of distance learning; courses offered in their entirety over the Internet. Interestingly, the same electronic tools being used in these distance learning courses are also beginning to be utilized by instructors of courses taught in more traditional ways. In fact, some researchers indicate a mixture of web-based and traditional types of instruction may be advantageous in some respects (Friedlander & Kerns, 1998). However, the most successful means of utilizing these new technologies has not been thoroughly investigated. One important area to consider with any new teaching-learning paradigm is student attitudes toward the new model.

Purpose of the Study

The purpose of this study was to determine pre-service music teacher attitudes toward web-enhanced learning in a methods class.

Methodology

Subjects

Subjects were music education majors (N=12) at a major Midwestern university who were enrolled in a music education methods class. Included in the population were six males and six females. The mean age of the subjects was 21.7 years. Four were juniors and eight were seniors

The Measurement Instruments

The questionnaires were designed by the researcher on the basis of a review of literature and the researcher's previous experience in using web-based technologies with students. Questionnaire #1 solicited dichotomous responses, responses selected from Likert-type scales, and free responses to determine the background of the subjects and their previous Internet and online learning experience. Questionnaire #2 examined subjects' attitudes toward learning via the web-based tools and resources that they utilized in the course. From a Likert-type scale, subject's selected their degree of agreement (1 = strongly disagree to 5 = strongly agree) with each statement given.

Procedure

The class met daily for 65 minutes in a traditional setting during a five-week summer term. In addition to this, many class assignments and activities took place online using web-based tools and resources. On the first day of the course, following discussion of the syllabus and the completion of Questionnaire #1, the class moved to the School of Music computer lab where students received a hands-on orientation to the course web site and the web-tools to be used in the class. Over the course of the class, subjects were required to regularly use a World Wide Web browser to access a variety of web-based resources. Through these resources they were able to check the course syllabus, complete reading assignments, take quizzes, participate in class discussions via newsgroups, check their grade in an online grade book, do research, explore course-related web sites, and communicate via email. All of the web-based tools/resources could be accessed from anywhere the student had a connection to the Internet. At the final class meeting, the subjects were administered Questionnaire #2.

Results

During the first class, subjects completed Questionnaire #1 to determine their background and previous experience with web-based learning. The most frequently used computing resource for completing school assignments listed by the subjects was the computer lab located in the School of Music (n=12), followed by other university computer labs (n=9), and personally owned computers (n=8). Six subjects said they were able to connect to the Internet from home. Responding on a Likert-type scale that ranged from 1 (very inexperienced) to 4 (very experienced), subjects indicated they were moderately experienced Internet users (M=2.6) prior to this class. The comfort level of the subjects upon beginning this course when using email, the World Wide Web, and newsgroups was also examined through their responses on a Likert-type scale ranging from 1 (uncomfortable) to 4 (very comfortable). Subjects were quite comfortable using email (M=3.7) and the World Wide Web (M=3.6), but indicated less comfort in using newsgroups (M=1.9). Subjects indicated their use of Internet/web-based tools and resources in previous courses was limited.

At the final class meeting, Questionnaire #2 was administered. Subjects responded on a Likert-type scale which ranged from 1 (strongly disagree) to 5 (strongly agree) to 14 statements related to their attitudes toward the web-based tools and activities used in the class. Descriptive statistics were calculated for the subjects' responses to each of the items on this questionnaire (see Table 1). By inspecting the mean, median, mode, and standard deviation of the responses to each questionnaire item, the items were categorized as (1) statements the subjects agreed with, (2) statements on which the subjects were neutral,

Statement	Mean	Median	Mode	S.D.
The Internet contains valuable resources for music education.	4.7	5	5	0.49
I like being able to access course materials at a time that suits my own schedule and preferences.	4.2	5	5	1.27
I feel more comfortable communicating with my instructor via email than face-to-face.	2.7	3	3	0.78
I feel more comfortable participating in class discussions online via newsgroups than in traditional classroom situations.	2.4	2	2	1.00
Participating in newsgroups as part of class instruction allows me to learn from my classmates.	3.8	4	4	0.94
I like being able to check my current grade online at any time I desire.	4.5	5	5	0.67
I have a greater opportunity to participate and contribute to online discussions than in traditional classroom discussions.	2.8	3	multiple	1.36
Online instruction is impersonal.	3.6	4	4	1.16
I receive better feedback on my class performance through online assignments than through traditional assignments.	3	3	3	1.13
Having course materials and assignments online requires me to spend too much time using the computer.	3.1	3	3	1.44
Using web-based technologies helped me to better understand the content of this course.	3.7	4	4	1.23
I would like to take more courses that use web-based technologies as part of the instructional process.	3.6	4	5	1.44
The online quizzes helped motivate me to complete reading assignments on time.	3.4	4	4	0.97
I would like to take a course that was conducted completely over the Internet.	2.3	2	multiple	1.29

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

Table 1: Student Attitudes Toward Using Web-Based Technologies

and (3) statements the subjects disagreed with. While only the means are listed in the following narrative, the median, mode, and standard deviation were also considered in placing each item in a category.

The subjects had moderate to strong agreement with the following items: "The Internet contains valuable resources for music education" (M=4.7), "I like being able to access course materials at a time that suits my own schedule and preferences" (M=4.2), "Participating in newsgroups as part of class instruction allows me to learn from my classmates" (M=3.8), "I like being able to check my current grade online at any time I desire" (M=4.5), "Online instruction is impersonal" (M=3.6), "Using web-based technologies helped me to better understand the content of this course" (M=3.7), "I would like to take more courses that use web-based technologies as part of the instructional process" (M=3.6), and "The online quizzes helped motivate me to complete reading assignments on time" (M=3.4). Statements which the subjects were neutral toward included: "I feel more comfortable communicating with my instructor via email than face-to face" (M=2.7), "I have a greater opportunity to participate and contribute to online discussions than in traditional classroom discussions (M=2.8), "I receive better feedback on my class performance through online assignments than through traditional assignments" (M=3), and "Having course materials and assignments online requires me to spend too much time using the computer" (M=3.1). Subjects tended to disagree with "I feel more comfortable participating in class discussions online via newsgroups than in traditional classroom situations" (M= 2.4), and "I would like to take a course that was conducted

To determine if there were any differences in the dependent variables (data from Questionnaire #2) by gender, a *Wald-Wolfowitz runs* test was calculated using the *Statistica Mac* computer program. No significant differences by gender were found. A second *Wald-Wolfowitz runs* test was calculated to see if there were any differences in the dependent variables according to whether or not subjects had access to the Internet via their home computer. One dependent variable, "Having course materials and assignments online requires me to spend too much time using the computer" was significant in this analysis. Subjects (M=3.83) who did not have Internet access from their own personal computer indicated greater agreement with this statement ($p \leq .05$) than subjects (M=2.33) who could access course materials from their own personal computer.

A *Spearman Rank Order Correlation* was calculated between the subjects' self-ratings of experience in using the Internet and each of the dependent variables. Significant relationships were found between Internet experience and two of the 14 variables. A significant ($p \leq .05$) positive correlation ($R = .60$) was determined to exist between amount of experience and "I like being able to check my current grade online at any time I desire." The greater a subject's experience level in using the Internet, the more they agreed that they liked being able to check their grade online. A significant ($p \leq .05$) negative correlation ($R = -.58$) was found between amount of experience and "Online instruction is impersonal." Here, the less their experience in using the Internet, the more subjects' agreed that online instruction is impersonal.

Discussion

The subjects in this study were positive toward many aspects of the web-based tools and resources used during the course. They strongly agreed that the Internet contained valuable resources for music education. They liked the asynchronous aspects of online learning, valuing being able to access course materials at times that fit their own lifestyle and personal schedule. The asynchronous features of an online education may be a tremendous advantage for students who might be juggling several classes, a job, family, etc. The subjects tended to believe that some of the tools they used in the course helped them to learn more effectively. They cited improved understanding of the course content, that they learned from their classmates via the newsgroups, and that they completed the reading assignments when assigned so that they could take the online quizzes. The actual impact of these items on achievement is an area that deserves further inquiry.

In general, subjects were neutral toward the amount of time they were required to use the computer to complete assignments for this class. However, when this question was viewed from the standpoint of whether or not a student had home Internet access (and hence access to course materials, assignments, etc.), a different perspective was obtained. Subjects who did not have home access indicated significantly ($p \leq .05$) greater agreement with the statement "Having course materials and assignments online requires me to spend too much time using the computer" than did subjects who had home access.

For subjects without home access the convenience and asynchronicity of learning online was at least partially sublimated since they had to arrange their schedules to go to a computer lab, at a time when it was open, to complete class assignments. A person's attitude toward online learning may be effected by how easy it is for them to actually connect to the online environment.

Subjects were also neutral regarding their preference for communicating with their instructor via email or face-to-face. It may be that some aspects of online learning are related to a person's personality type or learning style. In this instance, there may be certain students who would prefer one type of communication, others another type. The population as a whole is neutral on the issue, but a certain type of person might feel much more comfortable in one situation or the other. The relationship of learning styles and personality types to aspects of online learning is an area that needs further research.

It appears that the subjects in this study preferred some aspects of the conventional classroom over the online learning environment. Numerous subjects perceived online instruction as being impersonal. However, it is interesting that there was a significant ($\underline{p} \leq .05$) negative correlation ($R = -.58$) between this questionnaire item and the amount of Internet experience a subject had. The less Internet experience, the more a subject felt online learning was impersonal. As with any new environment one encounters, persons who have not spent a great deal of time using the Internet may not feel comfortable in this unique atmosphere. This lack of comfort may lead to feelings that the environment is impersonal. It may be that as a person gains experience in the cyber-environment, they begin to learn that it is not necessarily more impersonal than a regular classroom, it is just different with unique alternatives for interaction.

While previous researchers (Kubala, 1998; Kelly & Leckbee, 1998) have found that some students are more comfortable engaging in online discussions than they are in classroom based discussions, the subjects in this study did not indicate they felt this way. This may be another area where learning style or personality type has a relationship to a person's attitudes. It is also interesting to note that the subjects were not anxious to take a course that was conducted entirely over the Internet. It may be that the combination of traditional and web-based instruction works very well, and most people prefer online learning as a supplement to instruction held in a traditional classroom setting.

Summary/Conclusions

While the design of this study does not allow for broad generalization of the findings, the results do suggest areas for further investigation that may lead to a more comprehensive understanding of learning via web-based technologies. In general, web tools seem to be received positively by students. Their asynchronous nature is one characteristic that seems to be particularly appealing. The degree of Internet accessibility may impact how receptive students are to the use of these tools. In addition, the unique characteristics of an individual's personality type or learning style may have some relationship to their preferences for learning online. This should receive further study. As the body of research in this area grows, trends may begin to appear which will enable instructors to use web-based technologies in the best possible manner. In any case, the education of pre-service teachers need no longer be limited to specific locations or times of day. The emerging online paradigm is an additional tool for teacher educators to utilize to prepare future teachers for the challenges they will face in school classrooms.

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What is Happening in the Virtual Classroom?

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Abstract: This paper discusses the dramatic differences of students' constructive sociocultural interaction between online courses and traditional face-to-face courses. The author of this paper taught a course called *Educational Foundations* several times in a traditional face-to-face situation as well as several times online. The course is the first course in the teaching credential program and covers primarily different educational philosophies. The instructor used the same books, the same assignments, the same lectures, the same visuals, etc. This paper compares the synchronous face-to-face discussions in the traditional classroom to the asynchronous communication in the virtual classroom.

Introduction

The integration of technology for educational purposes provides teacher education institutions with powerful tools not only for the delivery of courses to geographically distant students but also for enhancing classroom learning. Online education should not be understood as the downloading of information followed by the passive and solitary activity of staring at a computer screen. Instead, online education advances the pedagogical principles of constructive learning through providing opportunities for constructive sociocultural interaction: Bazillion and Brown (1998) described these opportunities in greater detail: (a) students actively construct knowledge by exploring web sites, experimenting with search engines or new ways of seeking information, manipulating things, and engaging in discussion; (b) students explore other learning styles and find out what works best for their cognitive abilities; (c) students work not only with the teacher but also among themselves which leads to additional learning; (d) students improve their critical thinking skills by examining ideas found on the World Wide Web and using the entire class time for critical analysis of a topic rather than information delivery; (e) students gain better understanding of a topic by searching for more web sites and exploring different perspectives of a subject; and (f) students learn how to learn. This paper looks in particular at the opportunities of constructive socio-cultural interaction.

The Background

The author of this paper teaches a course called *Educational Foundations* for the Department of Teacher Education at National University in California. National University offers graduate courses in an intense one-month format. The student population consists of working adults. Most of the students are currently teaching on an emergency permit in California's public schools. The emphasis in the course *Educational Foundations* is on diverse goals and philosophies of education. The author of this paper had taught this particular course several times in the traditional face-to-face situation before she developed and taught the course in the virtual environment. For accreditation purposes, the course content, the reading requirements, the assignments, the visuals, etc. were kept the same. The exerpts below are taken from a lesson on various educational goals. The instructor presented students with the following five goals of education:

1. To develop students' ability to think clearly, to use intellectual reasoning, to solve problems, and to make rational decisions.

2. To nurture the individual child's unique potential, to allow full development of his/her creativity and sensitivity, and to encourage personal integrity, love of learning, and self-fulfillment.
3. To diagnose the learner's needs and abilities, to design instructional strategies which develop skills and competencies, and to produce trained people who are able to function efficiently in our ever changing complex technological society.
4. To transmit to young people the basic knowledge, skills, traditions, academic concepts, and values necessary to interpret, participate in, and further the heritage and traditions of our country.
5. To create a future world condition of peace, harmony, equality, and love; and to foster a new society with humans who can live together in balance with their environment and with each other.

The excerpts below present the initial discussions after introducing the five goals of education. The author of this paper choose these particular excerpts because they are representative of most conversations throughout the courses.

The Virtual Classroom

The most dramatic differences between online courses and traditional courses is how students participate in discussion with their professors and peers if there is no face-to-face meeting. Online communication tools develop and improve almost daily; for example, text-based environments are evolving into graphical and even multimedia environments. In the present day, the most common tool that is used for online collaboration is asynchronous communication.

In April 1999, 20 students had enrolled in the online course. The five different goals of education were presented on the course web-page. The following will show an excerpt from the asynchronous discussion in the online classroom.

Assignment posted by Instructor: "I would like you to think about the goals of education. Try to rank the above mentioned five goals in the order of importance to you."

Posting 1; Student A responds to the instructor's initial posting: "All of these are so important that it's hard to rank them! What about teaching a child self-worth?"

Posting 2; Student B responds to posting 1: "I agree, I think our job as educators is to raise a community of well rounded, good people. I want to teach my kids good moral lessons! If I can be a good role model to the kids I teach and they learn from this I have done more than simply teach them book work."

Posting 3; Student C responds to posting 1: "This is where Character Education comes into play. Everyday, we as teachers can be examples by being Responsible, Respectful, Caring, Fair, Being a Good Citizen, and Portraying Trustworthiness. These traits are so important and children need role models they can emulate these from."

Posting 4; Student A responds to posting 3: "Don't forget ... we may be the best role models some of these kids have!"

[Posting 5 through 12 started a new discussion about a different goal of education.]

Posting 13: Instructor responds to posting 3: "What is a good citizen? Different people have very different ideas about what a good citizen should do. Your culture defines your idea of a good citizen. Whose definition of a 'good citizen' should we strive for?"

Posting 14: Student C responds to posting 13: "Yes, different cultures may interpret citizenship differently, but I believe it all goes back to the Golden Rule. Do you like to be treated with kindness? Most people do. Wouldn't it be great if everyone lived by the Golden Rule? The crime rates would plummet."

Posting 15; Student D responds to posting 13: "Is this assuming that the entire world would play by our rules somewhat ethnocentric?"

Posting 15; Student E responds to posting 14: "The Golden Rule to me is to be kind to all people and respectful to others and elders."

[Posting 16 through 25 started a new discussion about a different goal of education.]

Posting 26; Student F responds to posting 1: "Just wanted to share this with you all. I found it in 'Better Teaching: Tips & Techniques to Improve Student Learning'. It is published by the Teacher Institute. Values are the princlies and ideas that people believe strongly in and that guide their behaviors. They deal with moral, political and social preferences-honesty, justice and equal opportunity. And they provide rational procedures to follow-like tolerance, reasoned argument and respect for critical inquiry. All values - or the lack thereof - affect what children do in and out of the classroom. The more clearly students understand the basic core values that exist in your classroom, the more orderly and civil your classroom will be. To help students better understand values, read them the values the defined a 'Good American' in 1926: 1. Control themselves. 2. Train to gain and keep good health. 3. Are kind. 4. Play fair. 5. Are self-reliant. 6. Do their duty. 7. Are reliable. 8. Are true. Do the right thing in the right way. 10. Work in friendly cooperation with fellow workers. 11. Are loyal. Ask students if these values are at work in their classroom and their lives today? Have them give examples. What do they think is missing? Should anything be changed?

Posting 27; Student G responds to posting 26: "Thanks for the tips."

The Traditional Classroom

In July 1999, 19 students had enrolled in the traditional, face-to-face, on-campus course. The instructor had distributed a handout with the five goals of education two days earlier but handed out additional copies for the students who forgot to bring them to class. The conversation went as follows:

Instructor: "Your homework was to read over the five goals of education and to rank them in the order of importance to you. Which goals did you choose as the most important?"

Student A: "I picked goal 1. I think it is very very true."

Student B: "I picked goal 1 too because it is a life-skill; necessary for everything."

Student C: "I think everybody should have the ability to think."

Instructor: "But why? You have to explain why you think a certain goal of education is important. Otherwise you could also say it is important for children to be able to jump on one leg around the block."

Student D: "I did not pick goal 1 as the most important because you do not need it to be functional in society; you do not need it to go down to McDonald."

Student E: "I think morals are more important."

Student F: "I picked goal 1. It is more important to make rational decisions rather than emotional decisions. Students need to be able to analyze a problem and make a favorable decision."

Student G: "I chose goal 2. I chose that because I believe that students are away from home so many hours of the day that they need support; I mean nurturing, not necessarily mothering. I believe that children have come to school to learn and actually, that is our job. I say that because when we run into a child that is having problems learning we have to backtrack and do different things to reach that child. I believe all children are different. Yes, we can point them into groups, so many of this type and so many of that. They come with different strengths and weaknesses, different concerns and I think we need to be aware of that. For example, yesterday one of the kids came to school crying and when I sent the child to the principal, she was upset; the principal said that I have to nurture the child even though the child was crying about something completely different."

Instructor interrupted G who was in the process of telling more stories from her day at school: "Thank you G. So it is most important for you to nurture the child. Let's hear what other students think."

Comparison between Online and Face-to-Face Communication

Today we are concerned if and how meaningful interaction between a teacher and students as well as among students can take place online. Fundamental to every computer mediated communication system is the concept of utilizing technology to simulate the human communication process. The above exerpts show that the students in the online course embark more on a conversation with each other than in the traditional classroom where students only respond to the instructor's questions but not to each others' comments. Furthermore, there were a total of 48 postings from 17 different students (7 postings from the instructor) whereas in the traditional classroom only 8 students participated in the discussion.

The students in the virtual classroom engaged in a discussion by supporting their postings. One student (see posting 26) even provided materials for further discussion which was appreciated by the classmates. In the traditional classroom, however, most students made a brief statement without any explanation of their thoughts. As student G showed, students in the traditional classroom tend to stray into issues that do not directly relate to the topic.

Conclusion

In the traditional classroom, some students process the presented information immediately and respond with interesting and valuable comments; other students might have interesting comments but not right away; and some students talk all the time without having anything to say. Asynchronous conversation allows every single student to participate in the class discussion without being forced to an immediate response, without being interrupted by another student, or being cut off by the sound of the school bell. Students have time to think before responding to their class members' opinions and they do not have to wait for the next class to express their views, yet they can participate in the communication when they are in "top form" rather than during a preset class hour that follows a long day of work or a long night at the campus party. Since the discussions are text-based, students can easily save entire conversations and access them at a later time.

But as appealing as asynchronous communication might sound, potential problems need to be known in order to counteract them before they turn into real problems, such as students getting off the topic or insulting their classmates. Thus, the rules for asynchronous communication need to be clear to all participants, just like rules in the traditional classroom need to be clear to the students. Most importantly, the communication needs to be very organized and structured in an effort to keep the conversations related to the topic. Nevertheless, the lack of body language and/or gestures can easily lead to misinterpretations of typed messages. Attempts to express body language, mood, gestures by using so-called emoticons have doubtable success.

In conclusion, the initial experiences with online teaching and learning show that the virtual classroom can be a means of advancing the pedagogical principles of constructive sociocultural interaction.

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Online Communication Modes – What's the difference?

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Abstract. Distance education is expanding the higher education classroom, sending it outside the walls of the universities, and even into students' homes. Online communication may be the key to providing interactive opportunities in these classes to foster the formation of learning communities. The challenge, then, is to develop activities that will promote learning while fostering the social interaction that is so much a part of traditional classrooms. Are certain communications modes more appropriate for certain delivery methods (classroom, online, video)? Is there ever a time when off-task behavior would be appropriate? These are issues facing the instructors who are preparing the teachers of today and tomorrow.

The university experience has changed dramatically since most of us attended our alma maters. Halpern (1994) describes "the 'old' style of classrooms where students sit quietly, passively receiving the words of wisdom being professed by the lone instructor standing in front of the class" (p. 11). This traditional view is what many of us remember as the norm. She goes on to present "a vision of a not-so-distant future in which the lone lecturing professor is accompanied by a host of educational technologies, global information, images, and sound that require active student participation in their own learning" (p. 190). This future has now arrived, and higher education is taking on a new look, as these new technologies have expanded the classroom concept, and distance education via interactive video or the Internet is enabling people to 'attend' classes in remote learning centers or even in their homes.

Central to the learning experience is communication. Today, with the advent and popularity of the Internet, online communication is expanding rapidly. E-mail has become as common, if not more so, than phone calls and letters, at home, school, and work. Conferencing systems utilizing both synchronous and asynchronous communication are proliferating, especially for work and school environments.

Although the type and direction may vary, communication is a necessity in the transmission and acquisition of knowledge. In Halpern's 'old' style of classrooms, it was primarily a one-way activity, as the instructor lectured to the students. However, communication in educational environments has expanded to include a variety of different types of interactions, methods, and technologies. Anderson and Garrison (1998) describe six distinct interactions, and some technologies that are used to support them. These interactions include learner-teacher, learner-learner, teacher-teacher, learner-content, and content-content. Anderson and Garrison conclude,

> Higher education is being transformed by new developments and applications of learning technologies both on and off campus. We believe that the use of interaction between and among learners, teachers, and

> content promises to increase opportunities for, and experience of, deep and meaningful learning. (p. 110).

A question arises, then, as to which communication modes are appropriate in which settings and for what purposes – and how does this relate to teacher education?

Teacher Education

Teacher education has been changing. With the advent of new technologies for instructional delivery, university courses are now offered in a variety of formats. However, despite the format, these are still university classes and as such have certain characteristics—and one of these is the need for communication. Although communication is a key element in all classes, the amount, type, and goals of the specific communication activities differ within the various course delivery methods.

Basic questions that might be asked about these activities within each delivery method include the following: How do students and instructors communicate as they strive to address course objectives and assignments, and about what are they communicating—specifically, how much of this communication consists of on-task behavior, and how much is off-task? In traditional face-to-face classes, communication will be both oral and written, and the physical presence of the instructor may promote on-task communications in both modes. However, in online classes, which by definition lack this face-to-face component, the instructor and students must rely on the written word, and these communications will include both on-task and off-task behaviors.

Communication Modes

A variety of communication modes, both synchronous (real-time) and asynchronous (time independent) are currently being used in educational settings. They include, among others, e-mail, mailing lists (sometimes referred to as listserv, which is the name of a popular program for this purpose), and computer conferencing through either postings (asynchronously) or chat (synchronous). Each has its specific characteristics that may influence when and where it might be used as an effective medium for learning. So which of these communications technologies should be used in which classes and for what purposes?

E-mail

The most well-known and often used of these is electronic mail. E-mail may be sent one-to-one or one-to many. An instructor may contact individual students, or send out assignments or other information to groups of students. Students may write back to the instructor, or may communicate with fellow classmates to work on assignments or for more social purposes. Gackenbach (1998) describes some characteristics and advantages of e-mail::

> The major appeal of e-mail is it asynchronicity and rapid transmission across great distances, making it an effective substitute for both FtF meetings and more traditional "snail Mail." E-mail participants do not need to be near each other to communicate: Messages can be left anytime, sent from any location. Moreover, messages are received almost instantaneously, yet they can be read at the convenience of the receiver. The *different time—different place* aspect of e-mail combined with rapid transmission overcomes scheduling problems, particularly when the members of teams work in different locations, schedules, or time zones…. (p. 202-203)

Additional advantages of e-mail include its ease of use, and the fact that it sometimes seems as if everyone has an e-mail address. These issues could also be part of a problem. Sproull and Kiesler (1991) discuss how

> two characteristics of computer-based communication – plain text and perceived ephemerality of messages – make it relatively easy for a person to forget or ignore his or her audience and how reduced social awareness leads to messages characterized by ignoring social boundaries, self-revelation, and blunt remarks. (p. 39)

Mailing Lists (Listserv)

Closely related to e-mail, mailing lists provide an easy way to send a message from one to many. Ideally suited for online classes, mailing lists provide a forum through which the instructor can reach all students quickly and efficiently. Of course, students must have e-mail accounts and must check their accounts on a regular basis for this to be an effective mode of communication in online (and other) classes.

Although it is possible through the use of address books to set up lists of people to be reached by e-mail, some advantages of mailing lists will be missing. One of these is ease of use – Mail can be sent to one address, and from there, it will be distributed to everyone who subscribes to that list. These lists can be configured so that a reply will go to everyone on the list, or so that the reply will go only to the original sender. This *configurability* provides instructors with flexibility—the option to customize the list for maximum benefit for the class. (A variety of other custom options are also available.) Of even greater significance is the fact that all communications sent out on the list may be archived and retrieved at a later date. Retrieving these messages may provide instructors with information that will assist them in future course preparation, or in assessment of the current class. Students may also be able, if the instructor so configures the list, to search the archives and to retrieve prior messages

Computer Conferencing

Computer conferencing may actually include either one or two modes of communication. The first is posting, an asynchronous activity where messages are placed in

a conference and remain there to be viewed by participants in a time-independent manner. This can provide a focused way to carry on a discussion in which all students are able to share their thoughts, and may return to read these whenever they wish. This time-independent, place-independent characteristic of makes posting ideal for use with online classes, as well as to enhance classroom-based classes.

The second is chat, a synchronous activity where participants engage in real-time discussions by typing responses that are immediately viewable by the other persons involved in that chat. This information will be available only to the chat participants, and only during that chat session. Some chat programs allow the retrieval of chat logs, which may of great benefit to instructors who wish to review what was said and by whom. This facilitates instructors assigning students to have focused chat sessions with each other, where the instructor is not present but can review the discussion later. This may help make the students more independent, and may also encourage them to stay on-task if they know that their discussions will be read by the instructor.

The specific method (asynchronous or synchronous) of computer conferencing to be used should be determined based on the instructor, the students, and the specific objectives of the activity and the class. Students who are slow typists, have slow modems, or language problems may find chat difficult, but may excel with postings where they are able to take their time to think, compose, and type. Mason and Kay (1990) describe advantages of computer conferencing:

> Computer conferencing vastly increases the opportunities for turns at expressing one's ideas and for receiving more feedback on them from a wider variety of people, and in a format that is easily retrievable (unlike audio conferencing). ... Thus, by enhancing the potential for interactivity, CMC allows students to personalize and control their learning activities and environment far more easily than with traditional methods. (p.19)

Palloff and Pratt (1999) suggest that in asynchronous mode, "postings can occur at the convenience of the participants, allowing them time to read, process, and respond" (p.48), whereas in synchronous mode, chat "rarely allows for productive discussion or participation and frequently disintegrates into simple one-line contributions of minimal depth" (p.47). They go on to mention that to be successful, synchronous (chat) groups should be small, while asynchronous (postings) groups can be larger.

Online courses may benefit greatly from the use of computer conferencing, in synchronous and/or asynchronous modes. This may contribute to the development of a sense of community within the class. In 1990, when computer conferencing was in its infancy, Linda Harasim (1990) suggested,

> Most computer conferencing systems are based upon asynchronous (that is, not real-time) communication. ... Users can thus participate at a time and at a pace convenient to them and appropriate to the application. This attribute impacts group dynamics and the learning process. (46).

Today, this last statement may also apply to synchronous communications when they are managed appropriately for the specific group with which they are being used.

Online Learning Environments

Hiltz (1994) suggests that "the most basic premise from which all online teaching should begin is that the goal is to build a learning community and to facilitate the exchange of ideas, information, and feelings among the members of the community" (p.101). Online communications may promote this sense of community in an online course, where members do not meet face to face. Harasim states that "computer conferencing is essentially a many-to-many communication tool that structures information exchange and group interactions" (p.43). For this to be an effective tool, though, it is important to remember Palloff and Pratt's (1999) statement: "An important element of community, whether it is face to face or in the electronic realm, is the development of shared goals" (p.110). Care must be taken to develop assignments and activities that will promote this sense of shared goals.

With the various types of online communication, which will contribute to the fostering of Hiltz's (1994) learning community? Which will provide our students, ranging from preservice teachers to the 20-year veterans who are returning to update their skills and knowledge, with experiences that will promote networking with other educators, as well as providing possibilities for continuing professional development online?

As mentioned above, online courses may utilize various modes of communication including, among others, private e-mail, class or discussion e-mail lists, conference or bulletin-board postings, and chat. The purpose, tone, and content of these vary, depending on the instructor, objectives, students, and communication mode. With the variety of modes available, instructors must choose which to use, either alone or in conjunction with others, when teaching online. Each has specific characteristics which may make it more appropriate for various types of course-related activities.

Task Orientation

A major concern is whether the chosen communication mode(s) will provide students with the appropriate experiences to promote their learning in the discipline under study. Although discussing only one mode of communication, Hiltz (1994) might have been referring to communications activities in general when she said, "A necessary (but not sufficient) characteristic of a successful conference is that students are motivated to participate actively, to think about the material, and to respond to one another" (p. 36). These are the keys to successful learning communities—promoting active participation and interaction. As in the Palloff and Pratt (1999) quote above, engaging students in activities where they have shared goals is essential to developing community, and in an educational setting, these shared goals will revolve around the course curriculum and learning. A possible concern may be the content of the student communications. How many times have we seen class e-mail that has addressed the assigned topic superficially or not at all? How often do people use e-mail to exchange information about out-of-class activities and issues?

In class-related online communication, how much time is actually spent on-task? What is on-task behavior, and is off-task behavior ever appropriate?

These questions are being explored in a study of e-mail, chat, and conference postings of graduate students in a variety of online courses, some about the Internet, and some using the Internet merely as a vehicle (the classroom), as well as some classroom-based and interactive video classes.. Preliminary findings suggest that while there are some basic behaviors across the communication modes, there are differences in the appropriateness of task-oriented behavior based on the course delivery mode. For example, an analysis of communications from four online classes has revealed that e-mail messages have more off-task information, while conference postings stay totally on-task. This may be partly because e-mail has a short life, going to an individual or group of individuals, and then being trashed. Conference postings, on the other hand, are semi-permanent, and may be read throughout the course. Since each conference has a specific assigned topic, students are able to see what their classmates have posted, and realize that their postings may be read and compared with the others. Chat sessions appear to combine the two approaches—containing both on-task and off-task comments, as students use this arena to emulate face-to-face discussions, beginning with small-talk and proceeding to the topic at hand.

The appropriateness of on-task and off-task behavior may vary based on the type of delivery system that is being used. For example, in a face-to-face setting, where students and instructor see and talk to each other on a regular basis, online communication activities may be more focused, with fewer off-task comments. However, in an online class where online communication is the only method of interaction, students may engage in non-class comments and conversations as a substitute for the small-talk that takes place face-to-face .

Student Reflections

In each of the online classes included in the research study mentioned above, students have submitted weekly reflections over their activities and related issues. These reveal that the various communications are effectively contributing to the over-all learning, and helping students gain perspectives from and respect for their classmates. In a rather extensive comment, a graduate student stated,

> The chat makes it possible to share ideas and exchange information in a way that can be reviewed later by reading chat logs. This review can provide interesting information and feedback about a person's response and my responses to them. This interchange helps to mold or shape opinion and make me more open minded to other's opinions. I think knowing there is someone on the other end makes me more sensitive to "listen" and respond thoughtfully compared to reading a book or even responding to an email. Though a person will read the email, it is not the same as chatting, where you actually get to read a person's immediate response. I suppose there is some added human touch to chatting, with more emotional connection knowing they are actually reading what you are writing in real time.

Another student found that e-mail provided a viable alternative. She said,

> I really feel that our group has been hindered a little by our inability to manage to chat. The storm the other night didn't help matters. But I have really come to value email as a good alternative to chatting. In some aspects, it has been better, in that it has allowed more time for thinking and reflecting as I compose the email. Whereas the chat demands immediate response. My favorite is the chat, mainly because of the bonding of the group together.

Yet another student indicated that her work group used a variety of communications as they were completing their project. She said, "My partner & I have accomplished quite a bit via e-mail and last week's
chats, as well as via the telephone."

New procedures for chatting were inaugurated about three weeks into the semester. These required students to read the material and then post comments related to that reading in the conference before the scheduled chat session. Then, before the chat, they were to go back and read what their chatmates had posted. Writing about this procedure, one student said,

> Chatting gives us time practicing the technology and exchanging ideas that help us develop a better understanding of the topics we cover.Ê I think posting to the webboard before chatting is important.Ê We can save time before the chat by knowing what has been said by each "chatter", and it requires that students make sure and cover the material before the chat instead of going in cold and trying to "wing it" through the chat.

Many students mentioned the benefits of this approach. In fact, I had some write me about specific people who had not been following the post-read-chat procedure, describing how this interfered with the group's discussion. These comments indicated that when students are involved in on-task discussions, they resent person's who are not prepared because those students interfere with the free exchange of ideas and information. One student sent the following:

> The chat tonight which was supposed to be 3 ended up with 8. I really hate that some of my classmates just show up at chats instead of signing up with someone. I think it has happened to me every week. I get flustered because I re-read the postings of my fellow chatters right before the chat to refresh my memory. Also, we end up with too many chatters to be successful. :>(
>
> The chat did go well, however. We broke into 2 groups. My group was communicating quite well and I learned some different view points on the change process.

After receiving this message, I sent out a reminder about the post-read-chat procedure, and the situation seemed to improve.

The postings and chat sessions fostered a sense of respect for the professionalism and knowledge of the students, as they learned that their classmates had various areas of expertise and interest.. A student reflected,

> I enjoyed chatting with Jessica and Samantha.... They are on the ball and are very intelligent about the chat topic! What a joy it is to be able to be a part of a chat group with them! I have really learned a lot from the topic chats this semester. I went into this class feeling like an outsider and everyone has been too kind and informative. The chats are really a highlight of my week. I also enjoy reading all of the postings to the board.

Another student reported,

> The chat this evening was fun, as usual. I enjoyed talking with Rachel, especially. It was nice getting to know her. She will be sending you the chat synopsis. The different positions we hold and the varied levels of experience with technology make the chats interesting. There's almost always something to learn. We each had browsed something different within the TENET web site, which was our chosen topic of the evening. The chat made me want to investigate even more of the sites that I had "missed".

As the instructor, I always look forward to reading these weekly reflections, as I can share in the students' joys and triumphs, but also monitor and adjust as needed if there are difficulties. The key is to provide students with the opportunity to communicate with all class members (myself included) as they build and participate in our online community of learners, and as they develop professional networking skills and contacts so that they will feel part of the global world of educators.

Final Thoughts

To maximize the teaching and learning environment, a class should evolve into a community of learners. For this to occur, there must be interaction not only between the instructor and students, but also between the students themselves. For this interaction to occur, communication is a necessity. Communications activities in online classes may include delivery of information, exchange of ideas, and submission of assignments—using one or more of the above (or other) communications modes. While many of these activities will be on-task, some will, appropriately, be off-task, for it is only through communication that a community of learners will be developed.

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Connect-ME: Building and Sustaining A Local, On-Line Professional Learning Community for Elementary Mathematics Educators

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Abstract: This paper discusses a World Wide Web site (Connect-ME: http://hydra.educ.queensu.ca/CM/) that is being piloted for preservice and beginning elementary mathematics teachers. It describes the year-long development of the electronic learning community and its impact on beginning teachers' beliefs and practices. The paper will focus on (a) investigating the efficacy of locally-developed and locally-managed, distributed, distance-learning communities in sustaining significant change to beginning teachers' practice and (b) assessing the impact of emerging internet technologies on beginning teachers' commitment to the basic tenets of mathematics reform. We will report on a scaleable and economically viable model for creating and sustaining a community of teachers, on the factors which facilitated its inception and the tools and resources which have maintained and enriched it.

Introduction

Research on mathematics teachers' efforts to modify instructional practices to meet current content recommendations, pedagogical principles and student achievement standards has grown over the last decade. Extensive scholarly study of teacher transformation underscores the importance of an empirical knowledge-base in implementing and maintaining curricular innovations and serves to clarify both the questions to be asked and the constructs that can be confidently employed. It has also firmly established the reliability and validity of specific analytic constructs (e.g., participation patterns as indicators of teacher learning). Still, gaps exist and critical questions remain: What social and organizational structures contribute to the professional growth of teachers? Can an electronic forum provide the context in which teachers begin to understand their practices, professional growth and development? What forms of support sustain changes to beliefs and practice? Clearly, only long-term and longitudinal research can answer these questions. We report on the early findings of a study designed to address these issues, seeking to yield both theoretical insight and practical application.

The framework for our study is rooted in a sociocultural view of learning, where teacher learning is conceptualized as a process of 'transformation of participation' in the activities of a community (Rogoff, 1994). We examine a group of beginning teachers who belong to a community in which they (a) exercise collective control over key decisions; (b) share a sense of purpose; and, (c) voluntarily elect to participate in and contribute to specific activities to sustain reform to their realigned mathematical disposition and beliefs, and instructional practices.

The work is shaped by three components: a comprehensive theory of internet-supported learning activities, specific theories of electronic communities and their development, and a commitment to linking theory and practice by providing bases for more scalable models of teacher professional development. The first of these comes from the work of many researchers including Shotsberger (1999) and Lieberman (1996); the second, from work in the first year of this project (Colgan, Higginson and Sinclair, 1999); and the last, from our ongoing work in changes to teacher beliefs and attitudes, and professional development and its relationship to pre-service education (Higginson and Colgan, 1999).

The objectives of the study are to: (a) investigate the efficacy of locally-developed and locally-managed internet communities in sustaining change to beginning teachers' beliefs and practice; (b) construct and test models of scalable collaborative electronic environments; (c) assess the impact of emerging internet tools on beginning teachers' commitment to the basic tenets of mathematics reform; and, (d) refine and test structures that are engendered by the learning community in response to their opportunity to learn about mathematics teaching and learning. The intent of the research is to provide a means to begin to integrate several disparate areas of the research literature.

We believe that our research will contribute to the advancement of knowledge by (a) modelling how on-line communities built on theoretical foundations can be constructed and managed; (b) providing detailed descriptions of developmental complexities; and (c) documenting the interdependence of professional learning and community with teacher practice and beliefs. We believe that the research has potential for considerable benefit in that it will clarify how a community-of-practice framework can be used analytically to examine teacher learning and evaluate the effectiveness of theory-based models which measure teacher learning by transformation from peripheral to full participation in a community. The study will investigate the design/developmental factors contributing to the effectiveness of internet technology as a vehicle for legitimate participation in a professional community-of-practice, extending a research initiative that has been ongoing for 18 months and will contribute to an overall research program focussing on professional development, and teachers and transitions in their knowledge, beliefs and pedagogy. Overall research goals remain the same, to model the active, continuous process of teacher reflection and instructional change and growth, to determine the nature of events and opportunities that can stimulate cognitive reorganization, and to design effective theory-based environments through which teachers can simultaneously be supported and challenged.

Background

Based on feedback from the Elementary Curriculum courses offered as part of the Bachelor of Education program at Queen's University, it became apparent that there was a need for specific programs to assist mathematics-anxious students to develop the necessary confidence and positive mathematical disposition required to be teachers in contemporary classrooms. A survey of 137 teacher candidates revealed that despite the fact that these individuals were, arguably, among the most able members of their national peer group, there was widespread unease and dissatisfaction about their earlier encounters with mathematics. Early analysis of the data collected prior to the formal study suggested that they viewed mathematics from a purely utilitarian perspective. They were unanimous in stating that the changes to the elementary mathematics curriculum made them feel extremely inadequate and lacking in confidence with respect to content knowledge. This added stress, they reported, since they believed that mathematics is important because it opens doors to the future for students with respect to technology and employment. About 25% of the teacher candidates replied that their last official mathematics course was in the second year of secondary school, a total of six or seven years ago. At least three-quarters said that mathematics was not their favourite subject, and of this group, half reported that their school experiences in mathematics had been extremely negative.

Beginning in November 1998, a community of 60 of these elementary teacher candidates enrolled in a voluntary extended enrichment program called *The Joy of X* (See Figure 1). The program was predicated on two assumptions, namely, that: (i) rich, carefully-chosen, professional development experiences could strongly impact the mathematical knowledge and disposition of beginning teachers; and, (ii) by modelling 'reform' practices through narratives and resources from exemplary classroom scenarios, the pedagogic repertoires of beginning teachers could be significantly expanded. The participants attended a series of twelve participatory workshops, ranging in focus from origami to music. At the workshops, the teacher candidates worked collaboratively, posing problems, formulating conjectures, and discussing the validity of various solutions while being guided and scaffolded by mathematics enthusiasts who framed appropriate contexts, facilitated discussion of the important emergent mathematical ideas and steered them towards conceptual connections. The goal of the program was both to provide students with an opportunity to build a positive emotional relationship with mathematics and to help them to broaden their often very limited perception of the discipline. More than 80% of the participants agreed that the assumptions were good ones and that the series had accomplished its goals.

Now that they have graduated, the 60 beginning teachers represent a geographically widespread community. Some have assumed teaching positions in Boston, MA and London, England, others in Mexico and Columbia, one in Arctic Quebec, and many throughout southern Ontario. Through *The Joy of X* sessions the teacher candidates have become a community. They have expressed their commitment to strengthen and forge on-going bonds within an electronic community called, *Connect-ME*, which was developed in response to the preliminary data that they themselves provided.

We collected data from two sources. The first data set is from an extensive open-ended questionnaire completed by the community of 60 teachers described above. The second source is in-depth, hour-long focussed

interviews which were conducted with both groups of 6-7 (n = 4) and with single participants (n = 8). The responses indicated that although all the teachers were regular email users, their experience with the internet varied greatly. There was an approximate 50-50 split between regular/irregular internet users. They most often used the internet to find activities and lesson plans and reported being very disappointed in both the organization and quality of on-line materials. This phenomenon is substantiated by other research (Lieberman & McLaughlin, 1995). The teacher candidates ranked lesson plans and activities as their highest priority, followed closely by assessment resources, curriculum integration supports and on-line help opportunities.

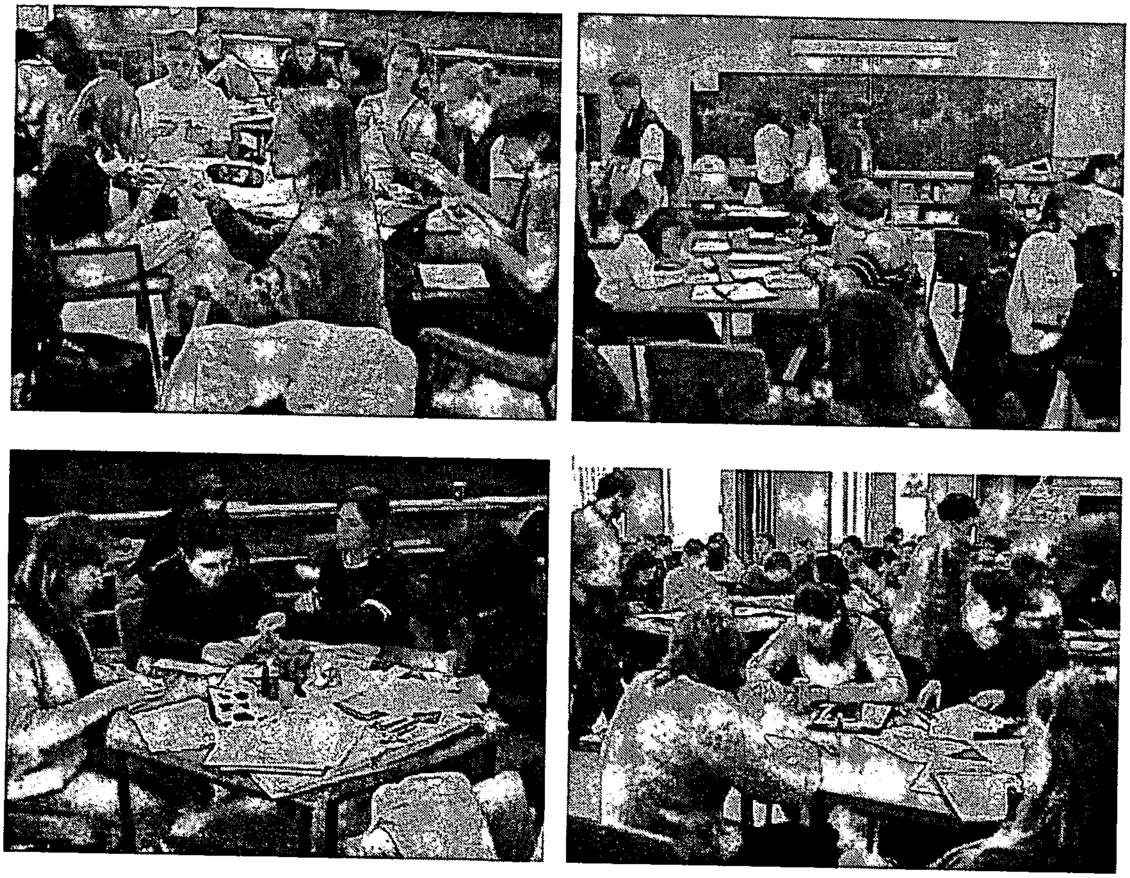

Figure 1. The *Joy of X* was a 12-seminar series designed for elementary mathematics pre-service educators enrolled in the 1998/99 B.Ed program at Queen's University, Kingston, Canada. Beginning at the top left, and moving clockwise, we see the teacher candidates involved in origami, an investigation of Fibonacci numbers, origami-supported algebra and graph theory investigations.

In response to our participants' data, *Connect-ME* (http://hydra.educ.queensu.ca/CM/) was designed and constructed (See Figure 2). In order to address teachers' concerns about quality and applicability, each resource on *Connect-ME* was annotated, following the current practice at the most comprehensive and successful American-based on-line community for math educators, the 'Math Forum' at http://forum.swarthmore.edu/. The *Connect-ME* teachers articulated the need for discussion with experts, as well as peers, in areas such as curriculum changes, technology integration, curriculum integration, and special needs. Direct and immediate access to advice and assistance is ranked by teachers as the most helpful feature in becoming more effective (Merseth, 1992). We have thus decided to assign discussion leaders and moderators for each one of these areas, drawing on the expertise of both teachers and academics in Ontario, all of whom became part of the community through *The Joy of X* workshops. Finally, the teachers were most interested in sharing the lesson plans and activities that they themselves had created over the course of their pre-service year.

There are six areas within *Connect-ME*: (1) *Xcite* (links to exemplary resources on the internet, lesson plans created by *Connect-ME* teachers and print resources); (2) *Xchange* (forum for discussing mathematics education issues

with experts from Canadian schools and universities); (3) *XOS Line* (an archived help/advice line with a library of frequently asked questions); (4) *Xtra* (news, updates, information about professional development); (5) *Xplore* (a collection of open problems that *Connect-ME* teachers pose, post and work on); and, (6) *The Joy of X* (a collection of photographs, papers and rich resource materials).

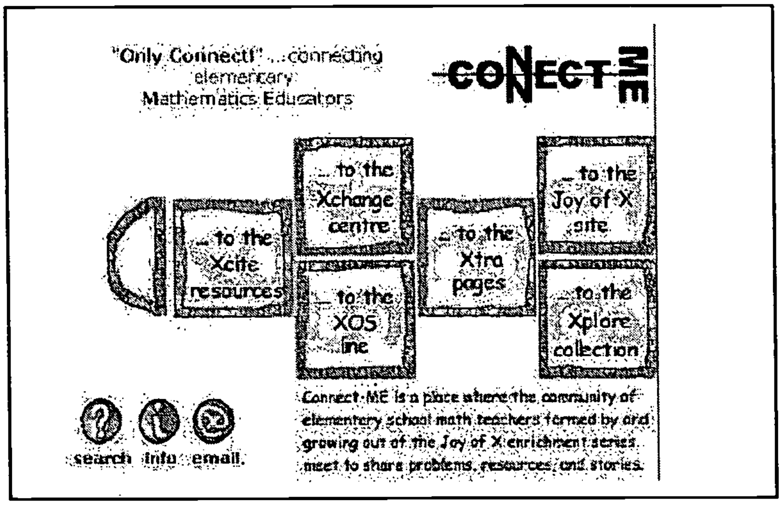

Figure 1. The *Connect-ME* website's opening screen. *Connect-ME* is an electronic professional development community designed for and by elementary Mathematics Educators from Queen's University.

The Study

Our study has grown from *The Joy of X* sessions. Other studies have documented the isolation new teachers feel, (Lappan & Theule-Lubienski, 1994) and noted that "the hard work of moving pre-service teachers to reconsider their beliefs and expectations about mathematics teaching and learning can be undone in a flash by "a beginning job experience in a school whose culture promotes order in the classroom, teaching as telling and standardized test results as a measure of teacher success," (Lappan & Theule-Lubienski, p.251). In at attempt to reduce their feelings of isolation and sustain their practice, our pilot project is an attempt to learn how to develop a self-sustaining forum for collegiality, given the knowledge that time and long-term support are critical aspects of change (Lappan & Theule-Lubienski). We have taken major steps to ensure that the community already existed before the transition to cyberspace, and that there is a sense of ownership among the members, e.g., our community members have contributed not only to the design of the *Connect-ME* site but have also contributed to the content of curriculum resources.

Since August 1999, our beginning teachers have had access to Connect-ME. Preliminary data has been collected by tracking and analyzing the transcripts of participants' on-line histories. In addition to documenting the number of log-ins, the context and content of the teachers' on-line histories have been analyzed (i) to determine the extent to which the use of this tool promotes mathematics education growth and inquiry; and (ii) to articulate some possible interventions that would help to achieve this result. Our field notes continue to be summarized on a grid with categories for: software interactions, exploratory behaviour, pedagogical development, computer comfort and confidence, teacher-teacher interactions, teacher-expert interactions, student learning outcomes and affective outcomes. The grid and coding system will be adapted and/or expanded as data is acquired in order to ensure that objective attention is given to as many aspects of the phenomenon as possible. These data will be supplemented by journals, responses to questionnaires and participation in both informal and formal interviews. Simple quantitative analysis will be done to determine total lines of text generated by each participant, amount of participation, total sums of questions, statements, as well as number of directed responses sent and received. In addition, patterns of participation will be mapped/graphed and correlated to the contexts of interactions.

Since its launch, we have 'seeded' the *Connect-ME* site and made explicit efforts to maintain the sense of community among our members. We wanted to engage our teachers in professional activities that are not frequent in their daily lives in order to provide learning opportunities that have the potential to enhance their sense of self as teachers and as vital, contributing members of a professional community. We wanted our teachers have access to learning opportunities as well as opportunities to discuss their own teaching successes and challenges with their peers so that they would acknowledge that they face the same issues and they were often addressing them in similar ways. We wanted to remove

the isolation they experience within their own classroom walls. We have attempted to address these issues by sending out individual weekly e-mail updates to all of our *Connect-ME* members. At the time of the launch, we had approximately 60 members. By the end of the third month, our official member list had decreased to 38, primarily because University sponsored e-mail accounts expired after convocation and some teachers had not made alternate arrangements. Our weekly updates include professional development information (e.g., N.C.T.M. packages for first-year teachers) and opportunities (e.g., Faculty of Education conferences, like *Y2X: Coming Home to Mathematics*) as well as information about new additions to the website (e.g., on-line articles, new problems). Between August and November, we have added 21 sets of resources to *Xtra* including resources on writing in mathematics, parents as learning partners, portfolio assessment documentation, lesson plans, and a discussion of the nature of open problems. We sponsored a one-day conference, *Y2X: Coming Home to Mathematics* that featured leading mathematics educators as workshop leaders, and we made the presenters' workshop notes available through the website.

Preliminary Findings

Since the launch of *Connect-ME* in late August, 1999 there has been an average of 90 hits per week. Electronic tracking shows that we had more *XOS* questions between August and September and during October and early November. This is presumably attributable to the long-range planning and preparation that occurs before the school year formally begins. We have had 24 messages telling us:

- **how they like the site** ("I also wanted to let you know how great the website and chat rooms are. I have not really had a chance to join in on anything, but from my browsing it looks great. It is nice to know that there is support network out there of familiar people who are both experienced and new to this. Thank you to all of you for the work you have put into it.") ;
- **how they found us again** ("I was talking to Sam (she's teaching kindergarten in Boston) and she told me about the math emails that you have been sending out. Apparently they are very helpful. I am in need of all the resources I can get my hands on to make math more exciting for my grade 2's"),;
- **about personal updates** ("I wonder if you have been receiving many desperate appeals as the school year approaches. I am scrambling to put together an extremely diverse and adaptable program for my new teaching position. Yes! I got a job. I got the perfect job for me teaching in a psychiatric crisis facility for kids. They range in age from eight to sixteen less a day. Their abilities are even more diverse. As you can imagine, the task of putting together a meaningful program for a group of ten kids who are all working at different levels, with different experiences and different emotional needs is quite challenge. What makes it more difficult is the fact that it is a locked facility and the children are only there for a maximum of thirty days by law. What!?! Yes, it is unlike anything one would normally think when it comes to teaching and almost impossible to plan for as I will arrive on the first day and have no idea what the current group of kids are able to do (there is no documentation on their levels or experience). What's more, it is a secure facility which means most manipulatives are not allowed due to security concerns (all items must be accounted for and anything even remotely dangerous is not allowed). This limits me tremendously. I have been going through my material from Queens, my placements and my own repertoire and am still feeling a bit short. I thought perhaps you might have suggestions for resources or any other ideas. If not, I understand it is a challenging scenario to work with. Anyway, any suggestions would be appreciated and I hope you have had a terrific summer. Take care. Thanks again.")

Additionally, there have been 5 contributions to the *Xchange* and requests for specific information on topics ranging from parental education, Family Math and related outreach programs to the implementation of portfolio assessment in the elementary mathematics classroom.

The visits to *Connect-ME* indicate that our members access the *Xcite* page most frequently, followed by the *Xchange* centre, the *Xtra* page, and the *Joy of X* pages in that order. It appears that *Xtra* is taking over *Xchange* as a place for us to communicate with them. With respect to resources, our teachers are using the links to assessment, lesson plans, and manipulatives, in that order. While participants are using mostly the *Xcite* resources component, many are going to the *Xchange*, presumably to see what others have written. The lessons plans they contributed themselves have been popular as well. About 1/4 of *Connect-ME* visitors are going to the *Xos* line with almost all of those reading the archives.

Despite our seeding and explicit outreach efforts, traffic at *Connect-ME* has been low. In response, we have hosted 2 on-line discussions. Through *Xlive* we are hoping to get a more lively interaction. Six participants participated in the first live interaction and nine in second. In our second conference, we also had 'featured guest experts' and brought together three leading mathematics educators from across the province.

There are very few 'outside' hits except a limited number of search engine matches and two visits from a Japanese site. We believe that this is a clear indicator that it is in fact our community members who are using the site.

Next Steps

Mid-way through Year 1 (January 2000), an on-line questionnaire will be distributed to all *Connect-ME* participants and an on-line discussion will be seeded that will focus on the challenges to teachers' attempts to implement the reform curriculum. The topics of the questionnaire will include: patterns of daily instruction, the challenges to teachers' knowledge, and the link between what happened in *The Joy of X* and the expectations of the larger teaching community. The on-line discussion will be modelled after the *Mathematics Case Methods Project* (Barnett, 1999) and participants will be asked to provide a narrative in which they describe an instructional sequence in which they were surprised or perplexed by students' responses or by the results of an assessment task. A facilitator will moderate an on-line forum in which participants will be invited to generate questions and issues raised by the various cases. The on-line archives will be analyzed on a grid for changes in beliefs about how mathematics should be taught as well as teachers' understanding of the transformations to their mathematical content knowledge and disposition. Again a software package such as NU-dist or Atlas.ti will be employed to assist in the thematic and inductive analysis of the extensive qualitative data.

On site focussed interviews with a subset of participants will be conducted at the end of the Year 1 (spring 2000) in order to determine the teachers knowledge, beliefs and practice, as well as to establish what the participants' professional development needs and preferences are (and whether or not they changed and were continuously met), what they needed to learn (and have gained knowledge about), and how the on-line community affected instructional practice and professional beliefs. Participants will be asked to self-assess the degree to which they were able to sustain their reconceptualized understanding of mathematics and its teaching and the degree to which *Connect-ME* influenced their practice.

The data from the on-line questionnaires, forum and focussed interviews will be aggregated to create a first set of levels that we will call our 'markers of change' and will include aspects of teacher beliefs, knowledge and practice.

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TELECOMM: SYSTEMS & SERVICES

Section Editor:

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Like many of you reading this, I have been involved with educational uses of the Internet for more than a decade. During that time, we have all witnessed the truly phenomenal growth of the Internet, from an arcane research tool to a bona fide global communications medium. The World Wide Web has only been in existence since the early 1990s, but in that short time, it has become the single most used component of the Internet. In fact, to a growing number of people, if not most people, the World Wide Web and the Internet have become synonymous, which is not necessarily a bad thing–it just demonstrates how powerful an effect the Web has already had. This effect has truly been staggering as people and organizations everywhere have embraced the Web with a passion that has only been seen with a select few media such as the telephone and the television. According to a Newsweek Magazine article published in 1988, ("Reeling In the Years," Newsweek, April 13, 1998, p. 14), new technologies are reaching mass use, (defined as use by one quarter of the population), at a faster rate than they did in the past. And the Web has reached mass use faster than any pervious innovation. The table below illustrates this point.

Date	Invention	Number of Years until Mass Use
1873	Electricity	46
1876	Telephone	35
1886	Automobile	55
1906	Radio	22
1926	Television	26
1953	Microwave Oven	30
1975	Personal Computer	16
1983	Mobile Telephone	13
1991	The World Wide Web	7

In less than a decade, the Web has fundamentally changed the way we send and receive information, the way we conduct business, and the way we deal with the explosion of new information that confronts us on a daily basis. Although it may already seem like a cliché to speak about the information revolution that has occurred in our lives, the truth is that we have just glimpsed the beginning of a change that is so powerful, it has the potential to affect almost every person on the planet.

But it is in the educational use of this undeniably powerful technology that many of us feel the true challenges and benefits lie. The articles in this section provide continued evidence that talented, motivated educators are finding new and innovative ways to extend the capabilities of the Internet, the Web, and all of the numerous digital communication resources that have emerged.

Cavanaugh and Cavanaugh begin the section by describing the development of a school network training course at the University of South Florida that focuses on the specific needs of the multi-vendor school network environment. The course provides fundamentals of network architecture and operation, along with practical hands-on maintenance, trouble-shooting, and legal issues. Shih, Howard, and Thompson report on the various formative evaluation activities that have been conducted for a distance education Master's degree program at Iowa State University. The paper provide useful recommendations for educators involved in Web-based course development and describes how based on the evaluations, lesson maps, examples of the calculations, glossaries, search, and more multimedia presentations have been added to the courses.

Tavalin, Quinn, Boke, and Lavigne articulate issues confronting school, community, and higher education groups as they create online discussions geared to deepen the level of student discourse about literature. This paper presents the various perspectives of researchers and evaluators, teachers, students, and agency representatives as they worked together to improve student online discussions about shared literature. It also gives suggestions for connecting pre-service educators to the circle of participants. Rizzi, Alonso, Hassan, Tarouco, and Jeanty de Seixas discuss their work, part of a national effort to develop distance education in Brazil. They describe the development of EquiText, a tool used for production of cooperative, colaborative texts.

Summers writes about the Professional Interaction Networks project that was created to determine the factors that affected the introduction of digital communication tools in support of teacher networks in Australia. The paper includes a discussion of how the project provided training to develop skills in the use of telecommunications tools to

enable participants to choose the most appropriate digital communication tools for a given task in professional network moderating. Watson's paper reports on the findings from a qualitative case study evaluating an online curriculum framework. This framework integrates content, context, and technology with primary documents from the "Valley of the Shadow" civil war Web site, created at the University of Virginia. An emergent design was used to analyze observational and reflective journal data and findings indicate that students were highly engaged in the activity and obtained a deeper understanding of American Civil War history through a designed reading, writing, and concept mapping instructional activity.

Jackson, Kueker, and Walker focus on the use of distance education in teacher preparation programs at different stages of course development. They discuss a "low-tech" inexpensive approach and include the perceptions of the professor and students as well as the decision making process regarding the selection of hardware and software. Liu recounts the successful experience of using an Intranet in teacher education technology courses at Towson University, including class management by the instructor and students' self-management of their progress. The processes, methods, benefits, potentials, and some issues of using an Intranet in technology classes are discussed in this paper.

Mengel, Gatz, and Meehan present an overview of Fermilab LInC (Leadership Institute Integrating Internet, Instruction and Curriculum), an intensive full-online, partial-online or face-to-face professional development program for K-12 educators who are already connected to the Internet and want ideas and support for integrating it effectively into their existing curriculum. The goal of the project is to create a national cadre of educational leaders from urban, rural, and suburban districts who effectively use technology to support engaged and constructivist learning. Vazquez and Victor describe a case study of a K-8 school in California that is using the concepts of information architecture to develop its Web site. The site is intended to be a virtual meeting place for all of the school's constituents: parents, teachers, students, and the community at large. The authors describe the school's Web site, the theoretical background on information architecture, and include recommendations for other schools pursuing similar projects.

Leh and Decroo give their view of how the Web is changing society and education as they report on how two educators—a university professor and a middle school teacher—use the Web for instructional purposes. Their examples show how the Web can motivate students conducting meaningful learning and foster students' interaction. Similarly, they discuss how the Web can enhance communication among instructors, students, parents, and school administrators. Course assignments and activity examples are illustrated and students' feedback is also reported in the paper. Echevarria and Weeks provide an overview of the development process of an interactive Web page Generator program. Created in response to the increased demand for online information on their university campus, this tool has hastened the delivery of academic Web pages and has also been applied to administrative applications. By eliminating many of the obstacles of creating Web materials, the Web page Generator provides a quick response to faculty and staff needs by using fill-in-the blank templates, and isolating end users from the often time-consuming process of coding their own Web pages. The authors discuss how one of the successes of the project has been the interest generated in developing even more sophisticated pages and the integration of technology in general on their campus.

Huh, Yi, and Kim propose a cyber education system as an open template education model, where teachers, business educators, or anyone who is not a specialist can easily create their own cyber learning environments. They describe the design approach for their education system as well as provide the details of how it functions. Chen and Brown point out the urgent need that K-12 teachers have in selecting quality Web sites for their students. In their paper, they discuss various Web evaluation standards, set up by librarians, search engine companies, Web site diagnostic services, and finally, by educators and school districts.

LaMaster writes about using one of the commercial Web-course management systems to convert a traditional university course to an asynchronous one, using the Internet. She describes how after collecting data and exploring various pedagogical concerns from the perspective of the instructor and students, changes were made to the course. A majority of the changes for the course focused on ways to create more interaction between students and also between the instructor and students. Klein provides an update on the status of the E-Rate Program, created as a result of the Telecommunications Act of 1996. He discusses how this program is helping schools and libraries install modern telecommunications systems in their facilities and looks at whether the present application process is allowing many US schools and libraries to take advantage of the program.

The last two papers that conclude the section provide a possible glimpse into the future. Koble and Molebash explore the concept of Network Computing as the educational computing model of the future. In their paper, the authors address the state of technology in today's educational environment including the concepts of total cost of ownership, how the network computer might help schools realize their goals as they relate to technology and the how this model could transform the teaching and learning process. Also discussed are the factors that prevent these

changes from occurring within the restraints of the current computing model. In their paper, Ahern, Jamison, and Olivarez contend that new and more powerful protocol schemes are needed to truly realize the potential of networked-based instruction. One such technology that holds great promise is XML, a more structured and dynamic approach to online content creation that allows the developer to define and order data instead of merely displaying it. The authors describe some of the issues surrounding this new technology, including using XML for instructional applications. They report on a study where they found that the Internet and XML were suitable for this type of application and where they found no difference in performance from either locally accessed classes and those delivered from an Internet server.

These papers provide a critical view of how telecommunications systems and services are affecting many different facets of education. From the design and development of Web-based courses to the search for the best evaluation rubric, from Information Architecture to Network Computing, from online discourse to curriculum frameworks, these papers demonstrate how telecommunications technologies are evolving and helping shape the future of teacher education. And the impact will become even greater as the entire world begins to benefit from these new and powerful ideas.

Developing a School Network Course

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Abstract: After the smoke of school network installation clears, schools find themselves in need of qualified network mangers. Most school districts cannot afford to hire trained network administrators, so they seek training for current personnel. Such training is usually oriented toward single-vendor business networks rather than the patchwork of legacy systems found in many schools. To address the need for school network training, the University of South Florida's Instructional Technology program developed a menu of options, including a guidebook, a website, a workshop series, and a graduate credit course. Each of these resources was developed through collaboration between university faculty and school district technology personnel. The School Networks course, offered on an attractive alternate calendar schedule, focuses on the specific needs of the multi-vendor school network environment. The class provides fundamentals of network architecture and operation, along with practical hands-on maintenance, trouble-shooting, and legal issues.

Schools and school systems worldwide are struggling to reach a state of computer connectivity. Educators realize the inevitability and necessity of building school networks for education. While funding exists for most schools to install hardware and infrastructure, there remains a critical shortage of funds for staffing and training school network operators. Several factors contribute to the dire lack of school network support. The climate of many school districts severely restricts the hiring of additional personnel who are not classroom teachers. Technology grants and budgets have consistently under-allocated for support personnel and training. Network training is very expensive and trained network administrators and support technicians can usually earn vastly higher salaries outside the schools.

Schools have kept their networks running by implementing creative solutions. Some schools increase class sizes to free a staff member for network tasks. Parent or community volunteers are asked to contribute their time and skills to man technology help desks and perform troubleshooting. Media specialists and technology teachers are called upon to serve as ad hoc network technicians, often part-time. Districts may require schools to share a network technician. Students have been called on to use their technical knowledge in the service of the school network. Some districts contract with commercial services. The majority of these solutions are piecemeal, oriented toward crisis management, rather than prevention of problems. Generally, the staff members with network responsibilities have little or no formal training in network administration, although they perform admirably as self-taught gurus.

The serious lack of education on school networks was brought to the attention of USF's Instructional Technology faculty by graduate students who felt a need for network knowledge

and experience, and by area school personnel who had network responsibilities but limited resources. These people had investigated alternatives such as Novell and Microsoft certification classes and community college technical training, but found them to be too business-oriented. While the instructors of the classes were very technically skilled, they were not helpful in solving school-specific problems, or in cases where multiple vendors and platforms were deployed.

The IT faculty responded to these requests first by developing a guide book, *An Educator's Guide to School Networks*, designed to be a reference for educators in a networked environment. The guide was published and distributed statewide in print and online. Network topics were incorporated to a limited extent into the *Microcomputer Hardware Systems for Education* course. The course focused primarily on the physical aspects of networks, but legal, software, and management issues were outside the scope of the course.

To begin to address the need for qualified school network operators, the University of South Florida developed a graduate course for teachers in school networks. The university's College of Education offers graduate degrees in Instructional Technology. In 1999, the School Networks course was added to the program. The course may be taken as a stand-alone training experience, as part of a Master's, Specialist or Doctorate degree, or as a component of the School Network Certificate program.

Once the need for the course was identified, successful school network operators and district technology coordinators were consulted in planning the course content. The school network operators listed the tasks that occupy the majority of their time at work, the materials and resources they used most often, and the skills and information they found most necessary to do their work. A survey of area schools showed a mix of Macintosh and Windows networks, sometimes at the same school site. The needs analysis phase of course development revealed that the greatest needs were for a course that helped learners to organize the knowledge of networks that they had gained haphazardly, to fill in important gaps in knowledge, and to provide a trouble-shooting structure. The School Networks course needed a practical, hands-on, cross-platform approach.

An instructional partnership was formed, in which a local school network operator and trainer worked with university faculty members to develop and co-teach the course. The structure of the network guidebook was adopted for the framework of course content, fleshed out with the practical needs identified by school district network managers. District personnel suggested several reference manuals that they depend on heavily in their work. Each was evaluated for its merits as a course text. Before the course was offered, a series of school networking workshops was offered. The workshops functioned as a trial course, in which methods would be tested and revised for the credit course.

The following topics were proposed for the pilot version of the course:

- Overview of networking fundamentals, including peer-to-peer and client-server models for LANs
- Network topologies
- Network components, including workstations, servers, hubs, switches, network interface cards, cabling, wireless systems

- Network connections, including installing and configuring drivers and NICs, connecting cable
- Server set-up, file sharing, users and groups, directories
- Network functioning, including OSI layers and 802 models, packets and data, protocols, access methods
- Network architectures, including ethernet, token ring, AppleTalk
- Network operating systems, including Windows NT, AppleShare
- Network administration, including planning, performance monitoring, security, backup systems, budgets and purchasing

A variety of instructional strategies was developed. Instructors prepared presentations introducing and illustrating concepts. Students learned to install network cards, plan network wiring, and calculate budgets using hands-on labs. Computer simulations led students through processes of configuring drivers, setting up groups of users, file sharing, and server setup. Internet research was used for student projects and presentations. Other experiences included field trips to see a variety of school networks, guest speakers, and student publications. The course took place in a fully networked Mac and PC lab. The student materials included hardware vendor price lists, school network wiring diagrams, Apple and Asante network guides, Internet sites, and *A Guide to School Networking* published by the Florida Center for Instructional Technology (online at http://fcit.coedu.usf.edu). The course text was Microsoft *Networking Essentials*, chosen for its breadth, generic approach, CD-ROM resources, and availability.

To accommodate the scheduling restraints of working adults, the first pilot for the course took the form of four days of workshops for teachers offered during Summer 1999 at the Florida Center for Instructional Technology Preview Center at USF. The workshops were advertised through school district staff development calendars and direct mail to schools. Two days of the workshop concentrated on Windows networking, and two days was devoted to Apple networking in the K-12 school setting. The number of participants ranged from 8-12 per day, with two instructors. The workshop evaluations became useful tools for preparing the course.

Following minor revisions, the workshop series developed into the Summer 1999 graduate course. The course was scheduled for one week of class meetings, Monday through Friday 8 AM until 5 PM. Fifteen students enrolled in the course. During the week, students attended three trips. On Monday, the class visited the College of Education network center to hear the network administrator discuss the decisions made when planning the network, methods used in running the network, and the roles played by the physical components of the network. On Wednesday, the morning was spent at an area technology magnet middle school that runs a hybrid network. Students toured the school with the network administrator to see the network setup, hear about planning and troubleshooting, and watch network diagnostic procedures. The final trip was to visit the university's academic network headquarters to learn about security, Internet2, Unix servers, and large scale network operation.

Much of the class discussion focused on problem-solving cases, in which instructors or students presented an authentic school network scenario for class evaluation. The course included a short final exam. The week culminated with student presentations. Each student created a presentation suitable for a school audience, such as parents, students, or staff, to educate them about a

network topic. Topics included netiquette, copyright and licensing, security and safety, and logging on to the network. Within two weeks of the end of class, students were required to send a publication designed to inform a school audience of a network issue.

For the Fall 1999 semester, the workshops were repeated, and the course was reorganized to account for the school workday. The class was scheduled during one month on Friday evenings and all day Saturdays. In addition to the exam and network issue presentation, students were required to develop a tool for network administrators, such as an equipment or software inventory, a trouble-shooting flowchart, or a network service log. Again, fifteen students enrolled. The makeup of the class has been primarily teachers who are responsible for school networks, along with full-time IT graduate students, and a few school and district administrators. The course has earned very favorable evaluations from students.

Formative Evaluations of a Web-based Masters Program: Insights for Web-based Course Developers

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Abstract: The purpose of this paper is to report the various formative evaluation activities that have been conducted for the Masters of Science in Agronomy Distance Education Program at Iowa State University and to provide useful recommendations for educators involved in Web-based course development. It was found that those faculty members having experiences with distance education held more positive perceptions toward Web-based instruction. Students believed they were learning as much in the distant environment as they would on campus. They liked the interactive multimedia activities and asked for clear structure for navigation in each web page. As results of the evaluations, lesson maps, examples of the calculations, glossaries, search, and more multimedia presentations have been added to the courses.

Introduction

Distance education has a long history of applying technologies in delivering instruction to those who are not able to participate in a campus-based curriculum. Many people involved in distance education are professional individuals who are seeking to pursue advanced degrees and empower themselves with knowledge that is relevant to their career field (Butler, 1996). The latest in the long line of instructional technologies is the World Wide Web (WWW). The World Lecture Hall listed almost 800 Web-based courses that were delivered by higher educational institutions, and this list had been growing daily (World Lecture Hall, 1999).

In the fall of 1998, the Masters of Science in Agronomy Distance Education Program at Iowa State University (ISU) started providing interactive multimedia courses in which most course materials and resources were accessed and delivered through the WWW and CD-ROM (Iowa State University, 1999). One of the goals of this program was to provide a way for professionals working in industry and the government to gain an advanced degree in Agronomy without having to attend the campus in person. The curriculum consists of 12 courses, a 1-credit workshop, and a 3-credit creative component, which totals 30 semester credits (Howard, 1999). The courseware integrates content material on CD-ROM with the interactive tools of WebCT (WebCT, 1999) on an ISU server. The WebCT tools allow students to interact electronically with their instructors and classmates by utilizing a course calendar, discussion board, chat room, student homepages, and group project organization, etc. The program began with an enrollment of fifteen students in a pilot program in the 98/99 academic year. Currently forty-two students are enrolled in the program.

At the initial development stage of the Master of Science in Agronomy Distance Education Program at ISU, conducting formative evaluations is needed to obtain more understanding and knowledge about Web-based learning/teaching and to improve and strengthen the program. The purpose of this paper is to report the various formative evaluation activities that have been conducted for the Masters of Science in Agronomy Distance Education Program, the results of evaluations, actions taken to improve the courses, and to provide useful recommendations for others involved in Web-based course development.

Evaluations

Formative evaluations have been conducted along with the course development of the Masters of Science in Agronomy Distance Education Program at ISU. Faculty members and students were the primary audience of the evaluations.

Faculty

Agronomy faculty members at Iowa State University were surveyed regarding their perceptions of the Masters of Science in Agronomy Distance Education Program in the spring of 1998 (Born and Miller, 1999). Findings showed that those faculty members having experiences with distance education held more positive perceptions toward Web-based instruction than those not having experiences. Table 1 shows the comparison of faculty perceptions by whether or not they were involved in other distance courses, familiarity of the M.S. in Agronomy Degree Program, whether or not they were involved in the M.S. in Agronomy Degree Program, and whether or not they have viewed a M. S. in Agronomy degree program lesson. Faculty perceptions were significantly positive if the faculty were familiar with the Agronomy Distance Education Program, and had viewed a lesson developed by the M. S. in Agronomy degree program. Faculty members were the most positive about the comparability between Web-based and on-campus courses in regard to challenge. They also thought the university should develop more Web-based courses and integrate them into the curricula (Table 2).

Furthermore, informal comments regarding the on-line course development were collected from the instructors involved in the program. Faculty revealed that developing and managing the on-line courses required them to have a larger amount of time commitment than traditional courses. For example, one instructor indicated that to interact with the students, she averaged half an hour per week for one student.

Table 1. A comparison of faculty perception of Web-based distance education and M. S. in Agronomy degree program by selected variables (n = 36) [a]

Variable	Overall Perception of Web-based Distance Education			Perception of the M.S. in Agronomy Degree Program		
	Mean[b]	SD	t-value	Mean[b]	SD	t-value
Whether involved in other distance education courses						
No	3.38	0.61	-1.4	3.03	0.55	-2.47*
Yes	3.70	0.66		3.53	0.57	
Whether familiar with the M.S. in Agronomy degree program						
No	3.30	0.61	-2.15*	2.93	0.54	-3.35*
Yes	3.70	0.61		3.50	0.52	
Whether involved in the M.S. in Agronomy degree program						
No	3.36	0.59	-1.23	2.99	0.50	-2.27*
Yes	3.60	0.68		3.34	0.65	
Whether viewed a M.S. in Agronomy degree program lesson						
No	3.22	0.60	-3.41*	2.88	0.46	-4.52*
Yes	3.83	0.49		3.58	0.52	

[a] Adapted from Born and Miller (1999)
[b] 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree
* $p < .05$

Table 2. Means and standard deviations for faculty perceptions of Web-based distance education and the M.S. in Agronomy Distance Education Degree Program (n = 36)[a]

Statement	Mean[b]	SD
Overall perception of Web-based DE.	**3.46**	**0.63**
Web-based, distance education courses can be as challenging as on-campus courses.	4.00	0.92
Web-based, distance education courses should become an integrated part of university curricula.	3.98	0.75
Our department needs to develop more Web-based, distance education courses.	3.67	0.93
If I were a student, I would consider enrolling in a Web-based, distance education course or program.	3.50	0.89
Web-based, distance education courses are as academically challenging as on-campus courses.	3.43	0.91
Web-based, distance education courses should be offered as substitutes for some on-campus courses.	3.38	1.03
Web-based, distance education courses can not be as effective as on-campus courses.	3.33[c]	1.14
Students spend less time working on Web-based, distance education courses than on-campus courses.	3.33[c]	0.61
I would consider teaching a Web-based, distance education course.	3.31	1.07
Teaching a distance education course would improve my on-campus teaching.	3.31	1.05
Effective student-professor interaction is not possible in Web-based, distance education courses.	3.26[c]	0.96
On-line degrees should not be valued as equivalent to on-campus degrees in the job market.	2.98[c]	1.14
Perception of the M.S. in Agronomy Degree Program.	**3.15**	**0.59**
The time and effort expended on the Master of Science in Agronomy Distance Education Degree Program is not appropriate.	3.27[c]	0.59
A Master of Science in Agronomy Distance Education Degree Program will be perceived by employers as having similar status or value as compared to an on-campus Master of Science degree.	3.10	0.77
The Master of Science in Agronomy Distance Education Degree Program is as rigorous as an on-campus Master of Science Degree Program.	3.10	0.94

[a] Developed by Born and Miller (1999)
[b] 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree
[c] Indicates negatively worded items that were reverse coded.

Students

In addition to seeking for faculty's opinions regarding the program, students were also asked to evaluate the Web-based courses developed by the program. One pre-pilot focus group study included interviews with the students after they previewed the lessons in August of 1998 (Singh, 1999). It was found that in general the students liked the lessons and they discovered the lessons were better than what they had expected. They thought that they were learning as much in the distance environment as they would on campus. The students said that the interactive exercises made the lessons interesting and helped them in understanding the concepts. Many of the students also said that more interactive exercises should be included in the lessons. They expressed that it would be helpful to have access to the Glossary at all times, not just from specific words in the lessons. Most of them were a little confused about their location

within a lesson so they suggested that it would be helpful to have a lesson map to the headings and subheadings within the lessons. Another suggestion was to have a list of study questions and assignments so that the students could be sure that they had not missed any question or assignment. The students liked the multimedia presentations and the ease of playing them. They suggested that audio should be added. Moreover, all the students agreed that the lessons should help them in making the connection between theory and its practical application. They also appreciated the opportunity to access a higher education degree program and the efforts made in conducting the pilot evaluation for the lesson improvement.

Students completed a questionnaire regarding their perceptions of Web-based distance education and the M.S. in Agronomy Distance Education Degree Program in the fall of 1998. Students agreed that the computer they used for the program was sufficient for course materials and they were satisfied with the technical supports they received (Table 3). They also believed that they had appropriate computer skills when they began their work in the M.S. in Agronomy program. They thought that the M.S. degree in Agronomy Distance Education Program should be of equal value to a traditional on-campus degree. They agreed that they would not be able to work on their Masters if it were not for this distance degree in Agronomy. They also agreed that they preferred distance courses to on-campus courses.

Students taking the courses offered in the fall of 1998 and spring of 1999 completed a survey questionnaire regarding various aspects of the courses. Overall, students agreed that the courses stimulated their interest in the subject matter. They thought their understanding of the subject has increased because of their experiences in taking the courses. They thought that the images and animations helped them in understanding and visualizing the lesson content and the course content was relevant to their career goals. In addition, they indicated that audio and video should be incorporated more often in explaining the concepts. They did not think that the navigation through the lessons was clear and logical or there was adequate explanation for all the acronyms and Greek symbols used within the lessons.

In the fall of 1999, one student in each course was asked to evaluate individual lesson weekly. Three questions were asked in the weekly lesson evaluation. The first question was: "What were the most effective parts of the lesson for you?" Up to the date of writing this paper, most of the students responded that the most effective part of the lessons were the multimedia presentations of concepts. They also reported that the lessons effectively used maps, charts, and tables to back up the text and the lesson materials were well organized. Students liked the use of features such as FYI, In Detail, Study Questions, and Glossary to supplement information presented while maintaining the flow of material. The hands on activities went with these interactive features "are the best learning" according to one student. The second question was: "What did you like least about the content and/or design of this lesson?" Some students replied that they did not like those lessons which were extremely too long for a week. One student revealed that he did not like the activities that required him to be on-line because he needed to be able to be in a motel, at home, or at some other site to study whenever possible. One student was frustrated to work on the symbols of the math or equations from MS Word for the assignment. Technical problems are always not patiently welcome. However, only one student reported having technical problems. The problem was that the animations did not work properly even though he had downloaded all the plug-ins required. One student had problems with exams. He said that he would like to know what is expected and what concepts were deemed to be important for the exams. Regarding what could be added to the lessons to enhance student learning, students would like to see more multimedia presentations to help convey conceptual topics more effectively and more real pictures as real world examples. One student suggested to add an appendix with a review, problems, or recommended supplemental text that will be important to study the subject matter. Another student would like to see some case studies where the modeling concepts were applied.

Actions of Improvement

Based on the results of these evaluations, improvements have been made. For example, lesson maps, examples of the calculations, and glossaries have been added to the courses. More multimedia presentations have been developed. Navigation has been improved by adding back to the previous lesson

and to the immediate following lesson. A search function for topics and words within each course has also been tested.

Table 3. Means and standard deviations for student perceptions of Web-based distance education and the M.S. in Agronomy Distance Education Degree Program (n = 11)[a]

Statement	Mean[b]	SD
Logistics	**3.15**	**0.86**
The computer I used for the program was sufficient for course materials.	3.64	0.50
Questions on technical problems were answered quickly and efficiently by the MS in Agronomy staff.	3.55	0.69
I felt comfortable with the computer systems and software.	3.27	1.19
The instructions that were provided to help set-up my computer for the program were effective.	3.09	0.94
I was given an adequate amount of time to become comfortable with the technology before I was required to participate.	3.00	1.18
The number of on-campus meetings was adequate.	2.91	1.14
Correspondence was answered by the instructor within two business days of receipt.	2.73	1.49
The library was available for research.	2.30	0.48
Research and reference materials were accessible.	2.30	0.48
If this course had not been offered via distance learning, I would have commuted to ISU to take a similar course.	.33[c]	0.50
Computer Skills	**2.49**	**0.89**
I had the appropriate computer skills when I began my work in the MS in Agronomy program.	3.18	1.25
Students should be informed about the level of computer skills necessary for the classes prior to enrolling in the program.	2.91	0.54
As a result of my work in the program, my computer skills have improved.	2.55	0.69
I needed more experience working with Excel for my work in the program.	2.45	0.93
I needed more experience working with the Internet for my work in the program.	1.36	1.03
Time and Convenience	**2.70**	**0.98**
This degree should be of equal value to a traditional on-campus degree.	3.45	0.93
I would not be able to work on my Masters if it were not for this distance degree.	3.27	0.90
I prefer distance courses to on-campus courses.	3.09	0.94
I never felt that the technical problems of this course were overwhelming.	2.36	1.12
The classes should adhere to the traditional semester scheduling.	2.36	1.12
I spent more time per week on the distance classes than I would have in a traditional graduate course taught on campus.	2.27	0.79
The amount of time spent on each class was consistent from week to week.	2.09	1.04

[a] Developed by Singh (1999)
[b] 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree
[c] Indicates negatively worded items that were reverse coded.

Conclusions and Recommendations

Based on the results of these on-going formative evaluations, the following conclusions were drawn:

- Those faculty members having experiences with distance education and the M. S. in Agronomy degree program held more positive perceptions toward Web-based instruction.
- Faculty recognized that more time commitment was needed to develop and manage the Web-based courses than traditional ones.
- Students were positive about interactive multimedia activities.
- Students wanted clear structure for navigation in each web page.
- Students believed they were learning as much in the distant environment as they would on campus.
- Students appreciated the access to a higher education degree program provided.
- Students also appreciated the efforts made in conducting the evaluations for the improvement of the lessons.

Recommendations were made for educators who are interested in Web-based course development as follows:

- Opportunities should be provided for faculty members to be involved with Web-based education to ensure the acceptance and adoption of the distance program.
- More interactive multimedia activities should be included in the Web-based lessons.
- Developers should make navigation of the lesson pages as simple and clean as possible.
- Distance education degree programs should be provided.
- On-going formative evaluations are needed to obtain evidence to help with the design of the Web-based courses and continue to improve the quality of the courses.

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Taking a Stand: Developing System-wide Collaborations for Effective Discourse

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Abstract: Using the example of Taking a Stand in Cyberspace, we articulate issues confronting school, community, and higher education groups as they create online discussions geared to deepen the level of student discourse about literature. Through a collaboration between the Vermont Center for the Book, the WEB Project, and six Vermont schools, students read and discussed three books while teachers maintained an online discussion about the student conversations and the degree to which the student discussions showed evidence of reaching selected learning goals. This paper presents the various perspectives of researchers and evaluators, teachers, students, and agency representatives as they work together to improve student online discussions about shared literature. It also gives suggestions for connecting pre-service educators to the circle of participants.

Overview

In rural states such as Vermont, it is often difficult to find needed resources in a single community. New educational concepts, new technology, and new subject content require collaboration among those with expertise in these new areas. With the advent of the World Wide Web and the recent technological ease of digitizing images, sounds, movement and text, these collaborations can occur at a distance. In 1995 the US Department of Education provided funds to Vermont schools via the WEB Project, http://www.webproject.org, to build an innovative online network of students, teachers, artists, and community organizations working together to help improve student performance in the arts, humanities, and social sciences. Online Arts Mentoring in music composition (Vermont MIDI Project) and visual arts (Art Responding Through Technology - ARTT) formed the first two online initiatives.

Building on current research and the professional lessons learned from five years of arts experiences, The Vermont Center for the Book (http://www.vermontbook.org) and The Web Project

(http://www.webproject.org) designed Taking a Stand, an online book discussion series among middle school students from several Vermont schools. Last year, students read and discussed three novels dealing with young people who intentionally or inadvertently take a stand on an issue. While students discussed the literature online, teachers engaged in graduate action research studies that examined multiple sources of data to determine whether or not online literature discussions hold promise as a vehicle to improve student analytical skills. Sources of data included an examination of the discussions themselves, surveys, student focus group discussions, classroom observations, and web-based discussions about the student discourse while the program was in operation.

Evolution of the Online Experience -- Two Classroom Views

Learning Outcomes at Edmunds Middle School

Teachers involved with the "Taking A Stand" initiative looked to online dialogue to deepen student discussions and increase student achievement of three specific standards: Reading Comprehension, Informed Decisions, and Responding to Text. In the Edmunds Middle School experience, effective training of students around discussion techniques in the classroom led to better online conversations. Because students had deep discussions in the classroom following a group reading of a text, they were more likely to carry those discussions over into the online forum to which they had been assigned, although talking too much in class served a deterrent to conversing further online.

Reading Comprehension

Because each of the books differed, it was necessary for students to analyze and interpret the features of each text. The first book, *Nothing But the Truth*, generated discussions about the style of the book. Students discussed online whether they found the book reader-friendly or not (it is written like a play, and each chapter shifts from character to character). The need to understand vocabulary relating to apartheid was important to students posting messages about *Beyond Safe Boundaries*. Each book allowed students to make connections between parts of a text, other texts, and experiences in and out of school. There were lots of online discussions about groups and cliques in schools after the reading of *The Chocolate War*. Students went beyond *Beyond Safe Boundaries* to discuss the larger issue of apartheid. They followed links to current events like the dragging death of a black man in Texas. With each book they discussed civil and individual rights. The richness of the topics covered in the "Taking A Stand" books allowed for plenty of opportunities to analyze, interpret, and evaluate texts for their cultural, political, and aesthetic contexts. First amendment rights were debated online after reading *Nothing But the Truth;* racism, classism, and sexism were brought up by students who read *Beyond Safe Boundaries;* and the way students treat each other in school was a focus of discussion following *The Chocolate War* (one can only imagine where that discussion might have gone had students been discussing the book following the recent Colorado murders).

Informed Decisions

Since each of the books in this strand dealt with a controversial topic, there were many opportunities for students to evaluate the consequences of decisions. When no one turned out to be a clear "winner" in any of the books, students discussed how taking a stand was often not easy or neat. They asked each other about characters' motives and authors' purposes. They wondered together about how things might have worked out differently. Through online discussion, students recognized others' points of view and assessed their decisions from others' perspectives. They did this in two ways: first, they discussed how characters in a given book were affected by contrary perspectives. Then, in online discussions, they challenged each other to see the "big" picture. They certainly analyzed and considered alternative decisions. Should Jerry simply have given in and sold the chocolates in *The Chocolate War*? What if Phillip's parents and the media had stayed out of the controversy in *Nothing But the Truth*? If Evie had known how things would turn out, would she have become as involved as she did with the anti-apartheid movement? Especially in *Nothing But the Truth*, students differentiated between decisions based on fact and those based on opinions. Because virtually no one told the complete truth in that story, entire lives were changed. Students wondered about fact vs. opinion in many of their online discussions.

Responding to Text

Students had many opportunities to make inferences about content, events, story, characters, and setting, and the relationships among them. The relationships among these aspects of a text were probably the largest focus of online discussions, although some discrete discussions also occurred. (Interestingly, some students wondered after discussing the three books whether it might not have been a good idea to set up a thread in each discussion area for things like characterization, setting, theme, etc.) The three books shared a common theme, but each was written in a very different style, allowing for much online discussion about themes and styles. Students explored the effects of point of view with each book. In *Nothing But the Truth*, it was precisely because every character had a different point of view that the story turned out as it did. Students compared *Beyond Safe Boundaries* to *To Kill A Mockingbird* in terms of point of view - told by a young girl who was initially oblivious to the racism around her. The omniscient point of view used in *The Chocolate War* was a switch for students; they needed to consider it in their dialogue. The entire focus of the "Taking A Stand" initiative led students to interpret the ambiguities, subtleties, contradictions, ironies, and nuances of each text. Precisely because there are no neat endings to any of the stories, and each book featured several sympathetic characters and extenuating circumstances, the students found them to be more representative of life, with its ambiguities, subtleties, contradictions, ironies, and nuances.

Details of the Online Experience

At Walden School, eighth graders typically spent literacy classes two weeks prior to their time online reading and participating in small-group, Great Books-style discussions, forming and responding to interpretive questions and referring to passages in the text to explain or underscore thoughts, back up opinions, and frame questions. They related issues in the books to their own lives and, in some cases, built background knowledge to gain a greater understanding of the book's context. At the end of that preparatory period, they worked with other students in small groups to select an idea or post a question, based on their class discussions and writing.

As a prelude to their online book discussions, students at the six schools got acquainted through personal introduction threads. This was initially very awkward for Walden students as they sought a way to present themselves in cyberspace to unknown others. This was particularly challenging before students had fully conceptualized the experience of online discussion, confirming what Brent Wilson articulates as he describes some of the dilemmas of engaging students in online learning communities (Wilson 1998). Prior to Taking a Stand, some Walden students had used e-mail, some had done chats, most imagined that communication would be relatively immediate. Few, if any, had experienced asynchronous, threaded discussions and were somewhat taken aback by the time delays. Once students received responses or read other postings, however, their interest and eagerness soared.

Students initially discussed *Nothing But the Truth*. Each school distributed groups of students among three discussion forums so that the volume of responses would be manageable and students would have opportunities to dialogue with small groups of students from each of the other schools. Even with this precautionary organizational structure in place, floods of questions, rudimentary responses, and only occasional examples of complete cycles of dialog characterized the first discussion.

As students reflected on the first book discussion, they recognized the importance of thoughtful responses and sustained dialogue. Informed by their early experiences, many students approached the second book, *Beyond Safe Boundaries*, with greater focus and understanding. These qualitative improvements were also promoted by the students' feelings of indignation and outrage about the injustices experienced by many of the characters in this book about young South Africans taking a stand against apartheid. This helped fuel passion for participating in the discussion as students were personally moved and had a stronger desire to write about the issues raised. A less overwhelming volume of responses online, generally greater focus, and more sustained dialogue resulted.

For the third book, *The Chocolate Wars*, schools were paired for discussions. This restructuring made threads even more manageable, although it left sites more vulnerable to the peculiarities of a single partner-school's computer and Internet access quirks, class trips, and scheduling conflicts. As students participated in their third discussion, incomplete cycles of online communication reduced and students increased their critical responses to other postings. The development of critical response over time stresses the importance of conducting a series of discussions rather than structuring online discussions on a book by book basis.

Improving the Collaboration in Year Two

In addition to looking at student discourse for evidence of reaching the standards associated with critical analysis and interpretation of text, participants sought to clarify the role of outside agencies in facilitating online conversations. The lessons that emerged from the first year of Taking a Stand through in-house analysis and RMC Research Corporation (Denver, CO) evaluation point toward some simple next steps both for the participating schools and the facilitating organizations as the system becomes refined.

To ensure that collaborations lead to the desired results for all students participating, we emphasize the following lessons:

1. Begin with common learning goals AND common methods of teaching. Selecting standards is only part of ensuring a common focus; a common approach to teaching is also necessary. In this case, inquiry based learning led to progress toward desired results faster than a traditional "test question/response" approach. Furthermore, an inquiry-based approach to discussions is directly aligned with the learning results and assessment systems that have been established by the network. Revised activities for Year Two include:

a. online discussions among the schools will last for three weeks per book with a minimization of the amount of in-class discussion that takes place beforehand so as to keep online work fresh with an agreement to print discussions, talk about it in small groups, compose a response offline, then post.
b. schools will serve as "question hosts" each developing one question about a book, facilitating the conversation, and bringing closure to discussions.
c. teachers will periodically download transcripts to discuss the quality of the discourse and engage in other metacognitive activities designed to heighten student awareness and understanding of good communication and thinking
d. summative responses to the literature will be generated by all students, either written or visual

2. Model the common approach in-person and online. Site analysis reveals that most questions from Taking a Stand fit into the "test question" category, rather than resulting from genuine inquiry. Thus, essential to model for teachers and students what genuine inquiry looks like. Initially, this may take the shape of learned forms of interaction so that students are taught how to hold meaningful inquiry.

2. Assess individual and group performance both in-progress and with a final product. In Year One of Taking a Stand, designers believed that it was possible to measure all learning goals by assessing discrete parts of the discourse. This approach was not an effective measurement of whether or not students achieved the desired results. As a result, participants have clarified their roles and proposed a four-part assessment schema which includes:

a. assessment of each post to determine whether students speak with specific reference to text and use literary vocabulary
b. assessment of the discourse as a whole to see whether the discourse leads to opportunities to learn and exhibit evidence of reading for meaning by using interpretive, critical, and evaluative processes
c. assessment after the online discourse to determine whether or not the experience has led to synthesis of information and generalization to other texts
d. evaluation of the experience to establish the relationship between student improvement and use of Internet technology

By examining successive posts and dialog episodes, other pieces of evidence from the selected learning goals emerge, such as showing different points of view and multiple interpretations of text. Moreover, when a complete dialog is regarded as evidence of group performance, the assessment system itself embodies a professional level of inquiry that parallels the inquiry behaviors desired from the students.

From a teacher's point of view, student individual postings can be monitored through a simple assessment instrument while the co-facilitating organization, in this case Vermont Center for the Book, looks at the overall dialog for opportunities that explicate the learning goals. In order to assess whether or not the opportunity to learn has indeed resulted in actual student learning, essay exams or similar types of traditional assessments are administered once the online discussions have been finished. Evaluation of survey responses establishes the relationship between student improvement and the online experience.

A Role for Pre-service Education

Because online discourse leaves a record of student performance, rich opportunities exist for pre-service educators to use the Taking a Stand dialogs to examine whether or not the standards addressed in Taking a Stand, or initiatives like it, are exhibited in the student work. The dialogs provide case studies of actual work with the added chance to interact with the participants via e-mail or at the web-based conferencing site. In this particular example, the students will also prepare summative materials. Drafts of essays and digital art pieces in-progress will be placed online for feedback. Pre-service teachers are in a prime position to provide online mentoring as students synthesize what they have learned through online dialog.

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EquiText:
A Helping Tool in the Elaboration of Collaborative Texts

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Abstract: Joining the national effort to develop a long-distance education in Brazil and based on the emphasis of the teaching/learning process bedded on the cooperation/collaboration , this work purposes to develop the EquiText tool, for the production of texts by a team, in a collaborative and asynchronous manner, and expressed through the written language. This tool, EquiText, is easy to use, free, portable and presents organization. Besides, it makes the text is being constructed available to everybody, at the same time. By doing so, all the team can make and see the alterations, and also can see where, when, why and by whom they had been made. Thus, each participant will be able to follow the " movement of the thought " of the other, in a really participant process of collaborative work.

Context and Motivation

In Brazil, there are support programs for the development of computer sciences in educational activities, as the National Program of Computer Science in the Education, which purposes to equip schools and to enable professors. Despite this fact, and also despite the efforts of the schools and the communities to make the knowledge available, there is still a lot of things to do in order to supply the lack of physical and human resources. Even though, the Brazilian educational community makes use of the features of computer

science and in such a way recognizes the importance of these tools in education and learning.

So, it must be pointed out the creation, in 1996, of the first PhD course in Computer Science in Education, at the Federal University of Rio Grande do Sul (UFRGS), aiming to discuss and to suggest: the continued production of innovative knowledge in the computer science areas, education, psychology, and sociology, among others; to consolidate the Excellency Center in Computer Science in Education offered to UFRGS by the Science and Technology Ministry in the II National Plan of Computer Science (II PLANIN); to enable professionals of the educational area to interact with new technologies in its work environments; to support the UFRGS, in the Education Ministry long-distance education program, where several Brazilian Universities are acting in a joined task; to construct tools to support educational environments.

It can be observed in Brazil the necessity of changes in the education which will promote new abilities in the production and use of the knowledge in Computer Science in the Education. It is necessary to improve and to discover new ways of teaching and learning so that there can be a qualified educational system which can take care of the necessities and the goals of this new society in a properly manner. The possibilities of the new technologies of Computer Science must be used by the educational system to prepare the new citizen for a society model based on the new levels of the human evolution. (PGIE, 1999)

Through the Law 9.394/96, the National Education Management and Bases Law (LDB)(MEC, 1999), the Brazilian government points the route to be followed by the Education, by indicating some alternatives for the inclusion in the educational process of as much people as possible. So, long-distance education appears as an option for this because of the existing cultural and educational diversities in this huge country. In this way, by associating the long-distance teaching definition (according to the Decree nº 2.494 of 10 February 1998 (MEC, 1999) to the self-learning method, it is possible to verify that learning can not be seen as an isolated activity. Therefore, it is in the dynamics of the long-distance education, which is carried out most of the times through the written language, that there will be found the motivating factor for acting in the interaction, extending the access to the knowledge, not in an isolated manner anymore, but propitiating the collaborative work.

The theoretical model for this project is based on Vygotsky's social-interactionist theory which considers that the mankind accumulated knowledge can be accessed through the human interaction and also, that when man acquires this knowledge, he becomes the subject of the history, not its object anymore. Furthermore, it must be detached that the essential element of this interaction is the social collaboration mediated by instruments and signs, it means, by the language. The alterations originated in the man's mind by the use of instruments and signs as external support are what allows him to mediate a stimulus which will represent him in other circumstances. This representation is materialized in language, that constitutes a major system of instrumental mediation. Thus, it is verified that the use of technologies, as a mediating element between the man and the social-cultural way, introduces substantial changes in its reality, mainly in education. So, new challenges are brought to the educators because it is up to them to construct innovative methodologies and instruments, which allow a productive work.

In our national context, educator Paulo Freire states that the discovery of the teaching possibility is analyzed through the historical social relation of learning. In Freire's words, "...it was through the social learning that, historically, men and women discovered that it was possible to teach. It was so, through social learning that, along the times men and women had understand that it was possible - afterwards, necessary - to make up ways, paths, and methods to teach. Learning came before teaching or, in other words, teaching is dissolved in the really fused experience of learning"(Freire, 1996, p.26). Still according to the named author, "...when it is produced, the new knowledge surpasses the another one which once was new and becomes old and is "exposed" to be surpassed by another one in the following days. Therefore it is so fundamental to know the existing knowledge as to know that we are available and qualified to produce the still nonexisting knowledge. Teaching, learning and searching, all are about two moments of the gnosiologic cycle: the first in which someone teaches and learns the already existing knowledge and the second in which someone produces the still nonexisting knowledge"(Freire, 1996, p.31).

Freire still points the teaching/learning interrelation as the producing of the knowledge originated from the dialogical teacher/student relation or, according to his words "to bring the other one close to the Freire, 1996, p.132).

This point is reinforced by (Jaffee, 1999) with the idea of the active learning: the "to learn it by doing it" in long-distance activities, usually is materialized through texts, which are not simple transcriptions but rather the products of reflection, reorganization and concept reforms, in a complex process of discoveries. The

importance of this question of own and collective elaboration, is also recognized by Pedro Demo (Demo, 1996, p.24) who affirms "when a text is only read in a reproductively manner or likewise copied, the reasoning, the questioning, the thinking knowledge still does not appear. When it is interpreted, it is assumed that some kind of participation already exists, even if extremely incipient, because it occurs the seeking for the comprehension about the meanings. The comprehension about the meanings of a text implies to establish relations between text and meaning, to move manners to understand and to comprehend, to inquire alternative possibilities of understanding, to discern and to give significance, and so one. This dynamics advances, moreover, when it is about to know how to write or rewrite a text, changing from reader to author. When the own elaboration appears, the knowledge of how to think and how to learn becomes visible". Once more, the concept "learn to learn" is seen not as isolated learning, but also as something that emerges from the interactions who are produced in the group activities, and more specifically, from the texts which have been elaborated by group as its work product.

The challenge of a written production in collaborative way requires to the participants, the emphasis and the will to do it, in a continuous process of displaying ideas, arguments and negotiations. This process requires a nimble dynamics, so that the spent effort can effectively be directed to the creative act itself and not to seek for ways to overcome the difficulties of the mechanical act of writing the material. In other words: when an interaction between communicating people occurs through the machine, the text under construction must be equally accessible to all, at the same time, to allow that all can make and see the alterations, where, when and by whom they had been made, and also, in some cases, why they were done. In this way, each one will be able to follow the " movement of the thought " of the other, and then, really participate in the process.

In this educational optics, the proponent team of the EquiText aimed to identify the difficulties showed by the course of Post Graduation in Computer Science in Educational Course (PGIE) students, who are attending the Tele Education course, through the deeply lived experiences in the distance elaboration of collaborative works. The absence of a tool that could satisfy the group necessities so as: to be easy to use, to be free, portable, to allow organization, purposed the construction and implementation of a helping tool in the elaboration of collaborative texts via Web in an asynchronous way, the EquiText.

According to the interdisciplinary philosophy of the PhD course in Computer Science in the Education, there was a searching for a partnership with students of the technical area in computer science in order to have an effective discussion about the pedagogical proposal and the implementation of EquiText.

Proposal of the EquiText

The Equitext is a tool used for production of cooperative/colaborative texts. This tool works with concept of paragraphs, to facilitate the visualization of the individual contributions, allowing the inclusion, alteration, new exclusion or paragraph proposal. It makes available, also, to the participants, one stack of previous versions, which makes the text accessible to all, making possible the visualization of the alterations, where, when and by whom they had been made, so that the previous contributions are not lost.

The Equitext must be installed in a local server, where the produced texts will be stored. A password distributed to the participants of a work group makes possible the use of the EquiText. This password will allow the unrestricted participation, including, modifying, excluding or considering new texts. The following screen shows a general vision of the original version of the EquiText, seen through browser Netscape.

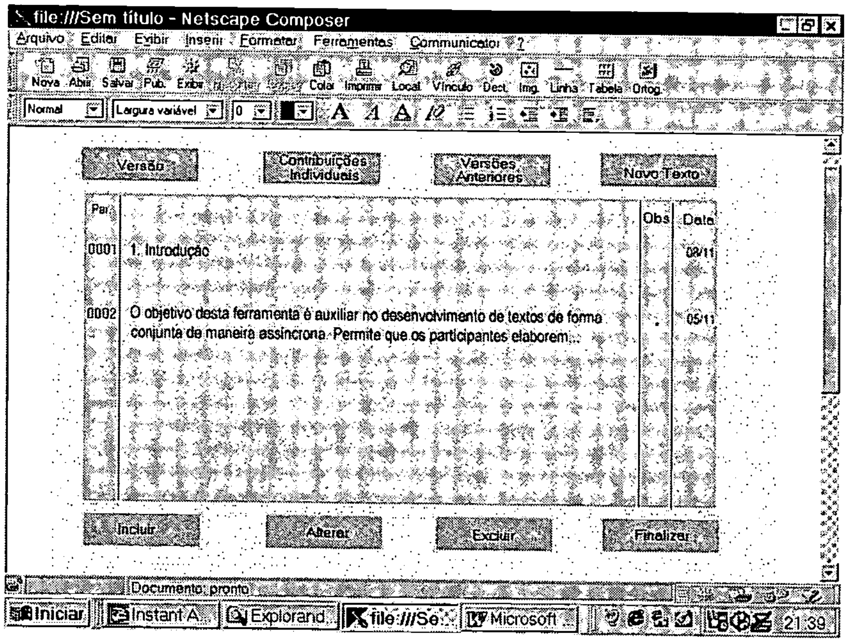

Figure 1: EquiText – Main screen

The EquiText works with the concept of "paragraphs". A title or even a line is seen as paragraphs. Such paragraphs are identified with a sequential number, initiating on number one. Equitext was developed in Perl language (Perl, 1999). Following, the functions of each button shown above are described in a synthetic form.

- *Versão*: it identifies the name of the text and its current version, beyond other information concerning the involved work group, such as deadline, coordination (if it has), links and others;

- *Contrubuições Individuais*: it presents a stack of all the individual contributions to the text, as much for name as for date. In this stack, it has the identification of the participant's name, the type of its contribution (inclusion, alteration, exclusion, new proposal) and the paragraph that was made. It is possible to see, if it has, comments on the contributions proposals;

- *Versões Anteriores*: it contains a stack of links, organized for date, of the previous versions of the text. To each of the participants' contribution (inclusion, alteration or exclusion) is made a copy of the previous version, that is here made available;

- *Novo Texto*: it allows the participant initiates a new text. When he presses this button, he is requested to inform the name of the text and any other necessary information such as conclusion deadline, comments, etc. These notations are visible through the button "*Versão*".

- *Incluir*: it allows the participant to include paragraphs. When this button is pressed, the number of the paragraph to be included is requested. If, like in the example above, the participant desires to include a paragraph after the title " 1. Introduction ", it must inform number 2. This way, after the conclusion of the inclusion operation, the EquiText makes an arrangement of the following paragraphs, renumbering them, so that previous paragraph 2, becomes paragraph 3, and successively. It is possible to make notes for the inclusion proposal. In this in case that, it is attached an asterisk to the respective paragraph, signaling its existence. This alternative is also available for the activities of alteration and exclusion, presented as follow.

- *Alterar*: it allows that the participant modifies an existing paragraph. When this button is pressed, the number of the modified paragraph is requested. If this number exists, all the corresponding paragraph is copied for an properly form, allowing that the desired alterations are made. When the alteration is made, the submission option is allowed, which ups to date the text.

- *Excluir*: it allows that the participant excludes an existing paragraph. When this button is pressed, the number of the modified paragraph is requested. If this number exists, the corresponding paragraph is presented and it is requested the confirmation of the exclusion operation. Then the submission option is allowed. This action ups to date the text, eliminating the paragraph in question, rearranges the numerical sequence of the paragraphs and ups to date version of the text.

- *Finalizar*: it allows that any participant generates a list of the current situation of the text in form of page HTML. This task is made normally, but not necessarily, in the conclusion of the works. The goal of this task is to make possible the elaborated text be independent of the EquiText tool, being able to become a page HTML as another any one.

- The column " *Obs.* " means aditional comments. The paragraph that contains an asterisk in this column, indicates the existence of commentaries that become visible when pressed the button on the corresponding marking. The presented commentaries always refer to the last alteration proposal. However, it is possible to consult the previous commentaries by searching them in the "*Versões Anteriores*" of the text. These commentaries also permit that is established a quarrel on questions of the theme of which text is being elaborated, allowing to offer, to defend and to contest ideas, in a sharing construction.

- The column " *Data* " contains the date where the paragraph was offered or modified. The main goal of this column is stand by the reader in the verification of which parts of the text had been modified, and when this was made.

To use the EquiText, the school or interested organization can acquire a copy for installation for free on the site **ftp://penta.ufrgs.br/pub/equitext**, via download.

Final Considerations

The EquiText is used as a helping tool in the elaboration of cooperative/colaborative texts in long-distance courses, being its implementation occurred during the course of Fundamental and Techniques of Groupware. This version is in phase of test and evaluation.

It is important to say that the current version of the EquiText is not conclusive nor definitive. Since its initial conception it has suffered improvements and it is expected that during its use other contributions for its improvement can appear.

The results gotten until the moment, with the use of the EquiText are promising. The proponent team think to have reached its goals, which are the construction and availability of a tool with features of easiness of use, share, portability and organization. Moreover, the team recognizes that the efforts to try to be faithful to the theoretical and philosophical conceptions that had based the conception of the EquiText, had been preserved.

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The Bowling Pin in Education

PDaccess Online Professional Development Service and the Professional Interaction Networks Project

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Section One: The Theoretical Background Rogers, Moore and the TALC Curve

Over recent years, innovations in communications technology have produced an impressive range of new opportunities, both to the public and private sectors. The explosion of Internet usage, particularly, and the tools which capitalise on this now routinely available service are transforming the speed and efficiency of information transfer within a considerable number of industry sectors. The adoption of these innovative technologies within large instrumentalities, however, provides instigators with particular challenges, related, in part, to the scale of embedded practice and the systems and processes that support that practice. If an organisation is to effectively meet these challenges, it is crucial to understand and address the unique factors that effect the adoption of innovative technology.

The Department of Education publication 'Learning Technologies in Victorian Schools' (1998) states that *'91% of Victorian schools have Internet access'*. While many schools have grasped the opportunity to invigorate their teaching with the immediacy and relevance of Internet, instances of the professional use of digital communication tools to support teachers were few. *What are the factors that effect the adoption of digital communication tools to support education?*

Diffusion theory

Diffusion theory is a research approach, which measures how an innovation is adopted among a population. Everett M. Rogers' innovation diffusion theory is outlined in his book, *Diffusion of Innovations* (1983). Rogers asserts (Chapter 5) that an individual's decisions to adopt/reject an innovation are a process, not an instantaneous event, and that this process has clear and identifiable stages.

Rogers (1986) has qualified his work on the diffusion of innovations to address the special nature of the diffusion process that occurs when communications innovations are adopted. His results revealed three ways in which the adoption of interactive communications innovations differs from similar processes with other innovation types. They are: -

1. A **critical mass** of adopters must be using the innovation to persuade potential adopters to do the same; "the usefulness of a new communication system increases for all adopters with each additional adopter" (p.120). Telecommunications networks will not readily be used by teachers until a noticeable community of educators, and/or information resources designed specifically to support education, are present online.

2. The **degree of use** of a communications innovation, rather than the decision to adopt it, is the dependent variable that will indicate the success of the diffusion effort. Teachers will continue to use Internet worked tools and resources, once introduced to their application, only if they use them regularly and frequently.

3. New communication technologies are tools, which can be applied in many different ways and for different purposes. Therefore, adoption of these innovations is an active process that involves much **re-invention**, or ***"the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation"*** (Rogers, 1983, pp.16-17). Teachers will continue to use digital tools only if they are successful in designing professional development and instructional activities that employ unique and personalized use of the tools that meet specialized needs.

Re-inventability. The importance of re-invention must not be overlooked. Innovations that are more flexible, with many possible applications are more likely to be re-invented than those that are less flexible or are diffused according to a centralized plan (Rogers, 1986). Also, re-invention appears to be very important psychologically to adopters of

such innovations (Rogers, 1983); ***adopters must take the innovation and "make it their own" if use of the innovation is to continue.***

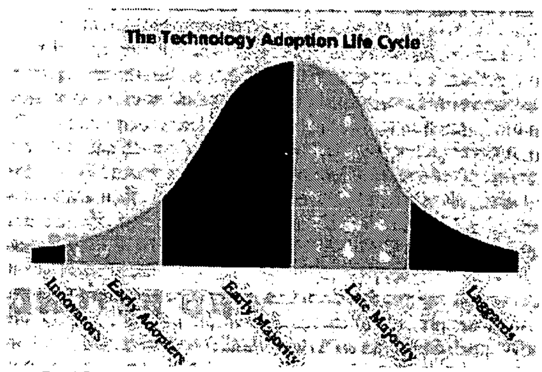
In this model, then, Rogers is seeing the adoption of an innovation as an evolutionary process, a gradual trend, which is assisted by a number of factors which include,

-Critical Mass (number of users/amount of content)
-Degree of Use (routine v occasional use)
-Re-inventability
and, -targeting of Opinion Leaders.

This model provides an insight into the process of adoption, however, it *doesn't tell use what it is about the tool that affects the rate of adoption and therefore* gives little assistance to designers in developing projects which can be effective in the encouraging the adoption of digital communication tools. This is due in part to the identification of *critical mass* and *degree of use* as key factors. While the model provides guidelines to success, a more precise tool, or model, is necessary to isolate the exact factors that encourage adoption of an innovation. In this light, a theoretical model developed by **Geoffrey Moore**, may be more applicable to those wishing to actively encourage adoption.

The TALC Curve

The model developed by Geoffrey Moore (http://www.chasmgroup.com/moore.html) in his publication 'Inside the Tornado'.is based on an analysis of the Technology Adoption Life Cycle.



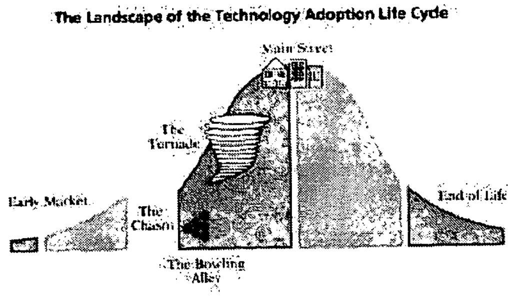
Source: **Inside the Tornado: Marketing Strategies from Silicon Valley's Cutting Edge**

This model was developed as a tool which illuminated the process involved in the adoption and consequent sales of new technology.

Characteristics of individuals involved in the various stages of Technology adoption

Innovators (Technology Enthusiasts): (2.5%): venturesome, cosmopolite, networked with other innovators, financial resources, understand complex technical knowledge, cope with uncertainty.
Early Adopters: (13.5%): respectable, more local than innovators, strong opinion leadership.
Early Majority (Pragmatists): (34%): interact frequently with peers, seldom hold positions of opinion leadership, interconnectedness to the system's interpersonal networks, long period of deliberation before making an adoption decision.
Late Majority (Conservatives): (34%): adoption might result from economic/social necessity due to the diffusion effect, skeptical and cautious, relatively scarce resources.

Laggards (Skeptics): (16%): most localite, point of reference is the past, suspicious of change agents and innovations, few resources.



Moore defines the fundamental problem in the transition from the early adopters to the early majority. The expectations and motivations of these two groups are markedly different. Moore defines this large split between segments in the Technology Adoption Life Cycle as the '**Chasm.**'

Features of the TALC Curve

The Bowling Alley: this is a period where your product is in the market place but it is not yet perceived as a general purpose solution. The beachhead that helped you cross the chasm can be viewed as the '**bowling pin,**' which can be leveraged to penetrate other closely related markets.

Tornado: the tornado starts when the pragmatists in the mainstream (the Early Majority) decide that the product is ready for them to purchase. And, like a stampede, the pragmatists come all at once, with a vortex of product demand. It is during the tornado stage that market share is set.

A pivotal moment in this process is the **'Bowling Pin'**, a key ingredient, configuration or feature which, when added to the product, satisfies the pragmatic expectations of the Early Majority. The process stalls at the Chasm, and it takes a key feature or aspect, a Bowling Pin, to start the tornado of adoption, as the first pin falls and 'knocks over' its neighbours.

In the adoption of digital communication tools by teacher networks, stalled at the Early Adopters phase, a 'Bowling Pin' was needed to cross the chasm.

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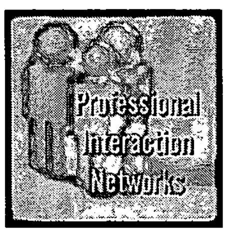
Section Two: Theory into Practice 1:The Professional Interaction Networks Project



PIN project Description

During 1997, the Victorian Department of Education commenced a project entitled **'Professional Interaction Networks'** (The PIN project) (http://www.sofweb.vic.edu.au/pin). A principle focus of this project was to establish the factors which affected the introduction of digital communication tools in support of teacher networks.

The PIN project began in January 1997. A call for Expressions of Interest was published in the February Victorian School News. The initial PIN training courses were conducted on 2/3 and 8/9 April. PIN Networks began operating from the beginning of Term 2 1997.

Through the generation of a Final Report for the Professional Interaction Networks project in December 1997, a considerable body of data was gathered, including audiotape interviews, listserve archives and network reports. A principal aim of the PIN project was, as stated, to determine the factors contributing to the successful use of digital communication tools by teacher networks. Listed below are the crucial factors that were identified as contributing to the success of the networks.

Crucial Factors

1. ***A clear focus***
   The development of a clear aim for a digital network is crucial. Furthermore, if the principle focus is augmented with **'milestone'** targets, a benefical effect is apparent. These milestone targets should be set about 6 weeks apart and are typically simple and straightforward, i.e. *'By the 11th April action plan proformas will be sent to each participant'* and , *'By 5th June Action plan proformas will have been returned'*. Each of these milestones contributes to the long term aim of the network.

2. ***A network Moderator***
   The role of the moderator (effectively a network digital comms. manager) is crucial to the success of the network. The moderator supports network participants by,
   -setting targets
   -providing feedback
   -answering questions
   -maintaining quality
   and, -providing a human focus
   Networks in which the moderation was shared between a number of individuals were less successful than those which had a single manager. The moderation can be 'rotated' among a management team.

3. ***Access***
   Access to appropriate technology is essential. Network participants must have a machine on which to access their nominated communication tool, preferrably an individually assigned machine. Additionally, reliable and quick internet access is an advantage.

   SOURCE: *Professional Interaction Networks: Final Report*
   Learning Technologies Section
   Department of Education Victoria 1997

The identification of these three factors (moderator, focus and access) was pivotal in the lifecycle of the PIN project. With these understandings, the training and support elements of the project can be modified. The 'product' now more closely matched the expectations of the 'Early Majority' teachers. Adoption accelerated and the first gusts of the 'tornado' of adoption disturb the quiet of the 'Chasm'.

By early 1998, guided by the recommendations of the PIN report, training and support to potential PIN networks was modified, and the early stages of a 'tornado' was apparent. There is emerging clear evidence of the expanding adoption of digital tools, as a routine tool in facilitating teacher professional networks.

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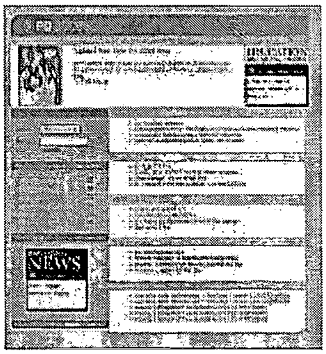
The learnings from the PIN report were crucial. They allowed the recreation of the PIN project as a 'Bowling Pin'. The advice and direction to potential networks now represents a 'whole product', more succinctly addressing network imperatives, through satisfying the pragmatic expectations of the 'Early Majority'.

The isolation and consequent adoption of these three factors enhances the re-inventability of the PIN networks. Through adopting a focus and milestone targets, moderators are re-inventing the application of the digital tool. This re-invention increases the degree of use through increasing the tool functionality in an educational setting, and a

critical mass of users is achieved. The moderators implicitly function as 'opinion leaders'. Thus through the identification and adoption of the PIN factors the requirements of Moores and Rogers models are satisfied.

Section Three: Theory into Practice 2: The PD access project



PDaccess User Interface
www.pdaccess.net.au .

PDaccess is an online professional development support service for educators The site is customisable by learning area, by geographical location, by school sector. It has an educational news service , which has a large database of stories and information relating to all states and all teaching areas. Mostly, however, the site is about professional development, finding it, registering for it and doing it. This is a resource for teachers that knows where and what they teach, what they are interested in, what news they would like to read and who they would like to talk to.

In contrast to a number of recent education projects, both on line and off line, which have achieved only marginal adoption, PDaccess embeds a number of strategies that will ensure engagement from educators. The underlying principle can be summarised in the following manner,

REINVENTABILITY => OWNERSHIP = > ENGAGEMENT

If a user can make the service their own, they are more likely to use it.

Customisation of the facility is the critical adoption tool. Internationally a number of web-based customisable 'portal' projects dominate the market, PDaccess provides educators with access to a comprehensive range of Professional Development through a customisable, easy to use interface.

Teachers consider Professional Development services to be a way in which they can learn, develop, enhance and refine their skills so they can improve their teaching. Professional Development is taken very seriously by teachers and is considered a way for them to stay in the education loop. The key aspect that is attractive to teachers about the service is the fact it can be customised to their needs. This provides them with an element of control and a filtering process that they do not currently have with the way they use the Internet now.

Section Four: Conclusions and Observations

Moore and Rogers models are extremely valuable tools in the process of adoption of new technologies. Designers of educational project will also find them useful models. In establishing a process, which sets out to isolate the key features of an educational project, in terms of its potential for mainstream adoption (Tornado), designers can dramatically improve effectiveness.
In the case of the PIN Professional Development and support procedures, the 3 factors isolated in the final report were the key. If a teacher network wants to adopt digital communication tools, then these are the factors to address,

-Focus (re-inventability)
-Moderation (opinion leader)
-Access.

It is conceivable that the PIN project may have more profound implications. Adoption of the Internet in professional life is linked to a sense of 'ownership', a personal reason for the use of the medium.

PDaccess as a service for Educators failed. The site is closed and the Memorandums of Understanding developed with over 50 Professional Development organisations have lapsed. There were over a 1000 teachers registered with PDaccess within the first 2 months.

Why is it closed? Simply put, the business model associated with the service was deemed too risky to be sustained by EMERGE. The answers are tied to the commercial ethos, but they can be instructive for educators. Innovation cannot be sustained unless it is cost effective, an obvious statement in the commercial realm, but one which educators should heed.

The model was correct, the market uptake sensational, the participation by PD organisation phenomenal.
If you were interested in what became of all that work, look at min (http://www.min.com.au) which is PDaccess for the multimedia and internet community. The site uses the same design, indeed the same database and is very successful. It has attracted investors and grants from the Federal and State governments. It has a bright future.

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The InfoTective: Evaluating an On–Line Curriculum Framework

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Abstract: This paper is a report on the findings from a qualitative case study evaluating an on-line curriculum framework. This framework integrates content, context, and technology with primary documents from the "Valley of the Shadow" civil war website. An emergent design was used to analyze the observational and reflective journal data. Findings indicate that students were highly engaged in the activity and obtained a deeper understanding of American Civil War history through a designed reading, writing, and concept mapping instructional activity.

Introduction There is a nationwide call for the use of technology in the classroom setting and technology literacy. Teachers are inundated with requests from school boards, parents and students to incorporate the Internet and technology into their classes. The teacher-centered social studies classroom needs to move away from the indoctrination, transmittal mode and move towards the more interdisciplinary and constructivist framework of the learner-centered classroom. (Frederick, 1991; Atwater 1991). Frederick discusses historian Henry Adams' disillusionment with' the educational system and with his own teaching. He suggests improving history instruction by involving students more actively in learning and proposes incorporating interactive learning strategies, including (1) interactive lectures; (2) questioning; (3) small groups; (4) critical thinking and problem solving; (5) debates and role playing; and (6) affective learning through media. (Frederick, 1991, 67-83; Hilligoss,1992). The on–line curricular approach equips students with this ownership. Through the use of the InfoTective framework students will use the Internet to study newspapers, letters, diaries, photographs and improve critical thinking skills (Gottesman, 1990; Junn, (1989). Additionally studies have revealed that student participation in active newsgathering and interpretation will enable them to recognize news bias and emotional appeal (Benenson, 1991). Students can become learners through conversations, research, writing, and grappling with data on the Internet. These critical thinking and decision-making skills can outfit the student of today with the necessary tools for competing in the 21st century.

The purpose of this study was to evaluate the merits of an on–line curriculum framework in a social studies classroom. The study explored how students in a high school U.S. Civil War History elective course benefit from the use of an on–line curriculum framework, in this case the retrieval of primary documents via the Internet for reading, discussing, and analyzing its contents.

The Internet in the Classroom Technology tools such as the Internet, if used properly, have opened a window of fresh educational opportunity, and if this opportunity is missed then it can easily become a Pandora's box. Ron Wheeler in the article, *Rx for Social Studies* maintains that the explosion of information and teaching resources (multimedia, audio–visual, computer networks) represents a mixed blessing. He argues that the proliferation of information access necessitates students learning critical and evaluative skills. Furthermore, Gerald Marker in *Social Studies and the Internet: Developing a School Policy*, asserts that while some students will become Internet "fanatics" most will never tap the enormous power of the Internet without a coordinated system of instruction. " For me the most powerful aspect of my study was to examine how using the Internet within an on–line curriculum framework, where access to information is a critical component to the course content, affects the student's learning experience. The InfoTective, an on–line curriculum framework, prompts the student to grapple with primary documents through a variety of instructional methods. This InfoTective activity employs (1) cooperative learning strategies; (2) explicit instructions; (3) tutoring/coaching; (4) modeling; (5) student responsibility/ control; and (6) equity of access to information (Fontana, 1990). This study affords the opportunity to investigate how a web-based curriculum and documents affect the student's understanding of historical events and how do they perform within this environment.

What is an InfoTective? "InfoTective is a term designed for education in an Age of Information. In the smokestack school, teachers imparted meanings for students to digest, memorize and regurgitate. In Information Age schools, students make the meaning. They puzzle their way through piles of (bytes) and fragments, sorting, sifting, weighing and arranging them until a picture emerges"(McKenzie, 1993). In this case the term InfoTective is used to describe a curriculum framework and activity that introduces the student to various methods of instruction to be used while conducting their research of primary documents on the world wide web. This online curriculum framework adopts the integrative model as an inductive strategy and "is designed to help students develop deep understanding of organized bodies of knowledge, while at the same time practice higher order thinking about information they're studying"(Eggen, 1996). According to Eggen,

"the Integrative Model as with the Inductive Model, views learners as actively constructing their own understanding of the topics they study...While the Inductive Model is designed to teach specific topics in the form of concepts, generalizations, principles, and academic rules, the Integrative Model is designed to teach combinations of those specific forms of content in large, organized bodies of information".(1996, p. 35)

Recognizing that the framework that I have developed is far from perfect, I tried to develop and present this curriculum framework in a fashion that utilizes these curriculum models with the Internet and the analysis of primary documents. InfoTective activities encourage the student to become more critical when they encounter information or resources housed on the various web sites. In this cyberworld, interdisciplinary learning approaches are a necessity in order to stimulate students to understand the context as well as the content of historical events. When they are able to understand the sociological and cultural contexts of history then they will experience even greater motivation to participate in the activity. The student will gradually progress to more independent document searches within a predetermined website and ultimately synthesize all researched information using several writing strategies, discussion groups, concept mapping and a final presentation.

In this InfoTective activity about the Civil War the student assumes the role of a CyberHistorian. The CyberHistorian is a student who surfs the web rediscovering pivotal moments in history. The Cyberhistorian's mission is to use the web to explore the principle of connections and to witness history's presence and effects on the present day. After a thorough examination of a variety of sociological, political, and cultural perspectives, the CyberHistorian will construct and personalize history. By way of this analysis of a microcosmic event the CyberHistorian will rediscover and experience history on the web.

The InfoTective Activity When instruction is based on primary documents and a student's ability to understand history by way of primary source documents there has been a qualitative difference in the way they thought about the past (Blake, 1981). The question is how to involve children most effectively in making the connections between their developing time concepts and historical understanding"(Downey, Levstik, 1990). The ability to use primary sources to substantiate argumentation and to improve critical thinking has been suggested as necessary by a variety of curriculum standards or frameworks. Not only does the well written narrative provide an understanding of historical cause and effect relationships, and some domain specific knowledge, yet more importantly, it "contextualizes history and presents it as a human construction open to interpretation"(Iser, 1978). Each component of the InfoTective was meant to bring the student closer to the historical event by witnessing and experiencing this event through the eyes of those who lived in that time.

The Valley of the Shadow

The InfoTective activity in this study uses the Valley of the Shadow primary document web–site as its database. Through a series of instructional steps the student will employ narratives, opposing accounts, artistic works and compare images. With the rapid increase of primary documents accessed through the Internet, the InfoTective seems aptly perched for multiple levels of classroom application.

Study Focus Do student's gain new understandings about the issues of this war and how they affected the lives of the people? Would they understand the connections between the citizens of the valley society and the national government, the interrelationships among all citizens? I began this study wanting to determine the student's computer literacy and learning orientation. I perceived this as the first step that a teacher may want to take in order to prepare for the facilitation of an activity in the computer lab. The learning orientation survey was used to determine the student's academic orientation. This information allowed me to assign students to group according to learning styles, levels of independent learning, leadership, the ability to work within groups and stay on task while conducting research.

Description of Method Because of the exploratory and complex nature of the present inquiry, I used a case study methodology employing multiple methods of data collection (e.g., Lincoln & Guba, 1985; Patton, 1990; Yin, 1984; Merriam, 1998). The strength of the case study approach was emphasized so as to promote an understanding of this unexamined approach to social studies technology education and to raise questions for further research. The targeted school for this study is a public high school located in Albemarle County in a very heterogeneous neighborhood. The school has a traditional configuration of grades nine through twelve. The study took place in a secondary school where the students are familiar with using the Internet in a social studies classroom and teacher who has incorporated Internet activities and used primary sources documents in the curriculum. For the purposes of this investigation, an American Civil War elective course was studied intensively. *Data Collection.* The data for this case study was obtained over a 2 1/2 week period from: (a) interviews with selected students and the teacher, (b) the students' and teacher's reflective journals; (c) student reports; (d) in-class observations supported by researcher notes; (e) evidence of participation in activities (cf., Kirby & McKenna, 1989; Yin, 1994). The study focused on the actions and interactions of two groups of 4 students as they proceed through the InfoTective activities. The InfoTective topic for the treatment groups are titled "Women in the Valley" and "New Political Parties" (NPP). All activities were held in the computer lab with the final discussions and presentations in the traditional classroom setting. The teacher was trained to be the primary facilitator for the activities. The students received traditional classroom instruction in the content area from the teacher of record. I met with the students and gave them an overview of this project and took them on a tour through the site. I described to the students the activities to be used and how they support their course curriculum. *Data Analysis* In the study of this treatment I am open to allowing the events to reveal what actually happens when the Internet is used in a social studies course and how an online framework of this type assists the usage of the Internet. I used an emergent design as the basic method for data analysis.

Results and Discussions Since this case evolved over a period of 2 1/2 weeks in which data was collected as the participants completed each level of the InfoTective activities, I will present the data in sections which represent these levels and discuss the results and implications for each level. I believe that this will provide an opportunity to not only evaluate the entire InfoTective curriculum framework but also investigate the strengths and weaknesses of its parts. Each level will therefore be a "real time" narrative of the events as they occurred then it will be followed by a sections on the implications and recommendations for teachers using this activity and others like it.

Level 1 Information Gathering. The students will choose newspaper accounts from each county and choose one letter or diary as your data source. They will write 1 brief editorial for the pro-abolitionists newspaper and 1 for the anti-abolitionist newspaper. Step 3: Information Sharing: After you have completed the editorial writing activity, cut and paste the text portion of your report into the correct location in the InfoTective on line discussion board. **Level 2** Step 1: Information Gathering: Use the Newspaper and Documents worksheet to read along with all documents. Step 2: Choose one of the letters or diary to read. Step 3: Use the concept map to compare and contrast the data from Franklin and Augusta counties and fill in the respective areas **Level 3** In Level 3 the InfoTectives must pull together and grapple with all of the data and information they uncovered. The InfoTectives will answer essay questions. **Level 4** Reassemble into your groups and write a group essay based on each member's essay. Organize final presentations. **Level 5** Visualize the roles played by the people in this civil war society as that of a family members. Use concept mapping to look for the causes, effects, and interrelationships with regard to the lives of the people in Valley society. **Level 6 Teacher Led Closure Activity** The teacher should use the Matrix provided and lead the class discussions for all InfoTectives assignments.

Observations and Discussion Day One Activity- Although this first day is hectic, I made myself available to the teacher and students for any questions in order to get things started. *Tips:*

- Make sure that all worksheets are stapled and ready.
- Do not rush.
- Write all instructions in a visible location.
- Make sure that all students under stand what they are doing and where are going.
- Read it again all instruction for all of the assignment.
- And be prepared for multiple questions.
- Remind the students to read directions in their entirety!!

When I walked into the classroom the students were ready to go. The teacher had prepared them for the activities. I quickly called all names and placed in into eight groups there were only three groups of four. Most of the students were a little excited. The had obviously, worked in the computer lab often. I was impressed by the number of students who were accustomed to working on the Internet, their keyboarding skills, and basic computer skills were excellent. The group that I am watching the group named, " Women in the Valley", had an interesting compilation. They comprised of one African-American female, two white-American males, and one foreign exchange male student. Initially, the female worked quietly by herself. Later I noticed that they began to break off into pairs. The second group under observation was the "New Political Parties" (NPP) group that consisted of four white-American males. Immediately they worked well together. Unknown to me at that time of the group's organization that two of the students had another course together and they also knew one another out side of school. At the end of the first day there were three kinds of questions from the students that stood out; they were computer operations, document reading, logistical questions, (e.g. Why did my computer shut down? How can I find the author for this article? Can I use this work sheet for all of the reading? Do we have to read all of the articles or just one? Read all instructions before you start clicking? As the student finished the first day, the teacher, Mr. Riddick had some good ideas.

- He closed the sessions by requesting that all of the students return to their same seats on tomorrow.
- Bookmark your web sites
- Start from their respective subject area pages.
- Creating a group discussion table outside of the lab.
- **Recommendations for the next day.** Students must reread instructions. Although there were few problems there remains that phenomena of just clicking on the highlighted areas.

Day 2 The class began immediately. Most of the students came in early and were ready to go. That was a nice feeling. The teacher was the real facilitator today. He actually took over the instruction that allowed me to take more detailed observations. There were a few questions, mainly regarding the availability of worksheets. Again today, the students in the focus group worked diligently on completing their readings for Level One "Women in the Valley". The female in the group worked quietly and alone. One note: She seems to be the emerging leader, the one who the guys listen to and take lead from. Andrew asked Amanda, "Who writes the best in this group", she replied well I write very small so that I can get all of this information onto the worksheet. They also began to strategize about how they would approach the writing of the editorial section. Some of the students were goofing off today. The teacher came to me and commented that "this particular group of guys are just plain difficult". We attempted to spread out the academic levels in our group selections, however it didn't set up perfectly. Amanda had a good question, " How can I interpret this article about taxation and no voting rights for women? I think there was a little old language in the article that needed a bit of translation. The teacher and I conversed about the approaches to moving the activity along. We both commented on the need for built in flexibility in the activity. In other words, we decided to halt everyone and assess where they are in the

reading and then describe to them what is coming next. At this time only two groups are near completing their level 1 step 1, sections. The "Women in the Valley" group is one of them. At the end of the class, the teacher and I spoke about some of the issues regarding computer lab work. He said that some students either because of academic levels or disinterest are less willing to participate in these types of assignments, "It does not matter how brief the assignments are or how detailed the instructions maybe".

Tips:

- Extra worksheets available-prepared!
- Ask students to read all instructions before they click onto the sites. Make note of document page number, so that they will go to the right section of the page. Teachers ready for facilitator role. Teacher must read and be prepared for questions about topic, instructions, and flexible plans in case too much time is being spent on one task!
- The students have really taken to this task, and assignments. Once started minimal direct instruction is needed.

Highlight of the day. Very few questions! Most of the students were on task and moving along! *Day Three* The teacher, Mr. Riddick was very comfortable with the students in the computer lab. He was quite exemplary in his ability to explain and demonstrate to the students everything that the students needed to do for today. Class began promptly at 12:50pm. Teacher organized and settled the class. He facilitated the activity, and everyone started. He told them that they had 15 minutes to complete their editorials. This really got them moving. (I think that the time constraints really help) There were 8 students who entered the class at least 5 minutes early and went right to the web site and started working on their assignments. This was so impressive. They were completing their homework assignments, and preparing to do the group editorial statement. The Groups under study was ready and prepared to finish the next step of Level 1. Amanda came to class about five minutes late. However, her group members were ready and took up the slack. This group had started this assignment yesterday before class ended. The second group began to pick up speed and I watched formulate a game plan for completing their activities on time, (very exciting). Mr. Riddick, commented, "that there was a group of boys who are not usually this motivated, in fact one guy has been doing a bang up job, very thorough work." Several of the students have been responding and greeting me with eager ready to learn attitudes...

Tips:

- Bookmark pages so that student can pick up from where they left off, the next day.
- Be prepared to show cut and paste to some students.
- Instruct carefully to discussion board; make sure that all required entries are in place.

Highlights:

- Students demonstrated remarkable technology skills.
- Good feeling in the room, everyone was working, with the exception of one or two.
- There was a strong sense of accomplishment from the students.

Day Four Amazing start to class 7 students came to class early, during the student break period to begin their assignments. They wanted to either finish part of yesterday's assignment or begin today's tasks. The Teacher calls the class to attention. He outlines on the chalkboard the remaining schedule of activities for next week. He commented on the presentation preparations and the expectations for each task. He also, showed the class their discussion group string and responses. A small group of the students struggled with the reflective journals. The teacher commented to me that they questions were too long. Group 1 "Women in the Valley" is well ahead of everyone. Group two had few questions about there responsibilities and seemed to work well together. Group1 - Amanda and John strategize their approaches to finishing the level 2 task. They take the lead and divide the group and assign everyone to read 1 new article. The teacher is regularly moving about the room, monitoring the work and answering questions. In this activity teacher movement about the room in order to facilitate the assignment seem important. It keeps the students moving forward by monitoring the activity, gives guidance and assistance, further the opportunity to bond with the students via casual conversation. I noticed the teacher having a small discussion about tonight's football game with a couple of the athletes in the class. Teacher comments to me, **"I should have spent more time teaching the about the importance of primary documents and how the fit within the history curriculum."** He realizes that some of the students don't quite understand the significance of documents like these. Teacher decides to appoint a team captain for each of the groups. It did not happen naturally for all groups. Group 1, had a team captain to naturally evolve, because the guys looked to the girl for leadership. Another suggestion from the teacher was list the schedule of the day's activities on the chalkboard daily.

Tips:

- Provide a Worksheet and Instructional Packet for the entire activity.
- Prepare students for reading primary source documents.
- Short teachers may need a stepladder in order to maintain a oversight advantage when making important announcements.
- Designate a Team Captain for each group.

Day 5 Wow, Another day with 9 students coming into class early to either finish or start today's project. All four of Group 2's members are present and working well. They are the most efficient and hardworking group that I have seen. Group 1 also works well together, however they require more prompting from the team leader Amanda. She has really been a leader, very much the first person to go to with the questions regarding the schedule and what to do next. Group 2 on the other hand has a strong composition of independent and naturally motivated students. They work, then come

together for discussions, and then work again. Overall the class is very enthusiastic. Today's class is very settled feeling. They have become familiar with the activity and there are no feelings of confusion or doubt!
I hear students in the background strategizing, Saying, " I'll take Franklin county and you take Augusta". They have decided their responsibilities and have become sub-category experts. Group 1, Amanda, says they are finished, "What do we do next?" The teacher tells them, "Fill in the group chart, and then to begin your journal entries".
Tips:

- Design a manual for the students and one for the Teacher, this will give them more of a sense of mission and a preformatted workbook. Set up tabs by Levels, include Rubric, cover page, and final presentation checklist.
- Divide students into groups as we have, and make sure that they are equally distributed varying academic level. We have noticed that most of the groups are working well together, however, some of the students do not like their topics and wanted other topics.
- Devote more time to group work before this activity so that students are comfortable working with groups. The manuals will also provide them with a more directed sense of purpose.

Highlights:

- Overall great day. Students worked well. Little direction and oversight needed from teacher. They were really working independently, ands effectively!
- Today the students spent much less time reading instructions, not only because the directions were more straightforward, I think that it is also attributed to the fact that they have become more comfortable with the project itself.

Day Six Again 8 students early, however, my feelings about the today's activities are mixed. I think that they may hit the wall today. Group 2 NPP 3/4 of members were early. Group 1"Women in The Valley", also 3/4 are early. Group 2 NPP they are really coordinated. They are preparing and organizing for today's activity. They have already come in early and mapped out who does what for the task. The level 3 writing activity seems to suit this group most. I have discovered from the teacher and by observation that this group has two very high achievers and two who desire to please. The latter two have been in early everyday, and very polite towards the researcher and want to help me. There seems to be no stressing in this group only the mission in mind. As for Group 1 - they seem to need more prompting and encouragement. This group has two really hard and disciplined workers, the leader Amanda and the other Sabastian. These two keep things moving forward. The other two gentlemen mean well, but tend to drift off into personal conversational interests. This group had the most questions about the assignments. They needed clarification regarding what they needed to do. Group 2 works quietly and diligently, organizing and researching for their essays.
Tips:

- Prepare class for essay writing
- Add more hints to the research procedures, re: what to look for, where to go next and what to look for next.

Highlights:

- NPP works incredibly well together. There is different energy with this group.

Day Seven Today, an unusual beginning, there were only 3 students in early. This was not typical. I guess it was because they are growing tired of the assignments or they may be prepared for today's class because they had completed the homework assignment. One of the 3 who came in early is a member of Group 1 Women in the Valley; he came in fired up and ready. He fired off a question to me as soon as he came in to the lab. "I am having a problem finding lots of differences between the Franklin County women issues and the Augusta County women"? I said to him that despite the political and geographical differences between the two locations, maybe there is not too much difference in the sociological and cultural differences. I saw the light bulb come on! Then he began to run off a list of similarities between the two locations.
The students are all in their seats and off typing their individual essays into the wordprocessor and saving them in the archive folders. This was a very intensely quiet time; they were really focused and engaged. Most students are very good typists, they navigated between the browsers and through ClarisWorks filing and saving with ease. All but 5 students brought a completed written essay of at least 2 pages. My feeling for today is this activity was successful because of two things: (1.) The students had an assignment prepared and ready to work when they came into the lab. (2.) They have become familiar with the routine from navigation through the InfoTective site, the valley site, and journal entries. The were very excited about cutting and pasting together their final products instead of rewriting one complete essay.
Teacher repeats today's time schedule. He does a great job at keeping them on task and on schedule. He tells them to finish typing their individual essay and print out a copy for him. NPP moves on, they are rolling. This group has a very mature work ethic. The assumed the responsibility and divide up the work and move on. Teacher stops the class to touch base. "Move on everyone, you should be winding down, and getting ready to start your journals". " NPP" and "Women" groups are nearly finished with essays and half have started journals. One "NPP" member has moved on to begin reviewing the next days objectives, and he has found my personal web page! The class was very engaged in today's writing assignment I guess that this is not new for them. *Day Eight* 5 students leap into the classroom and screamed, "We have a short class today!" I asked them why, they said with smiles on their faces, "We have Club Day today"! Club Day is a period that occurs once a month, where students are given a choice of various extra-curricular activities to participate in. So, Unfortunately today's hour-long class is literally cut in half. The teacher enters the class and echoes the previous announcements, He says, "So, Guys you know what you have to do, Let's get going. We have

1/2 hour to get through most of level 4. If some of you have not finished your level 3 Journal entries then you will have until 1:00pm to finish". If your are ready to start Level 4 then you must go to the Valley of the Shadow and find 1 letter or diary excerpt to be used in your opening presentation statement - An excerpt that speaks with the voice of someone who represents your topic."

Tips:

- Preview Presentation checklist earlier in the sessions.
- Switch levels 4 with level 5
- This activity seems to really encourage students who don't like the traditional classroom techniques. If traditional is defined as writing, taking notes, listening and being engaged with that process vs. Technological techniques is defined as word-processing, surfing the web, detailing analysis from a web site and critiquing web based work.

Highlights:

- Despite the fact that we had a shortened class, they moved on well.
- The students did not waste time; they worked diligently, and were very engaged.

Day Nine Today the Level 4 presentation preparation should be completed and students will begin and some may finish Level 5. There were several questions about how to write an abstract. Despite the fact that I provided a brief explanation of an abstract for them along with instructions on where it fit within the final presentation, they seemed unnerved by this part of the activity. The abstract seems to confuse the students.

Group 1 "Women in the Valley"- This group had many questions about the abstract. They wanted to know what was an abstract, what to put into an abstract, and how long should it be. Group 1- Captain Amanda says, "I am writing the abstract, and you (Andrew), go back and look at the questions asked of our group and try to answer those." As for Group 2 "NPP" 2 of this group's members were blazing through the abstract activity, and the other 2 were glancing over the Level 4 journal questions. This group not only has a very mature approach towards learning they also seem to aggressively take on the tasks and want to complete each task with high honors. I have discovered that 1 of these students is AP, 2 are above average and 1 average. One of the students from the Antislavery Movement topic found a letter and said that she could not understand what it said. The teacher coached her on how to read it and what to look for.

Day Ten Wow, today was hectic. We started class in the traditional classroom. The teacher distributed the Level 5 worksheets, and gave students the option of going to the lab to finish the presentation preparation. Well, there were lots of questions about the Systems Chart. Group 1- these guys are tired, at least they looked tired. No enthusiasm for the activities today. Group 2- Usual- focused and ready to go, lots of academic stamina with this group. They had a couple of questions: Aylor-Group leader asked, " 1. How would we use this systems chart in our presentation? Can we use pictures and maps from the website for our presentation? Can you list on the board what we need for the presentation?" The teacher listed the presentation requirements on the chalkboard and explained each. Some of the students in the other groups are not engaged at all particularly the guys who are below average learners. Being back in the classroom allows them to drift back into the old habits. At least the computer seemed to place some responsibility in front of them, in other words with a computer in front of you and everyone working on something seems to force them to participate in this learning experience as well. I realize that a good lesson should do the same thing, however these guys were also little more intrigued by the idea of working on a computer.

One student politely suggested that his group would perform better if they had some choice in the group selection. He expressed that this would affect the group motivation and in fact he said, "that friends would have a similar motivational level". I trust this young man's opinion, he is the one with his own website development business.

Day Eleven Unbelievable! These students were ultra prepared! Wow I don't get it? Yesterday when class ended I was unsure about what would happen today and unsure about the effectiveness of what went on with the concept mapping activity. The teacher had drawn the matrix on the chalkboard and had printed out his list of questions for each group and was ready to go. He also had written the names of the groups onto small strips of paper and placed the strips into a student's hat. Class began with a small announcement of the drawing and all groups should be ready to go! Mr. Riddick reached into the hat and the first name chosen was A Nation Divided! Wow were they ready! The lights went out and the team captain turned on the overhead for the computer and revealed an excellent web page! What a way to start. Two of the students created the web page using Notepad. The work was all their own. All parts of the presentation were linked and anchored to the corresponding sections and each student took a turn at reading and explaining the significance of their section. The first section to be read was the excerpt. This group chose a letter from a soldier to his wife. Great choice. This letter describes life on the battlefield and day to day events in the camp. The team leader began with the reading and next a student who used the metaphor of a thread to explain how the Nation was dividing/unraveling. Each thread was described and connected to an unraveling/divisive event. The 1st thread was the political divisions between Lincoln and Davis, 2d thread was slavery issue the Union v. the Confederates, and the 3d thread not yet broken North v. South the UNION not yet broken! The second part of the presentation was an original drawing of the metaphor and the nation divided and a Map of the divided nation on the web page. (each person spoke the leader would click onto the corresponding link and display what was being said.)

The third part was the reading of the abstract. The student who read this did very well. He began with the brief summary and then elaborated on it using specific examples from the Franklin and Augusta Counties newspapers! He said, Despite the different political parties' function in the press they all presented articles on slavery, North v. South,

with a local point of view." He used quotes from the press to support his assertion, used article perspectives, and frequently referred to newspaper and letters in his statements.

The students were very confident. The fourth part was to address the questions from the discussion group. They answered the more reasonable questions and then began to answer the questions put to them by the teacher. As the teacher would ask a question the students in the class would fill in their matrix charts. This entire presentation took 15 minutes. The group answered to question #2-newspapers accounts differed! No significant difference in viewpoints. The reports on the candidates were similar. Q#3 Slavery not presented much in the articles that they read. There were more pre-election articles and therefore an emphasis on the election. Q#4 Benefits-Students cited 1st hand accounts, and papers revealed a clear expression of party message. The said that the part press affects the outlook, students answered both pros and cons of the press. The teacher closed with an elaboration of their answers and tied it in nicely to what they had been studying. Mr. Riddick emphasized the importance and uniqueness of Franklin and Augusta counties' perspectives. So many students were impressed with this presentation that they all began huddling immediately after the matrix was completed, before the next name was called.

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Distance Education: Low Tech and Beyond

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Abstract: This panel will focus on the use of distance education in teacher preparation programs at different stages of course development. A small, private Catholic university will discuss a "low-tech" inexpensive approach. The perceptions of the professor and students will be included as well as the decision making process regarding hardware and software. Plans for expansion will also be discussed. A public university will discuss the various forms of course delivery over the last decade.

Introduction

According to information on personnel supply and demand provided by the National Clearinghouse for Professions in Special Education (NCPSE), there is a well documented national shortage of special education personnel that will require an increase in the number of available teachers simply to meet the present need. NCPSE projects that by the year 2005 as many as 502,723 special educators may be needed nationally. . In 1995-96, 4,000 positions in special education were vacant and 28,000 were staffed by those not fully certified in special education across the nation (SPeNSE, 1999). In Texas, the trend is similar. The 17th Annual Report to Congress indicates that 987 full-time special education teachers are needed to provide services for children and youth with disabilities in Texas (OSEP, 1995). At the local level in San Antonio, many districts are forced to operate with special education slots either filled by a permanent sub, who may have little or no formal training, or the position is not filled at all. The problem is more intense in the inner city and rural districts.

Two professors at Our Lady of the Lake University (OLLU) collaborated with 4 school districts on a one year grant whose purpose what to address the teacher shortage in Texas, specifically in critical needs areas. The grant focused on special education certification. A component in this grant was to offer courses through distance education. The short timeline on the grant required the Education Department to quickly establish a means to deliver a course to rural partner schools.

OLLU is located in an urban area, which is surrounded by small towns. To access graduate education, teachers teaching in a rural school must commute to the city. Teachers, as graduate students, must drive a minimum of an hour to get to a 6:30 P.M. class, and then make the return drive after the class is over. The thought of teaching all day and then making this drive either one or two nights a week is a demanding experience, on top of the requirements that must be met to be a successful graduate student. Low-tech video conferencing provided a way for students to travel less frequently to campus.

Education delivery to remote sites - initial experience at the low end

At the beginning of the grant, all members of the partnership were in the beginning stages of technology use. We did not have ISDN lines or T1 lines established to the school districts. But we had partners who agreed to provide a computer. The rural schools were in the process of having the wiring installed for Internet connections. Most of the teachers did not use e-mail but were comfortable with word processing skills. Also one of the professors volunteered "to be a guinea pig".

With limited funds for a 1-year program in 1999, we were tasked with finding a method to deliver graduate level special education courses to two rural schools in a distance education mode. Numerous options for distance education are available; however, they must be appropriate to be effective. Further, existing courses had to be quickly adapted to the method we chose. Finally, the four professors who were teaching the classes had little or no technical training or previous experience in distance education course development or delivery.

Options for communicating in distance education settings range from asynchronous to synchronous, to any combination of the two (**tab. 1**). For the students, who did not have individual computer access, and the instructors, who were used to teaching face-to-face, we needed a synchronous method where students at the remote site could participate in class as a group. Videoconferencing was the solution, but the $2700 budget required a creative low-tech approach.

Asynchronous	Asynchronous	Synchronous	Synchronous	Synchronous	Synchronous
Text	Audio, Video	Text	Audio, Video	Audio, Video, Data	Audio, Video, Data
Multiple Users	Multiple Users	Multiple Users	Multipoint	Point-to-Point	Multipoint
E-Mail	Streaming Audio/Video	Web Chat Internet Relay Chat, MOO	CUSeeMe,	NetMeeting	High-bandwidth video-conferencing
Cost: Included with most Internet access	Camera, microphone, free software	Free software, or web access	Camera, microphone	Free software, camera, microphone	Institutional WAN/LAN infrastructure, or T1/ ISDN connectivity, plus proprietary hardware

Table 1. Asynchronous - Synchronous options for communicating in distance education.

Videoconference Selection

The university had no videoconferencing connectivity or hardware. To install, implement and maintain H.320 videoconferencing would have cost the university over $150,000 per site. Local Area Network-based videoconferencing would not work either, since the outlying school districts were not on the OLLU network and the cost to implement that strategy was also prohibitive. The ultimate solution lay in Internet-based videoconferencing.

Consumer-grade Internet videoconferencing is poor in video quality (max. 10 frames per second (fps)). However, in audio-video distance education applications, audio quality is more important than video. Although the audio quality of Internet videoconferencing is not up to par with switched-circuit telephony, the quality is acceptable. From a variety of Internet videoconference software we chose NetMeeting. A variety of companies market their Internet videoconference software as the solution to videoconferencing for education. However, some companies require a server package costing up to $5,000 for software and licenses. C-U SeeMe, a popular and well-established Internet videoconference program,

available free over the Web, proved inadequate in audio quality. A start-up company's server-based software proved untested and expensive. Classpoint, another server-based program relying heavily on C-U SeeMe, failed to work properly during the vendor's demonstration, and we deemed it too complicated to install and operate if the vendor could not make it work properly. Moreover, this software package was over our budget, as it requires licensing and a server package.

NetMeeting is free from Microsoft. It offers video, audio, chat, application sharing, and collaborating. With a computer loaded with NetMeeting, a microphone, and an $80 camera at each location, we were able to set up videoconference classrooms at a minimal cost. The teaching site, on the OLLU campus, used a computer, camera, digital projector and wireless microphone, while the remote location simply used a computer, camera, and microphone set up in either their school's conference room or library. The total cost to outfit three site's existing computers with cameras and microphones was $550.

Discussion of Outcomes

The panel will also discuss the training for the professor, the perception's of the professor about NetMeeting and its effectiveness, the feedback from the students and their grades. Finally the panel will discuss the plan for expansion for multi-point videoconferencing and the expansion of the partnership through a five-year grant.

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New Distance Learning Initiatives – Doing the Steps

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As new communications technologies impact the higher education, faculty must be trained to determine the most appropriate tools for delivery of their course content. The need for continuing professional development and renewal to adapt to this changing environment becomes critical. Adapting instruction to new technology required, for instructors, consideration of three different aspects of instructional design.

First, the best practice of current instruction must be preserved and renewed. Instructional and evaluative strategies that have been successful in face to face settings need to be examined and, if necessary, altered to continue their salutary effects with students participating from a distance.

Second, technology's instructional enhancements must be incorporated in the instructional design. As technology places new demands on traditional practice, it adds dimensions for learning that were unavailable in older settings. Instructors must recognize, master, and carefully incorporate these innovations. The instructional development model that will serve the needs of both faculty and students much be capable of almost infinite adaptability, however. The recent availability of compressed video, streaming (web-based) video alters instructional choices. Enhanced web bandwidth alone promises that media such as video that are currently the property of synchronous instructional strategies will become available in asynchronous settings as well.

Third, student access to and skill with the new learning environment must be insured. Since learning *with* technology is predicated on some degree of learning *about* technology, efficient instructional systems strive to provide consistent expectations. Students who transfer their learning *about* technology from one class to another can concentrate their efforts on learning in subject areas.

Staff development can further each of these three objectives. With planning and sharing among new and experienced faculty members, it can particularly increase the level of comfort students will find when entering into instructional relationships that are facilitated by compressed video, Internet, and desktop video conferencing.

The training model developed for the College of Education at Northwestern State University in Louisiana focused on the adaptation of existing course to implement new technologies. Instructors optimize their course revision efforts by extending the process over several semesters, gradually introducing new delivery strategies as technology, student ability, and institutional support improve the instructional improvement models that have been followed for basic distance delivery have continued to develop as distance classes, themselves, change to exploit new technologies.

This presentation describes the stages of course development for teachers and students. Media conscious classes involve technology materials in preparation of class material. Text-intensive Internet classes deliver significant course material to students responding from a distance. True Web courses integrate instruction, research, and response in ways that are different from Internet classes. Advanced Web productions include features such as streaming audio and video clips as well as Active Server Page programming supporting data retrieval and database function. Finally, the blending of these new technologies into desktop video conferencing courses allows a merging of the fundamental assumptions that have distinguished synchronous from asynchronous classes from the beginning.

Since technology investment and connectivity control the limits of many of these kinds of instruction, each strategy is considered in relation to the kinds of bandwidth, development hardware, and receiving equipment it needs. In many cases, instructional strategies born of high-end technical laboratories can be modified to apply to sell sophisticated settings.

Each development stage is described according to instructional design, student expectation, and instructional material. Students change in the ways they react to class presentations, analyze course material, and respond to assignments. Classes that move gradually to these new technologies can follow a progression that involve both teacher and student in these changing skills.

Using IntraNet in Technology Classes

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Abstract: In teacher education technology classes, instructors need to use the available classroom/lab technology equipment to manage classroom and class time, prepare class activities, track the progress of students' work, and evaluate group projects. Students need to have convenient information resources, work on the computers, store their lab work, share ideas, work with group, and so on. This paper will present successful experience of using Intranet for the instructor's class management and for students' self-management of their study. Intranet management was used in three technology courses: a computer literacy course in which students work on a technology portfolio that demonstrates 19 computer skills; a computer assisted instruction course in which students designed multimedia courseware; and a Web based instruction course in which students developed web curriculum segment. The processes, methods, benefits, potentials, and some issues of using Intranet in technology classes will be introduced and discussed in this paper.

Introduction

In teacher education technology classes, on one hand, the issue for almost all instructors is whether they can effectively mange the class. They need to use the available classroom/lab technology equipment to manage classroom and class time, prepare class activities, track the progress of students' work, and evaluate group projects. On the other hand, the issue for almost all students is whether they can effectively manage their own study and class work. They need to have convenient information resources, work on the computers, store their lab work, share ideas, work with group, and so on. As in the literature, effectively using the available capacities of computer networks turned out to be one means to solve the above issues both for instructors and students (Siegel, 1996; & Clyde, 1998). As with the use of Internet, the development of an Intranet offers an opportunity for instructors and students to manage their teaching/learning (Birkhead, 1996; Sosabowski, Herson & Lloyd, 1998; & Schwartz, 1999). The research findings suggested that the Intranet had enhanced teaching and learning within schools with minimal cost implications (Dearnig, R., 1997; Butler, Straughn-Mizerski, & Lacher, 1995; Cunningham, 1995; Kelley, 1998; Sosabowski, Herson & Lloyd, 1998). Although most of these previous experiences were in the fields of business education or science education, they provided some applicable structures that can be used in technology classes. Based on the previous experiences, the author of this paper explored some Intranet classroom applications to improve teaching and learning in three educational technology classes. This paper will discuss: (1) the basic concepts of Intranet and it's applications in education, (2) the experiences of exploring the use of Intranet in classrooms, and (3) outcomes of the Intranet-managed teaching/learning.

Intranet and It's Educational Uses

The term "Intranet" is more often used around in conversation than understood. "Isn't an Intranet just a fancy name for a local computer network?" This is a frequently asked question. The answer is "No," although Intranet technology is dependent on aspects of local area networking. Gralla (1996, p XI) described the definition of Intranet as "When Internet technology is applied and used inside a corporation, and open only to its employees, it is referred to as an Intranet." An Intranet is a private network that is developed within an institution or company. It is usually linked to the Internet for external communication (for instance by e-mail), for obtaining information through the World Wide Web, for searching commercial online services. An Intranet consists of all the local networks of the organization or company, including networks at some remote sites of the same organization or company. It is normally separated from the Internet by a "firewall" or security system, so that only people inside the organization or company can access it.

Gralla's definition of Intranet (1996) indicates some major characteristics of Intranets. One characteristic of Intranets is that Intranets are based on Internet network "architecture" (the wires, technologies, hardware, and software behind the system), on Internet protocols (the standard ways of doing things), and Internet software rather than on standard local area network systems. Internet is a network of networks (Maddux, Johnson, & Willis, 1997) based on TCP/IP (Transmission Control Protocol/Internet Protocol); similarly, Intranets are local networks based on TCP/IP (Gralla, 1996). This enables us to use Web browsers to locate information from both Internet and the local system, and to create document/materials with hyper links in a local program (e.g., a ".doc" file in *Microsoft Word*) that will activate the Web browser and locate Internet information.

Intranets can be used for anything that existing networks are used for and more (Gralla, 1996). For instance, via a school Intranet, teachers and students can access and share all kinds of school documents, including text materials such as curriculum information; hyper-materials such as documents with hypertext links (as on the World Wide Web), and interactive materials such as materials in multimedia formats. Gonzalez (1998) suggests that one important aspects of the school Intranet is that it provides the opportunity for collaboration. For instance, students can work together on projects and activities that cross grade levels, buildings or campuses, and subject disciplines. Teachers can also use the Intranet to collaborate on teaching. Another aspect of Intranet is it's potential in professional development (Mintz, 1999). For instance, Intranet can make available training manuals/materials, and provide links to online courses or resources. Students or teachers can learn what they are interested in but is not available within the school.

Taking the advantages of Intranet, there are many ways to organize and manage a technology class that will produce effective teaching/learning. In this paper, the discussions focus on the use of Intranet in three teacher education technology courses: (1) Computer Literacy, (2) Computer Assisted Instruction, and (3) Web Based Instruction.

Problems in Technology Classes

In the three technology courses, all students' assignments and projects were technology "products." In the Computer Literacy course, students were to complete 19 technology tasks:

1. word processing
2. letter head design
3. memo design
4. mail merge
5. mailing label
6. graphic design
7. digital picture
8. e-mail
9. e-mail distribution list
10. spreadsheet
11. database
12. Web search and documentation
13. bookmark
14. Web site evaluation
15. Web information evaluation
16. Web page design
17. PowerPoint presentation
18. software evaluation
19. multimedia authoring (*HyperStudio*)

When students completed each task, the instructor checked the quality of the outcomes, sometimes students needed to revise their work according to the instructor's comments or suggestions. Then they put the revised work into an electronic portfolio. After all 19 tasks were completed, students organized and re-documented them in the portfolio.

In the Computer Assistant Instruction course, students were to finish 10 lab modules of basic techniques and skills of developing multimedia courseware with *ToolBook II*, a multimedia-authoring program. Then they were expected to be able to develop a multimedia lesson segment to teach one specific topic.

In the Web Based Instruction course, students were required to complete 10 lab modules to design a Web page that covered HTML, *Netscape Page Composer*, and *FrontPage*. Then they developed a Web- based-instruction lesson segment and presented it at the end of the semester.

Looking at the technology tasks in these classes, you can imagine how much work students needed to do, and how many files they needed to manage or store. One common problem in these classes was that students had difficulty in storing their files. The size of some file (e.g., PowerPoint file or Web page file) that contained graphics or multimedia components was so large that it could not be stored in one 3.5 floppy disk. While computers in some classroom or lab did not have Zip drive, there was no better way for students to store their files than save them in the computer they were currently working with. However, this violated the rules of computer classroom/lab, and made it hard for the system administrator to mange or maintain the systems. Most of the time, when students came back next time, they could not find the file for several reasons: for instance, sometimes other people deleted the files by accident; sometimes the system automatically deleted the temporary files periodically. Therefore, storing files of large sizes became an urgent issue of the technology classes.

The second problem, hence, was that the instructor found it difficult to check the progresses of students' work, since they did not have a "safe" place to store their files. Even some files could be held in one disk, it was inconvenient for both instructor and students to collect and distribute the half-done projects back and forth each week/class. Because of the problem of file storage, student collaboration and class sharing were even harder.

The third problem was that the instructor found it difficult in class timing. Sometimes when the instructor needed to distribute some files to the class (e.g., some useful graphic-base or bookmark files to the Web design class), the process would waste a lot of time that one student copied the files after another from the teacher's station.

These major problems in technology classes brought out a new challenge to our instructors, that is, how should we manage and control classroom teaching/learning effectively in this new technology age. This challenge was the start of reforming the technology class teaching/learning, and the start of using Intranet into technology classroom.

Using Intranet in Technology Courses

The technology classes were taught in two "smart" classrooms, each of which has 30 computers. One computer lab with 30 computers was open to all the students. All computers in the three rooms were networked within the Intranet of the department. The use of Intranet in these technology classes included the following steps:

1. The system administrator set up a class directory on the Intranet network server. With specified class password, students and the instructor can access this directory from any PC at the network.
2. Each student created an individual directory at the beginning of the course. They would save all their work/files under their own directory.
3. The instructor created "Instructor" directory and some directories for the class, such as the assignment directory, project sample directory, class lecture notes and presentation slides directory.

Figure 1. Class Directory on the Network

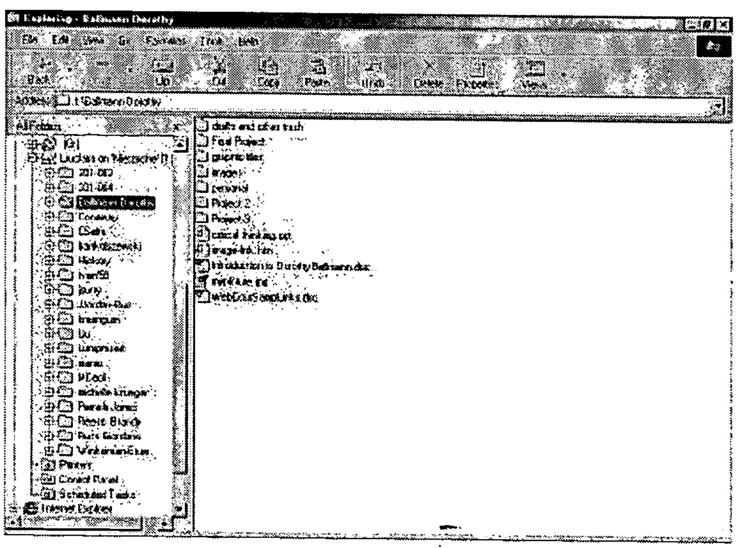

Figure 1 is an example of class directory and students' individual directories. As shown in the Windows Explorer's All Folders window, the (I:) directory "Liuclass" is the class directory, under which listed are students' individual directories named by their names. The directories and files listed in the right frame of the window are the sub-directories and files in one student's directory.

Figure 2. Instructor's Directory

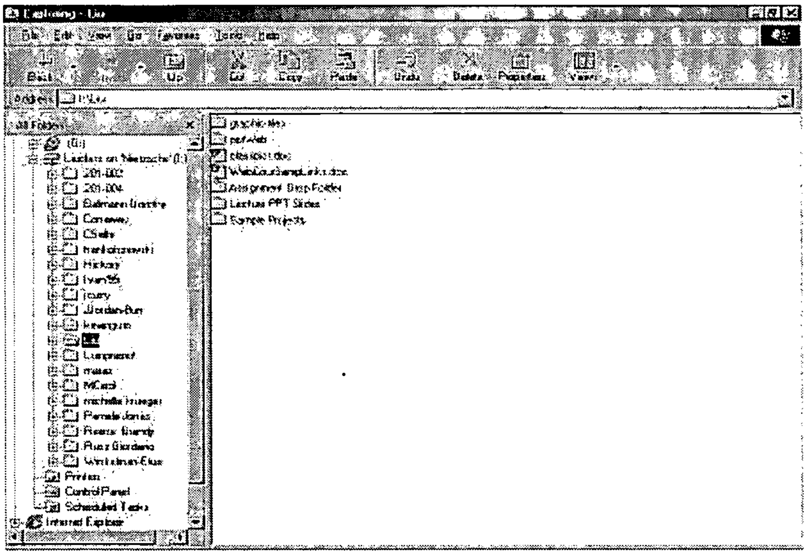

Figure 2 is an example of the instructor's directory, in which listed are some directories that students can find useful information, for instance, graphic files, presentation slides, lecture notes, and sample projects.

With this class directory in the Intranet server, the three major problems addressed in the previous section, to certain extent, were solved. Instructor's classroom management and students' self learning-management were improved. The following are some examples and experiences of using Intranet in the three technology classes:

Example One

Students could store their files of large sizes into their individual directories. In the Computer Literacy class, students managed their electronic portfolio under their own directories. They could access and work on their own files from any computer on the network, that is computers in the two classrooms and the lab. If they wanted to make backup files to the Zip disk, they could find a computer with Zip drive in the lab, log into the class directory with the same password they used in class, open the files and save them into the Zip disc. In the Computer Assisted Instruction class and Web Based Instruction class, they could save and work on their ToolBook program or Web page in and after classes.

Example Two

When students worked on team projects, they could access one another's directory to check the project and keep consistence of the design. They also had the opportunity to review the sample projects or other projects from other class or previous classes. For instance, when teaching two sections of the Computer Literacy class, although the two classes met at different time, and the students in one class even did not meet those in the other class, they can share their experiences and ideas. The most important thing was that they could do this at any convenient time within the Intranet.

Example Three

The instructor saved a lot of class time and arranged more activities within limited class time. For example, to provide the Web class some useful graphic files and useful Web links, the instructor put the files/folders in the

class directory or instructor's directory, students were able to view them directly, activate the links, or copy them into individual directory for further use. Another example was digital picture assignment. Each student took his/her picture with a digital camera. The instructor then import the digital files into the teacher's station. Before using the Intranet, students brought their own disks, and copy or save the picture files from the teacher's station. With the use of Intranet, they could quickly save the file into their directory, or, the instructor could do this while students working on other work. They could open and edit the pictures later.

Example Four

The instructor was able to check the progresses of students' projects, such as the electronic portfolio. Before using the Intranet, the instructor collected students printed hard copy of each task, and the disks. For some multimedia design or Web page design, hard copy could not show the "links" or any effects. Instructor now, with the use of Intranet, was able to check all the interactive properties of the projects. Also, for some technique problem that could not work out within class time, for example, in the multimedia courseware design, very frequently happened problem was the function of button and the transition effect between pages. To solve these problems, the instructor need to check all the script code, which, evidently, could not be done during class time. Now, the instructor could log into students' directory and solve these problems at any convenient time.

Example Five

One method used in these technology class was to encourage students to learn through evaluation. That is, before or during they worked on their own projects, sample projects were provided for them to evaluate. By evaluating other projects, they learned to improve their own designs. Also, before they presented to the class, they evaluated one another's projects, provided some suggestions to others, and obtained some comments from others (they dropped some notes to other's folder, and received some comment note in their own folder). The class directory provided them the convenient environment to review, evaluate, and improve one another's design.

The five examples could be considered as the solutions to the major class problems addressed in the previous section: the storage of files with large sizes, teaching/learning management, and class collaboration.

Outcomes

The outcomes of the Intranet-managed teaching/learning could be summarized as the following:

1. With the use of Intranet, the three classes became more effective. Comparing with the projects from previous classes, the quality of the technology tasks were improved, especially the quality of multimedia designs and Web based instruction designs. Some of the projects showed that students accomplished more than they had expected, and even more than the listed course objectives, because they had more opportunities and time to explore the technologies, and to improve learning by team collaboration.
2. The classes became more interesting. Both students and instructor enjoyed working with it. Students learned knowledge and technology in the way they felt comfortable, which, to certain extent, motivated their learning. Learning could be more effective when the learners were highly motivated.
3. One of the most important outcomes was that students actively involved through the teaching/learning processes, from which they learned to manage their own studies.
4. Students also learned how to use Intranet to enhance teaching. Their projects reflected not only the technology designs, but also the use of Intranet in teaching. They learned this from the way the classes were organized, and from the way they were taught.

The experiences introduced in this paper suggested the positive effects of using Intranet in classroom teaching/learning. In these classes, randomly assigned treatment groups experienced the Intranet assisted learning in different ways, and some data were collected through the class experiences. However, the effectiveness of the Intranet assisted teaching/learning has not been examined statistically. More experiences need to be conducted and, of course, more data need to be collected, if we expect some meaningful results and findings. It is the hope that the main components, factors, and effectiveness of using Intranet could be determined. Also, some issues such as network security and network information sharing need to be considered when adapting the current experiences in the future.

The literature suggested few findings of using Intranet in educational technology classes, especially for teacher education students. Therefore, it is believed that the continuity of the current study would be worthwhile and make contributions to the literature.

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Strategies Used in *Fermilab LInC Online* to Develop Leadership Teams that Integrate Technology to Support Constructivist Learning

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Abstract: This paper describes the Fermilab LInC Online program and the strategies used over the past six years to develop leadership teams who can:

- recognize, design and implement engaged learning experiences for and with their students based on local, state or national standards.
- effectively integrate technology in these experiences to allow students to communicate, collaborate, explore, research and publish in ways that would not be feasible without the technology.
- provide professional development and act as change agents in their region.

LInC has developed and refined a wide variety of scaffolding strategies to assist educators in making the transition from traditional lecture-based teaching to technology-supported engaged learning. LInC has also created a successful online course by developing online strategies to maintain and improve upon essential qualities of the original face-to-face course.

Introduction

Fermilab LInC (http://www-ed.fnal.gov/lincon/) is an intensive full-online, partial-online or face-to-face professional development program for K-12 educators who are already connected to the Internet and want ideas and support for integrating it effectively into their existing curriculum. Our goal is to create a national cadre of educational leaders from urban, rural, and suburban districts who effectively use technology to support engaged/constructivist learning.

LInC (Leadership Institute Integrating Internet, Instruction and Curriculum) was developed in 1994 in response to a needs assessment with area school districts. Among the needs identified were:

- assistance in the transition to a new teaching/learning paradigm.
- staff development for computer and networking skills.
- development of in-district capabilities and leadership in effectively integrating emerging technologies as a means of improving instruction and curricula.

Research such as (Means et al. 1993, Jones & Valdez & Nowakowski & Rasmussen 1995, U.S. Congress, Office of Technology Assessment 1995) identified similar challenges and needs. Current research also calls for increased technology-related staff development, particularly in the area of integrating technology effectively into the curriculum (Trotter 1999, CEO Forum on Education & Technology 1999).

In addition, the needs assessment attendees requested online resources and distance learning opportunities. Fermilab LInC is a non-profit grant-funded program that addresses these needs and was created by teachers for teachers. The LInC goals and design were developed in collaboration with a team of master teachers. To date, 30 educators from 12 school districts have participated as course facilitators or on the program design team. In all, about 200 educators from 60 school districts in 18 states have participated in the LInC program. The participants have included classroom teachers (from all K-12 grade levels and a wide range of subjects), staff developers, curriculum coordinators, library media specialists, counselors, technology coordinators and administrators.

LInC was originally offered in a face-to-face format and was expanded into an online format starting in the fall of 1997. Offering the course in an online format has enabled us to serve a more diverse group of educators. In the past two years of online courses, 74% of LInC participants have come from urban or rural districts. Some of our participants have stated that this type of expertise and staff development is not available to them locally. Participants have also reported that they greatly enjoyed working with a more diverse group of educators than they typically encounter in their own districts. The online strategies we have used have helped us to achieve an 85% retention rate in our online classes.

The strategies described in this paper have been developed and adjusted over a six-year period based on participant surveys, proposal and project assessments, instructor reflections during and after each course and input from an external evaluator. These strategies are not intended for use as a fixed recipe for staff development. Instead, consider them as tools to be selected, adjusted, mixed and matched according to your audience's needs.

Fermilab LInC Online Program Overview

The LInC program challenges participants to combine engaged/constructivist learning with effective use of technology to develop powerful learning projects for and with their students. The projects are Web-based and address local, state or national standards. In addition, the participants, as school/district leadership teams, create a staff development plan for their school or district.

The program includes the following components:

- an 80-hour course that can be taught face-to-face, partially online or completely online
- extensive Web-based instructional materials for participants (Mengel & Bingham & Ciesemier & Clifford & Gatz & LaMaster & Marszalek & Meehan & Quigg & White 2000a)
- follow-up support as participants implement projects and offer staff development
- a facilitators' academy for teams that wish to offer LInC or a similar course
- extensive Web-based materials for facilitators (Mengel & Gatz & LaMaster & Marszalek & Meehan & White 2000b) and support from mentors as teams conduct their first courses

The LInC course is usually taught as a one-semester (14-week) course for 4.5 graduate credits. The facilitators' academy is taught as a three-day face-to-face session for 1.5 graduate credits.

During evaluation by an external evaluator, LInC participants reported:

- engaged learning instruction positively affected teachers' classroom practices.
- greatly increased technical knowledge and skills.
- providing technical assistance to teachers and others.

After participating in LInC, many participants were involved in leadership behaviors such as:

- conducting inservices and workshops.
- writing grants.
- participating on a technology committee.
- participating in efforts to improve teaching and learning in their school or district.

Evaluation of the online course concluded that classroom projects were of similar quality to those produced in the face-to-face course.

Engaged Learning and Technology Integration Strategies

Scaffolding Engaged Learning and Technology Integration

The LInC program has used and refined a collection of scaffolding strategies to choose from to foster engaged learning and effective use of technology. Instructional materials for all of these strategies are available from the engaged learning section of the LInC Web site. Strategies include having participants:

- take part in a short simulation in order to experience a technology-supported engaged learning activity from a student's perspective.
- share their own best learning experiences and construct a list of indicators of engaged learning and effective technology use by identifying common attributes of their best experiences.
- read *Plugging In* (Jones & Valdez & Nowakowski & Rasmussen 1995) and compare its list of indicators with the list they created.
- discuss model and non-model project examples to identify the presence or absence of indicators of engaged learning and best use of technology.
- observe a live modeled group discussion that demonstrates the typical process involved in creating and revising a project proposal.
- read an example short series of e-mails between a project team and a facilitator that demonstrates the typical feedback and revision process for a proposal and later project work.

In addition to the above, we have developed a four-part activity to practice changing traditional curriculum which does not use technology to technology-supported engaged learning. In the first part, participants view strong and weak examples of proposal elements and then identify whether additional examples are strong or weak. In the second part, participants view and discuss "before" examples of whole proposals, a facilitator's analysis of the proposals (including guiding questions posed to the author about areas that can be improved) and improved "after" proposals. In the third part, participants view "before" and "after" examples of proposals and write facilitator's analyses. In the final part, participants view "before" examples and write facilitators' analyses and design improved "after" examples.

We recommend that participants do several of the above activities *before* they create a project proposal because it is easier to objectively analyze and learn from project ideas that are not their own or their colleague's. The next step is to have participants collaboratively create and revise their own project proposal for a unit within their existing curriculum. The proposal is short (about one page) and identifies key project elements such as learner outcomes (based on local, state or national standards), authentic task, hook, student direction and effective use of technology. We recommend having participants refine a project proposal *before* they start investing many hours in creating Web pages for their projects. Typically, we ask participants to brainstorm several possible project topics, narrow it down to two project proposals, and then discuss and choose the most promising one to proceed with.

In addition to the proposal, LInC participants write a scenario which describes their vision of how their project will play out in their classroom. The scenario is a narrative version of what someone might see and hear if they were visiting the classroom as the project is implemented. This helps participants reflect on and plan their project and get a clearer picture of what implementing the project will be like. This can help participants anticipate problems and decide how to work through them. The scenario is also an invaluable tool for facilitators to use to determine if participants understand and are applying engaged learning and best use of technology in their project. This allows facilitators to pose targeted questions to guide participants in recognizing and incorporating missing elements.

To complete their project, participants design Web pages for students to use to work through the project. Web pages for students invite students to start on the project by offering an authentic task or situation that piques their curiosity. The Web pages for students must provide enough information and resources so that students can form their own questions, make choices about how to proceed, explore alternatives at their own pace, collaborate with others and produce original work. Participants also create a rubric or a framework for a rubric that students contribute to in order to assess student work.

Modeling Engaged Learning and Technology Integration

The LInC course and facilitators' academy are designed to model the new teaching/learning paradigm and effective use of technology that we want educators to implement in their classrooms. This is important in order to have participants experience this style of learning first-hand, which improves their likelihood of incorporating it. This is modeled in many ways throughout the course. In particular:

- We respond to individual learning needs of participants, facilitating their movement along the continuum from more traditional to more contemporary teaching strategies. We ask participants to let us know their preferences and problems during the course and then adjust the course as needed to address their feedback.
- For the course, LInC participants have the authentic task of creating a curriculum unit on the Web for use with their own students that incorporates engaged learning and effective use of technology. For the facilitators' academy, participants have the authentic task of creating materials needed to offer a LInC course or similar staff development in their area.
- After initial discussions about engaged learning and effective use of technology, the majority of the course consists of participant-requested breakout groups which discuss the topics participants need to make progress on their projects or staff development plans. This encourages participants to direct their own learning.
- Course facilitators assist as coaches and guides as participants design and publish their work.
- Participants work collaboratively by frequently sharing their work, experiences and skills with their colleagues and by giving each other feedback. Participant discussion groups are formed and varied as needed during the course to give participants access to a variety of different perspectives. Most participants choose to work together on a project with their LInC team.
- Participants are encouraged to take on an instructor role by assisting other participants or by starting a discussion on an area of expertise. Past experience is valued and built upon.
- Participants are asked regularly to question and reflect upon their teaching, course concepts and how they might apply these concepts.
- Participants learn technical skills by using technology *as needed* to create their projects and staff development plans. Technical skills are not taught as an end in themselves. Technology is used to communicate and collaborate with experts and peers, to research new and frequently changing information and to publish original work to a worldwide audience.
- Course assessment is performance-based (based on project components), generative (participants construct knowledge and develop a useful product) and ongoing.

Online Learning Strategies

Effective online instruction shares many of the same characteristics as effective face-to-face instruction. Some of these characteristics may seem like they happen automatically in a face-to-face class. These don't have to be lost just because the course is online. They just have to be planned in more deliberately and adapted for use in the online medium. In fact, the need for some of these characteristics actually becomes magnified in an online course. This includes essential features such as making sure students are prepared for and know what to expect from the course, facilitating meaningful and frequent interaction for participants, coordinating staff for effective team-teaching, and providing useful resources for class work. LInC's strategies for incorporating these features are described below.

It is very important that participants have the prerequisites needed for an online course. If they don't, they will not be able to use the very mechanisms that are in place to help them during the course. To accomplish this, LInC uses an online application. This immediately screens out applicants who are unable to use a Web browser or an online form, or who don't have a working e-mail address. Because some people do not realize that they do not meet the prerequisites, the online application also contains specific questions that a person without the course prerequisites would be unable to answer. In addition, the application contains items asking if participants are able to meet specific commitments and dates for the course. This clarifies and draws attention to the key requirements for the course.

It is also important that participants know what the process of taking the course will be like. We compare taking an online course for the first time to being in a foreign country. Participants need to know the "local customs" in order to be comfortable and effective. We provide an orientation for participants to let them know the goals, process, product and resources for the course. This includes an introductory description of the class, tips for success in an online course, a scenario describing what a participant does in a typical week and a tour of the resources available to help. In particular, participants need to understand that the online chat serves the same function as a face-to-face class meeting, that they need to schedule

regular blocks of time to work on the class and resist the temptation to procrastinate, and that they need to be active in asking questions and sharing ideas so the class can meet their needs.

Another crucial component of a course is interaction. This makes the course meaningful and reduces procrastination. In LInC, participants have frequent interaction with each other by attending weekly two-hour online chats where they discuss requested topics, collaborate on projects and present their work for feedback every few weeks. In addition, participants are asked to reflect and share ideas using the electronic discussion board or the course listserv. Participants also have frequent interaction with course facilitators. The course is team-taught, but each of the participant teams has a "primary facilitator" who is responsible for guiding that team and making sure their needs are met. Participants can ask questions or request feedback at any time by sending e-mail, posting a message on the bulletin board or attending optional weekly office hours that are offered via online chat. Facilitators check for postings many times throughout the week so participants do not have to wait a week until the next class session for a response.

Any course that is team-taught requires facilitator communication. In a face-to-face course, this may happen at lunch, on breaks or as participants are arriving for class. These meetings do not happen as automatically in an online course, so they need to be scheduled. In addition, LInC has developed several other strategies for facilitator communication. Firstly, LInC facilitators meet in the same physical location for key online chats. If they are not in the same physical location, they communicate with each other on a special channel *during* online chats for class. This is extremely useful because it allows facilitators to support each other in answering questions, moderating discussions and coordinating times to switch to the next breakout topic. Secondly, LInC facilitators send a copy of all e-mail communication to a staff listserv. This allows all facilitators to understand the progress of all participants. This is especially useful for office hours because any participant may come and ask questions of whichever facilitator is offering office hours. This also avoids duplication of work because one facilitator can incorporate an answer from another facilitator if a similar question arises. Lastly, mentors provide extensive support to new online facilitators. They do this by attending the new facilitators' online chats and answering questions from the new facilitator during the chat using the special channel for facilitators. They also answer questions from new facilitators outside of the chat via e-mail and phone and help new facilitators plan their courses.

Finally, effective resources and information dissemination are very important for an online class. Communication and resources need to be more complete and varied in an online course where participants do not see or hear instructors each week. To compensate for this, class information needs to be communicated in multiple ways and take multiple learning styles into account. For example, orientation information for LInC is discussed in an online chat, posted on Web pages, mailed to participants in hard copy and communicated in an introductory phone call. Extensive online materials are available at all times to participants so they can proceed at their own pace and direct their own learning. These online materials include guiding questions, examples, descriptions, templates, rubrics, tutorials and resource links. Media used include text, graphics and animation clips with and without audio. Participants can use their preferred navigation aids to find needed materials. Aids include a navigation bar, topic home pages with annotated lists of resources, a table of contents, resources listed by assignment and a search function.

Leadership Development Strategies

LInC employs a variety of strategies to develop leaders who can assist others in effectively using technology for engaged learning. These include administrative, follow-up and other strategies.

We require participants to come as school/district leadership teams rather than individually because teams are more effective at catalyzing change in a district. In order to ensure that participants come with administrative support, the program is discussed with administrators and they must submit a letter for their team indicating how support will be provided in each of the key areas needed for successful participation. In addition, we ask participants to contact and involve key people in their district when they plan and roll-out their staff development in order to get input and ensure "buy in."

LInC also provides follow-up support which is an essential component to ensure that the learning is implemented back in the classroom. Follow-up activities include a listserv and face-to-face or online meetings to learn about the latest innovations in technology and education. During these meetings, attendees share concerns, ideas and information about topics they have requested such as grant writing, staff development, project implementation, problem-based learning and cutting-edge software.

In order to sustain change and so that dissemination is not left to chance, many other facets of the program give support such as peer review and coaching, an embedded leadership component, online materials for participants and facilitators that can be used as building blocks to create and tailor local staff development, an academy to develop facilitator skills and extensive mentoring for new facilitators.

Conclusions and Future Work

LInC is an effective program and is continuing to expand to better serve a larger audience. An external evaluator concluded that LInC is an "effective model for Internet use, classroom instruction and teacher training." LInC has developed and refined a wide variety of scaffolding strategies to assist educators in making the transition from traditional lecture-based teaching to technology-supported engaged learning. LInC has also created a successful full-online course by developing online strategies to maintain and improve upon essential qualities of the original face-to-face course. The online format has allowed more educators from under-served urban and rural areas to participate. Another strength of the LInC program is the development of teams of educators who provide leadership in their districts in the form of staff development, technology committee participation and grant writing.

Currently, we do not have enough capacity to offer the course to all educators who have requested it. We are seeking partners to develop "centers" which offer LInC Online on a regular basis in order to provide the professional development needed to create more educational leaders who use technology to improve teaching and learning.

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Designing a School's Web Site Using Information Architecture

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Abstract: This paper is a case study of a K-8 school in San Diego, California, USA, that is using the concepts of information architecture to develop its Web site. The site is intended to be a virtual meeting place for all of the school's constituents: parents, teachers, students, and the community at large. The site is a dynamic, ongoing endeavor, and site developers will continue to use processes of information architecture to guide its growth. The paper presents the school's Web site, the theoretical background on information architecture, and recommendations for other schools pursuing similar projects.

Introduction

It is often stated that we live in an "information society." Increasingly advanced communication technologies, including the Internet and digital telecommunication technologies, allow us to communicate across the globe at faster and faster rates. Wurman (1998) describes the situation as a "tsunami . . . a tidal wave of unrelated, growing data" that requires organization if it is to make any sense (Wurman, 1998, p. 15). Clearly, educational institutions are not shielded from this "tidal wave" of information. The Internet has pervaded most levels of society, and we hear increasing calls from politicians and educators to provide teachers and students the opportunity to use the Internet for instruction and learning.

As we have become submerged in this ocean of information, the discipline of information architecture has evolved to meet the challenge of organizing and using information to provide meaningful communication. Information architecture is a structured process of presenting data to meet the informational and management requirements of an organization or group of people, and its focus is always user-centered. This paper presents a case study of the applications of information architecture to the design and development of a K-8 school Web site.

The Longfellow Web Site

Longfellow Elementary (located in San Diego, California, USA) is a Spanish Immersion Magnet School with grades K-8. The program was started in 1977 and serves about 500 children from all over San Diego. Students become fully bilingual in Spanish and English by the time they leave the program. Teachers and administrators at Longfellow perceived a need to improve communication between parents, teachers, and the community at large. This need gave rise to the idea of using a web page as a tool for communication and to have a virtual representation of the school community. The primary goal of this ongoing project is to encourage the entire school community to participate in the information exchange provided by the school's Web site. The Web site is a virtual meeting place where all members of the community can share important information and have dynamic and useful interactions. The school community is separated into three groups: parents, teachers, and students. Each group has the opportunity to best use the virtual space on the Web site to meet its unique needs.

Traditionally, school Web sites are used to provide basic information about the school and do not go beyond a superficial "show and tell" of schedules and activities. The project at Longfellow has broken away from

this model by using principles of information architecture to structure the site to meet the needs of a diverse community and to develop new uses of Web technology.

Information Architecture and Web Page Design

Theoretical Background

The field of information architecture embraces such diverse disciplines as business administration, computer science, cognitive psychology, graphic and typographic design, and technical communication. A user-centered approach to design is informed by principles of information theory and communication theory, information design theory, the findings of cognitive psychologists on perception and learning, hypertext theory, and sociocultural learning theory. Some of these theoretical considerations are briefly discussed below.

Information design theory draws on information and communication theory to suggest that designers structure information in ways that minimize "noise" and facilitate the transfer of meaning. Many factors, including personal characteristics, past experiences, and present feelings, can affect individual interpretation of sensory information (Stern & Robinson, 1994).

Vygotsky's (1978) sociocultural learning theory suggests that learning takes place as learners interact with more advanced peers and adults. The Vygotskian model of instruction is highly democratic rather than authoritarian. The teacher is a co-participant in the student's construction of knowledge (Stremmel & Fu, 1993). Effective instruction requires intersubjectivity, or the creation of shared meaning through collaboration (Stremmel & Fu, 1993; Wertsch & Sohmer, 1995). Teacher and student share power and authority in the classroom (Driscoll, 1994). The distribution of responsibility for both learning and instruction among students as well as teachers is a hallmark of the Vygotskian model.

Hypertext can provide instructors with a powerful tool for allowing learners to visually map their own representations of knowledge. Collaboratively-developed hypertext documents can also serve as sociocultural learning tools, providing learners the opportunity to "interact" with peers and expert users, even those who are geographically removed from the learner (Victor, 1999a).

A User-Centered Model for Development

The literature on information architecture suggests that Web site creation requires a systematic process of audience and content analysis; creation of detailed site diagrams and documentation; and production and implementation (Rosenfeld & Morville, 1998). Development of user-centered Web sites may be guided by a four phase model: Design, Develop, Deploy, Document (Victor, 1999a). This is a cyclical, iterative process, as illustrated in the following diagram:

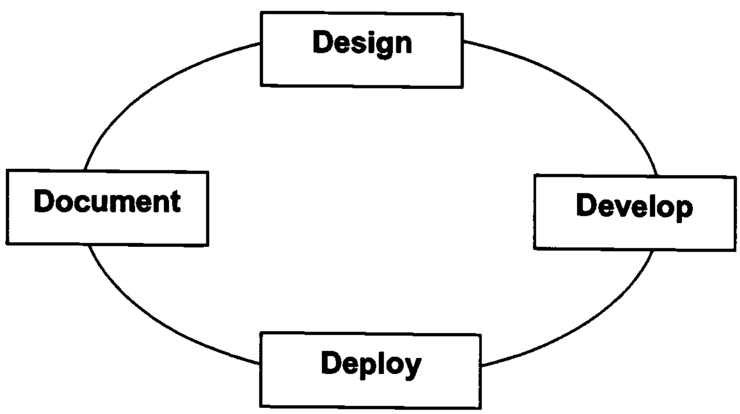

Figure 1: A user-centered model of Web site development.

In the **Design** phase, the designer performs needs analysis, audience analysis, and task analysis. The activities associated with this phase are identical to those found in traditional models of instructional design. In

collaboration with the intended audience or the client, the designer develops initial prototypes and blueprints. After client approval, the project moves to the **Develop** phase, in which the development team builds the product according to the specifications developed during design. In this phase, the designer works with graphic artists and technical experts to build the site. As the product is developed, the design/development team meets with the client for discussion and negotiation of modifications, if needed. Upon client approval of the final product, it is moved to the **Deploy** phase. In this phase, the Web site is installed and made available to the target audience. In the **Document** phase, the design/development team assembles project documents and blueprints and presents them to the client to guide future product revisions. This documentation feeds into future Design phases, and the cycle continues.

Design and Development of Longfellow School's Web Site

As stated above, the Longfellow School community include parents, teachers, and students, and the Web site provides for the needs of each group. There are sections dedicated for the use of each group of the school community. In keeping with the user-centered focus of information architecture, the Web developers at the school chose to adopt a child-centered process from the start. Children were allowed to vote on different aspects of the web page since the children's education is the primary reason for the existence of the web page. A child-centered approach also helped the Technology Committee to decide on what information to allow in the School's web page. Even the information placed on the web page by adults is made to help the education of the children. The teacher and parent sections are left to the discretion of adults, and the student sections are created with adult supervision.

Another important contribution of the Longfellow Web site is that the students are able to publish their work on the Internet. Proponents of constructivism suggest that learners construct their own knowledge in ways that are personally meaningful and so should be allowed to engage in activities that aid them in their own construction of knowledge. Knowledge is constructed as users assimilate multiple perspectives on a topic (Nelson & Orey, 1991). Schools can use the principles of user-centered information design to allow students to create Web-based resources that foster their own construction of meaning (Victor, 1999b). At Longfellow, students learn to be participants in the "information superhighway" through a constructivist approach from very early in their lives at the school. The experience of publishing their own work helps them become more critical consumers of information as they learn to evaluate other information they see on the Internet (just as playing an instrument helps with music appreciation).

Further assistance has been provided by SciberNet, Inc., a software development company that has helped with hosting the site and with training staff and students in creating Web pages. They also provide guidance with technical questions. Each summer, SciberNet has trained approximately 20 students from grades 3-7 to create web pages in two sessions. Several teachers also participated in these training sessions.

Through a grant received from the State of California, all staff at Longfellow were given monthly inservice training in technology for two years, including training in Web page development. After analyzing surveys of staff computer proficiency, it was determined that the school's level of computer knowledge had gone

Contributions of Information Architecture

The first attempts at creating a web page at Longfellow proved to be exciting, but as more information was added to the side the need for change became evident. The site became increasingly complicated, and the user could get lost trying to navigate through it. It was clear that a complete remodeling of the web site was required. Application of principles of information architecture allowed for the newer version of the web page be friendly and useful to the user.

Distinct categories on the opening page help users determine what information they can access on the site. In addition, the depth (number of links) to get to the desired information was placed to a minimum (2-4 jumps at the most). This eliminates the confusion of scattered information and assists the user in finding required information rapidly. A clearly-defined labeling system is an essential element of a usable Web site (Rosenfeld & Morville, 1998). Longfellow has adopted a color-coded labeling system to it easy for users, especially children, to access desired sections of the site.

Organizing information using information architecture has made it easy to assign Web development responsibilities to specific individuals or groups, simplifying site maintenance. This has created a more cohesive organization system since members of the community are able to learn about and from each other. The Longfellow site contains links to relevant educational resources outside the site, removing the need to surf the Internet looking for information. This capability helps users invest their time more wisely and enhances the educational program of the school.

Description of the Site

The site's opening page introduces the school and provides links to each community group's section, as shown in Figure 2.

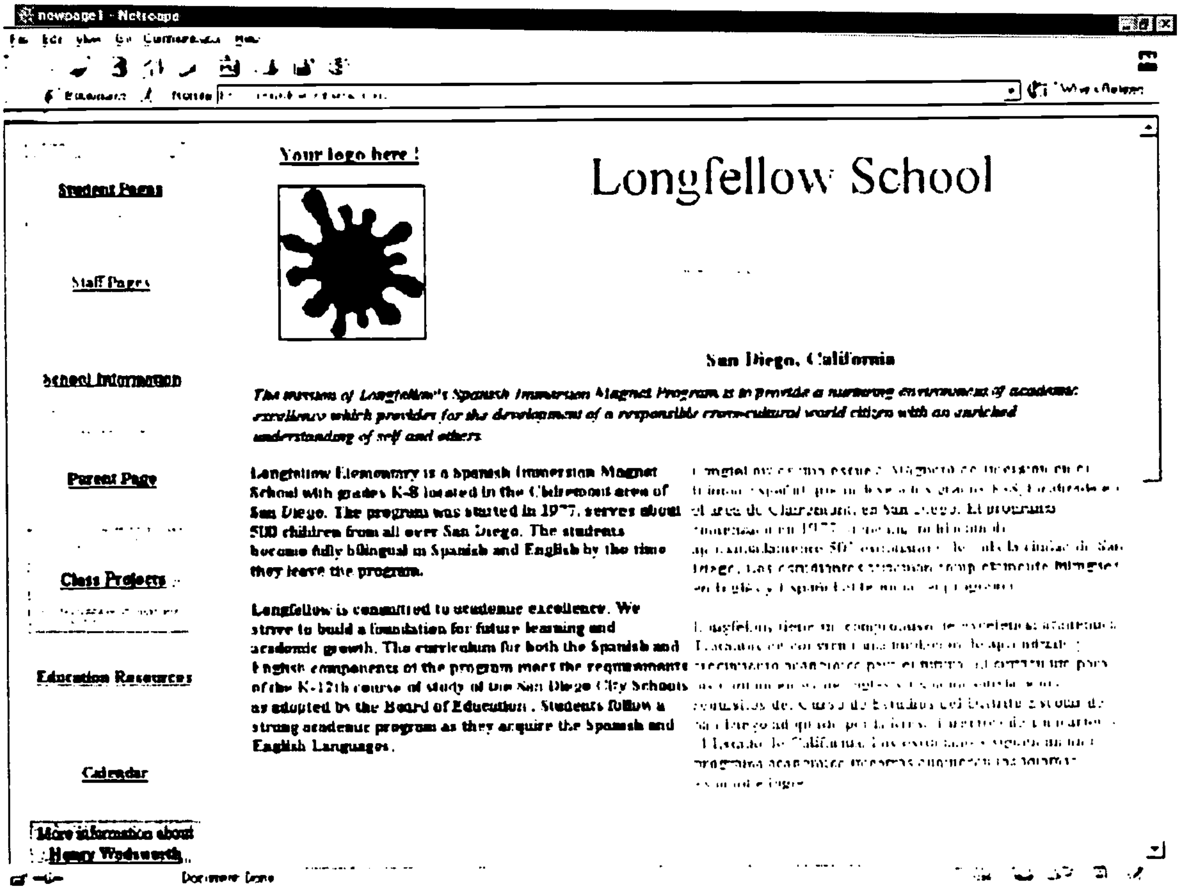

Figure 2: Longfellow School Web site (http://longfellow.scibernet.com/).

On the left column, the student pages are placed at the top to emphasize the importance of a student-centered approach. Students use this section for publication of their work.

Beneath the Student Pages link is the link to Staff Pages, where teachers give important information about the educational programs available at the school. Information such as daily schedules, class rules, book report forms, and other handouts are available for parents and students 24 hours a day.

The Parent Page section gives information on PTA (Parent Teacher Association) meetings, parental involvement activities such as beautification projects, fundraisers, and a yearly schedule of events.

The School Information section explains in greater detail the specialized language program at Longfellow. Furthermore, the Education Resources page provides links to the Internet that are relevant to the education of

Discussion and Recommendations

The design and development of the Web site at Longfellow School has been a valuable learning process for the Longfellow community. We hope that other schools can learn from the experience of Longfellow. The following recommendations have emerged from the process of developing a Web site for the Longfellow community.

- A major area of concern is that while a large number of people are included in the project, and most do not have a good idea of how to create a Web site. Training in site design is essential; ideally, all members of the community (teachers, students, and parents) should have some training. It is also important that participants work toward developing consensus on site contents.

- Initially, the information placed on the web page needs to be important and of great value to the school community. It should also be information that does not change frequently (for example, book report forms or Frequently Asked Questions) since it is difficult to make rapid changes to the site.

- Having an organization such as Scibernet, or a Technology Resource Teacher from the district, to deal with the mundane job of maintaining the server, allows beginning Web developers to focus more on the creative aspects than on technical issues.

- As the use of the site increases, it is likely that the institution will need to purchase its own server. Begin with small steps, and place the most important information on the server first.

- Maintain a focus on keeping the site simple because teachers and administrators are often required to perform other school district priorities.

- Remain flexible and open to new ideas so that diverse groups in the community can make their voices heard.

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Instructional Use of the World Wide Web in Classrooms

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Abstract: The web is changing our society and our education. The paper reports how two educators—a university professor and a middle school teacher—use the web for instructional purposes. Their examples will show how the web can motivate students conducting meaningful learning and foster students' interaction. Similarly, the web can enhance communication among instructors, students, parents, and school administrators. Course assignments and activity examples are illustrated. Students' feedback is also reported in the paper.

Introduction

In the last few years, we have been experiencing tremendous change due to advanced technology, especially with the World Wide Web (WWW). Starting with Mosaic, then Netscape and Internet Explorer, the WWW has become part of our ordinary life. For example, we check the weather on the web before we travel, download maps of our destinations from the web, purchase airplane tickets on airline websites, and reserve hotel rooms via the web before we depart. We sell and buy products, watch news, communicate with our friends and families, and conduct many other activities via the web.

The web is changing how we live and how our society functions. It is also changing our education. While more and more classrooms are being wired, we are experiencing tremendous change in our teaching and learning: students having access to huge amount of information loaded on the web and instructors switching their role from a information giver to a facilitator.

How can the web be used in instruction? The paper reports how a university professor and a middle school teacher use the web in their classrooms. It is hoped that the paper provides insights to educators who are employing the web in their teaching.

Web Use in University Classrooms

The professor teaches technology courses in Instructional Technology at a public university. She teaches graduate courses and one credential course. The graduate students have better computer skills than students in the credential course. To answer the need of the students at different levels, she uses the web differently in her classes.

In all her courses, she posts the course syllabi on the web. Students have access to her syllabi at their convenience. Below is one of the syllabi she posted:

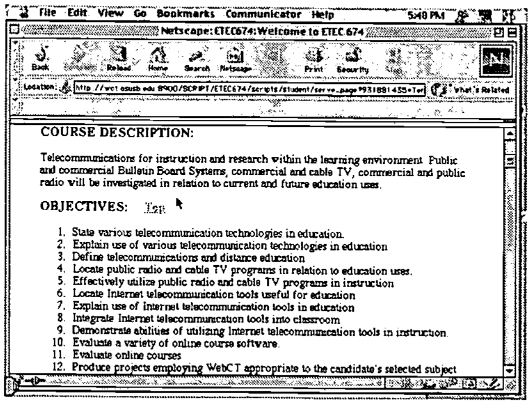

Figure 1. A syllabus of a graduate course.

In addition to her syllabi, she also posts students' course projects. Below is a list of her students in the credential course:

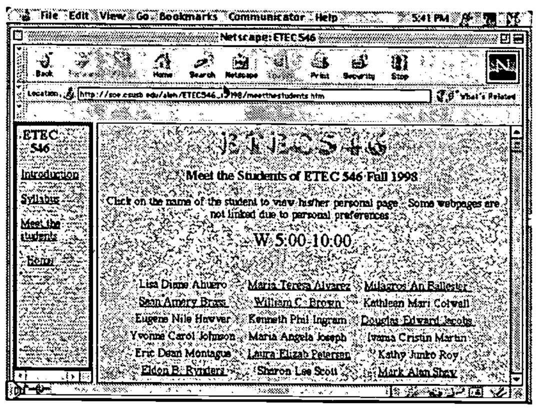

Figure 2. A list of credential students' projects.

In the credential course, students learned features of a webpage editor—Netscape Communicator. Their webpage was composed of a paragraph of their educational philosophy, pictures (optional), websites pertaining to their subject areas (e.g. language art, mathematics, science or social science), annotations of the websites, and Netsearch questions that allowed their students to find answers on the Internet.

Figure 3. A webpage project produced by credential students.

The majority of the students (inservice teachers) enjoyed developing their own webpages although it was challenging for some of them. Many students expressed that posting their webpages on the Internet motivated them to produce better projects. They felt proud that they could develop a webpage and that their students could really use it in classroom. Searching for websites and annotating them allowed them to explore tremendous resources for teachers on the Internet.

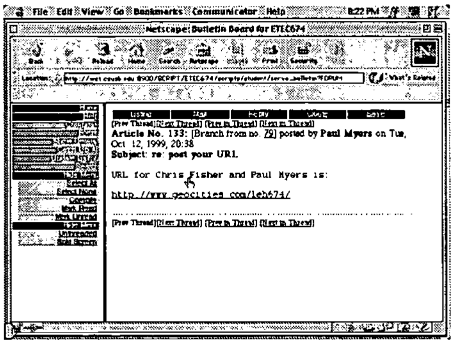

Figure 4. Students posting the URL of their assignment on the web.

Different from the credential course, the professor did not teach webpage development to graduate students since these skills were prerequisite for the course. Instead, students used the web as a tool to share their assignments with their classmates. They were supposed to find their own web space to post their assignments, and most of them used free web space like from Geocities. After they loaded their assignments on the website, they posted their URLs on the class discussion board on WebCT (see figure 4).

Every student was required to review assignments of his/her classmates, select the best project, and explain the reason for their selection. Through the process, students had opportunity to review all of their classmates' projects and learn from each other. Since they needed to provide a rationale for their vote of the best project, they had to think critically and express their critique on the project. The majority of the students enjoyed the assignments. They said that they learned from their classmates by reviewing their projects. In addition, they were enthusiastic about producing best products because they would like to be selected to be the best. Some students even referred to this challenge on their website, where they asked their classmates to click on "yes" or "no" buttons for the question "Since we are competing for the best site, we ask the question, DO YOU LIKE OUR SITE?" (See figure 5).

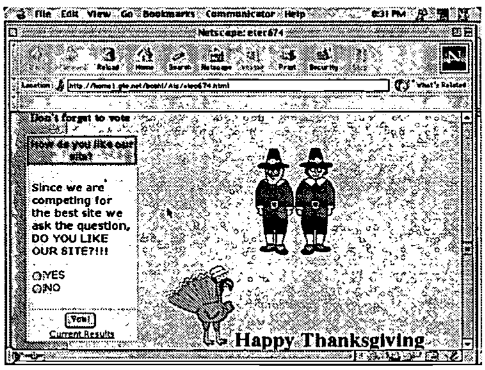

Figure 5. Students asking for voting.

The exercise stimulated a dynamic class atmosphere and interaction among students. Although the course was a web-based course in which students only met four times throughout the whole quarter, students frequently interacted with other students on the web and they expressed that they greatly enjoyed the interaction.

In addition, students used threaded discussion and chat rooms for exchanging ideas and sharing information. Students also filled in surveys on the web to provide their suggestions to the professor. They could also use the anonymous feedback form (see figure 6) to express their opinions without revealing their identity.

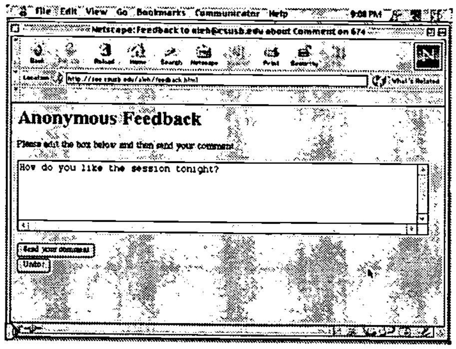

Figure 6. Anonymous feedback form.

Web Use in a Middle School Classroom

The middle school teacher developed a course that would engage students while building their computer literacy skills. The course was designed to support the standards-based curriculum at the school by transparently integrating computer technology across all disciplines. Skills that were at the foundation of the different disciplines were searched. The goal of the course was to build students' ability to technically read, write, and think critically.

The course, called ComputerQuest, was offered as an elective course in a Southern California middle school. It used web-based, project-based activities and an on-line syllabus to meet the objectives of building students proficiency in technical reading, writing, and critical thinking. The course was a nine-week elective that met with 32 students for 50 minutes per day. It was conducted in a computer lab that had 38 Macintosh computers connected to the Internet. The on-line syllabus served many functions in this course. First and foremost, it was like any syllabus the guide and structure for the course of study. More so, this syllabus became a graphic representation, to the students, their families and the school district, of what had been accomplished in the course. It made the learning visible. It served as an on-going resource for students even when they were not in class or had moved on to other classes. It was very useful to new students that needed to get orientated and caught up. It kept parents/guardians informed as to what their children were doing and gave them access to the information and assignments after the regular hours of school. This was especially useful when students were absent. Resources and public access to computers connected to the Internet were covered at the beginning of the course. It opened the channels of communication to the families by giving them the opportunity to email the instructor or use the on-line chatroom that was linked to the syllabus. Homework, additional assignments and activities were posted weekly. It also served as the structure for the student-led conferences at the end of the quarter.

A major benefit of this syllabus was that it promoted technical reading and critical thinking. Students were required to visit the syllabus daily to read and follow the directions of the assignments on their own. They were expected to do this before asking for help. This empowered the students to control a major part of their learning, accessing information on their own.

The other component of this course was introducing students into the inquiry of on-line, web-based projects. Basic computer literacy was presented in the context of doing these web-based projects called WebQuests. A WebQuest was an inquiry-oriented activity in which some or all of the information that learners interacted with came from resources on the Internet, optionally supplemented with videoconferencing. There were at least two levels of WebQuests that should be distinguished.

Short-Term WebQuests: The instructional goal of a short-term WebQuest was knowledge acquisition and integration. At the end of a short-term WebQuest, the learner should have dealt with a

significant amount of knowledge and demonstrated its understanding of the new information. A short-term WebQuest was designed to be completed in one to three class periods.

Long-Term WebQuests: The instructional goal of a long-term WebQuest was extending and refining knowledge. After completing a long-term WebQuest, a learner should have analyzed a body of knowledge deeply, transformed it, and demonstrated an understanding of the material by creating something that others could respond to, on-line or off-line. A long-term WebQuest would typically take between one week and a month in a classroom setting.

Basic computer literacy skills of keyboarding, creating and saving documents/files, word processing, basic Internet navigation, etc. was required and taught within the context of doing these WebQuests. The course taught the students to use computer technology in four important ways: 1. As a tool to create documents and communicate with each other (applications and electronic communication, i.e. email, chat rooms, listserves, etc.). 2. As a tool to conduct research and retrieve information (reference resources, newsgroups and the Internet). 3. As a tool for communicating ideas (presentation and multimedia). 4. As a tool to interface with our world (robotics and probes). The goal of this class was to use all four above mentioned areas to participate in on-line WebQuests.

It was hoped that the use of the on-line syllabus and the use of web-based, project-based activities would engage the students in activities that promoted the use of computers in authentic contexts. It would empower their learning by giving them greater access and control of their learning. It would demonstrate the power of accessing and controlling information by using the powerful tool of the Internet. The participation in WebQuests would give the students the opportunity to engage in activities that challenged them to think critically.

Conclusion

The World Wide Web opens a door for educators and brings us to a new arena. We can use the web to (1) motivate students to conduct meaningful learning, (2) provide them with the opportunity to access to course materials at their convenience, (3) motivate them to produce best products, (4) encourage them to be engaged in substantial interaction, and (5) stimulate them to participate in peer review activities. We can also use the web to communicate with children's parents and keep them posted about their children's progress. The web is a powerful tool, and using it in a creative way in instruction will profoundly benefit our students.

INTERACTIVE WEB PAGE GENERATOR

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Abstract: This paper provides an overview of the development process and screen captures from an interactive web page Generator program. Generator is a Faculty Resource Center response to the increased demand for online information. Generator's development has hastened the delivery of academic web pages and has also been applied to administrative applications. Too often faculty and staff find themselves bogged down with the details of syntax, code and graphic layouts required to make web pages. Generator provides a quick response to faculty and staff needs by providing fill-in-the blank templates, and isolating end users from the process of coding their own web pages. One of the successes of Generator has been the interest generated in developing more sophisticated pages and the integration of technology in general.

Introduction

The Faculty Resource Center (FRC) at Valencia Community College supports faculty and staff in their online endeavors including the necessary training for developing web pages. Often the amount of time necessary to train users with basic multimedia and HTML editors exceeds the expectations of users and projects fail to develop. The objective of Generator was to provide a quick response to the visions of the faculty and staff. Generator eliminates the technical skills [mechanics] which could get in the way of the creative process..

Development of Generator

Generator was developed in the FRC using a combination of software tools that includes Perl, Java Script, Dynamic HTML, HTML and PhotoShop. Generator is a dynamic web page which provides different template styles with or without graphics along with support for additional pages.

The template choice is similar to many other familiar software programs, which allow the user to select the style and then is shown a preview of that style. Initially, there are three template choices available in the automated process. Custom styles can be implemented outside of the automation of Generator. Users also have control of the formatted text used for titles including the title of the free text and link areas. In the free text area, users can add tables, lists and any other text style. Another feature of the free text area is use of HTML tags. The script that parses user input will interrupt the HTML tags and insert the user code into this area.

To be successful and accepted by the user community, ease of use is fundamental. From inception, this concept was woven into Generator. When in doubt about usability of the tool, user input was solicited.

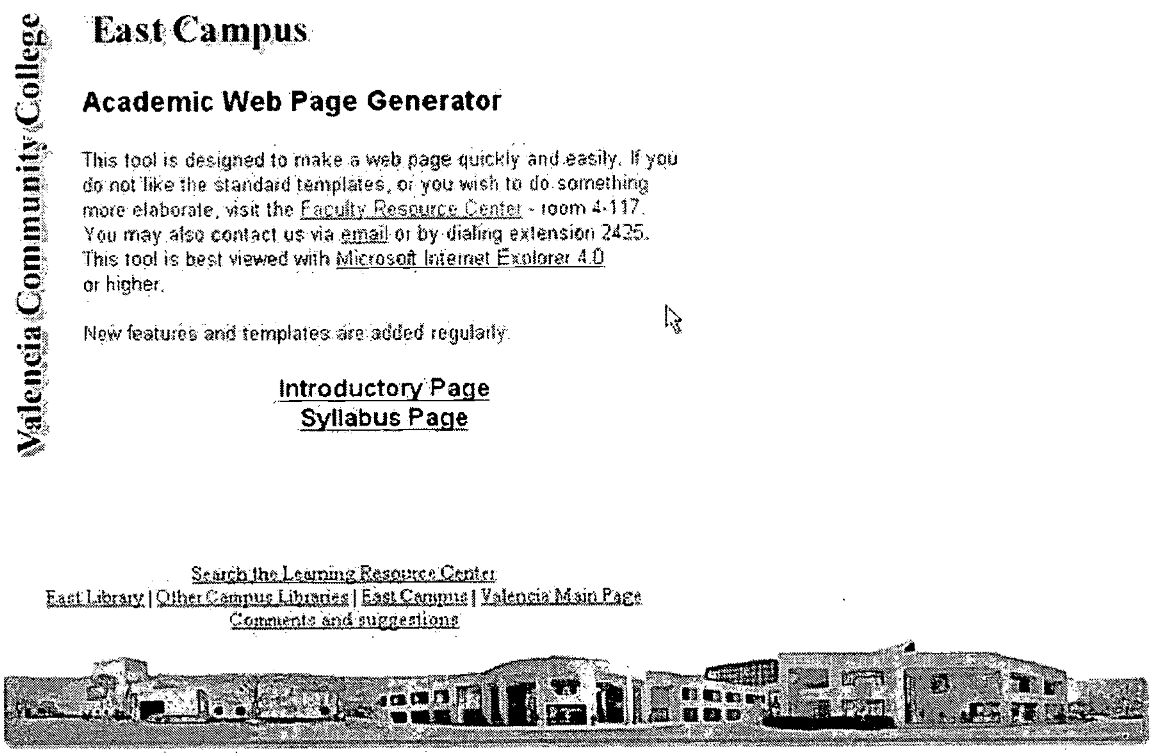

Figure 1: Welcome page

To begin a Generator session, a user points a browser to the Generator web page (Figure 1), selects a template, fills in text boxes and clicks on the submit button to make a web page. Generator provides an alternate to learning HTML, the editors associated with HTML and graphic design elements. The first choice a user needs to consider is page layout. Generator at this time has three options available (Figure 2). Clicking on the hypertext below the thumbnail image provides a preview of each option. The option is selected by checking the radio button under the desired option.

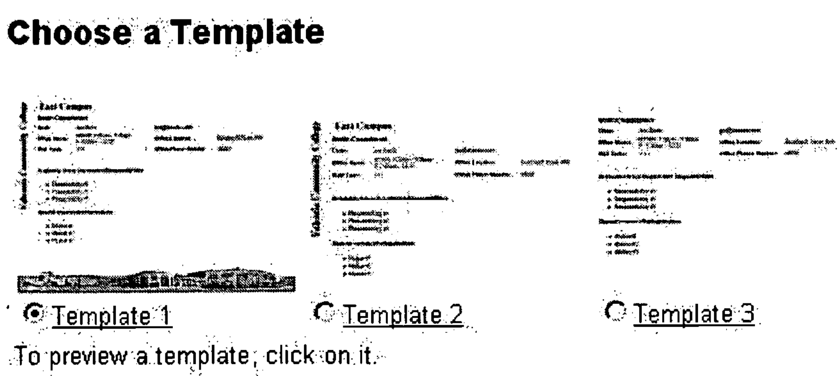

Figure 2: Template choice

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All additional information requested from the user is a fill in the blank type online form. The title fields that are inside a box can be changed. Titles (on the left side of the input form) will display in bold face type. Allowing the users to change the title areas builds flexibility into the final web pages.. After filling out the necessary fields in Generator, users then submit their page for review (Figure 3).

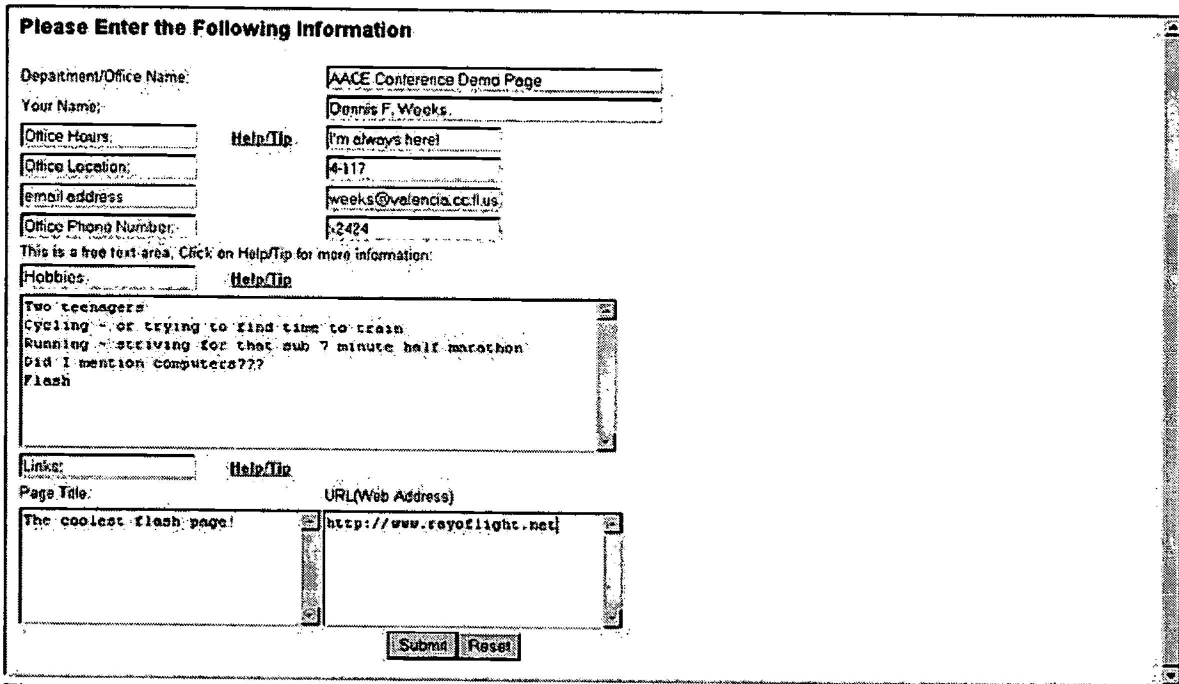


Figure 3: User input page

If the user finds the page representative, he/she submits the page. If not, the back text returns to the input page. After submitting the page, Generator turns the browser into a preview of the requested page (Figure 4).

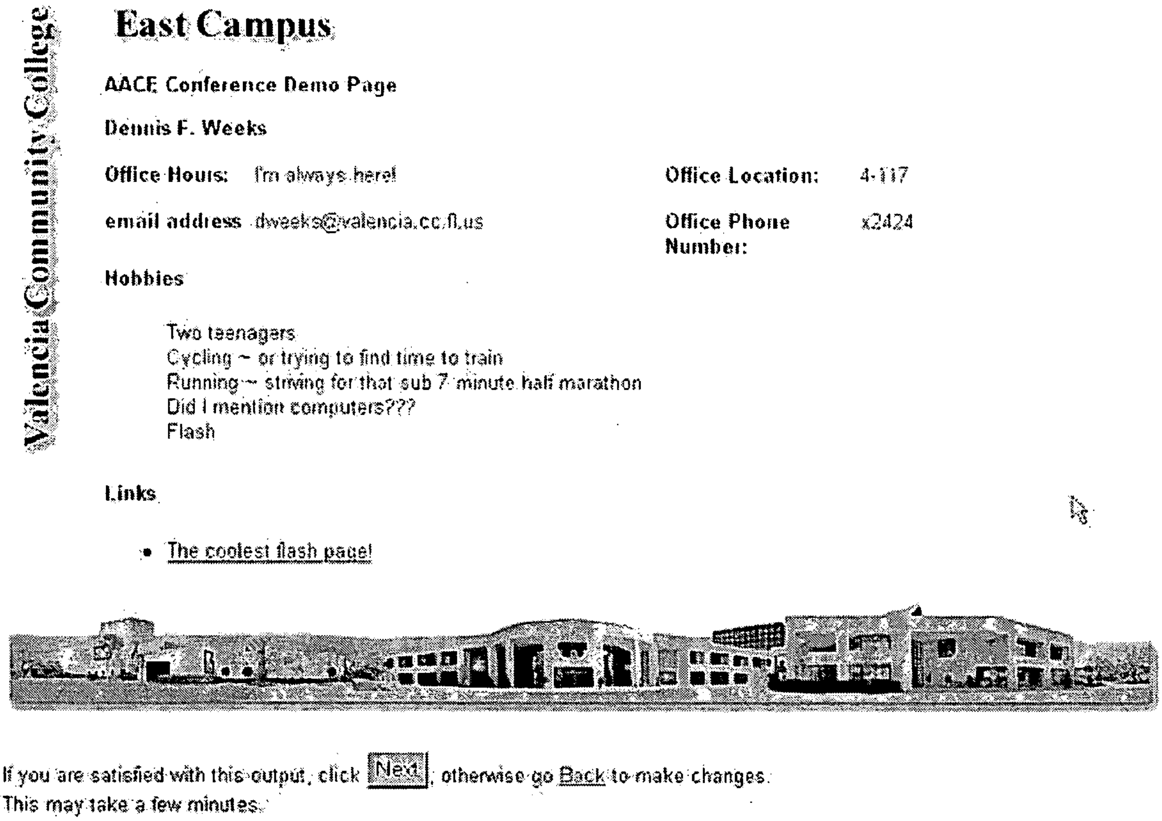


Figure 4: Preview page illustrating the final product

Once submitted, the page is created automatically and staff members of the FRC are notified via email of a pending new request. Often pages are online within minutes of the request. Users have help/tip options (Figure 5) that are popup windows providing online help and suggestions.

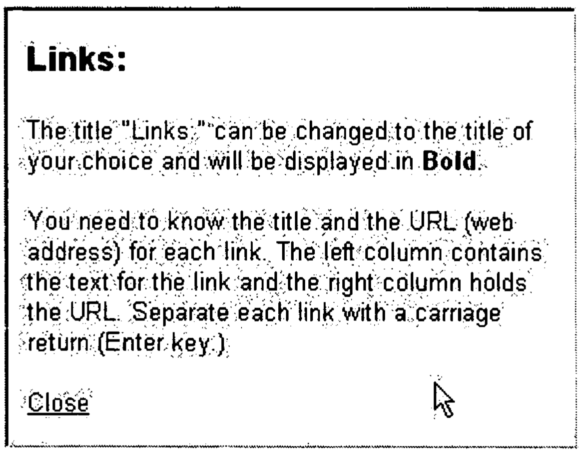
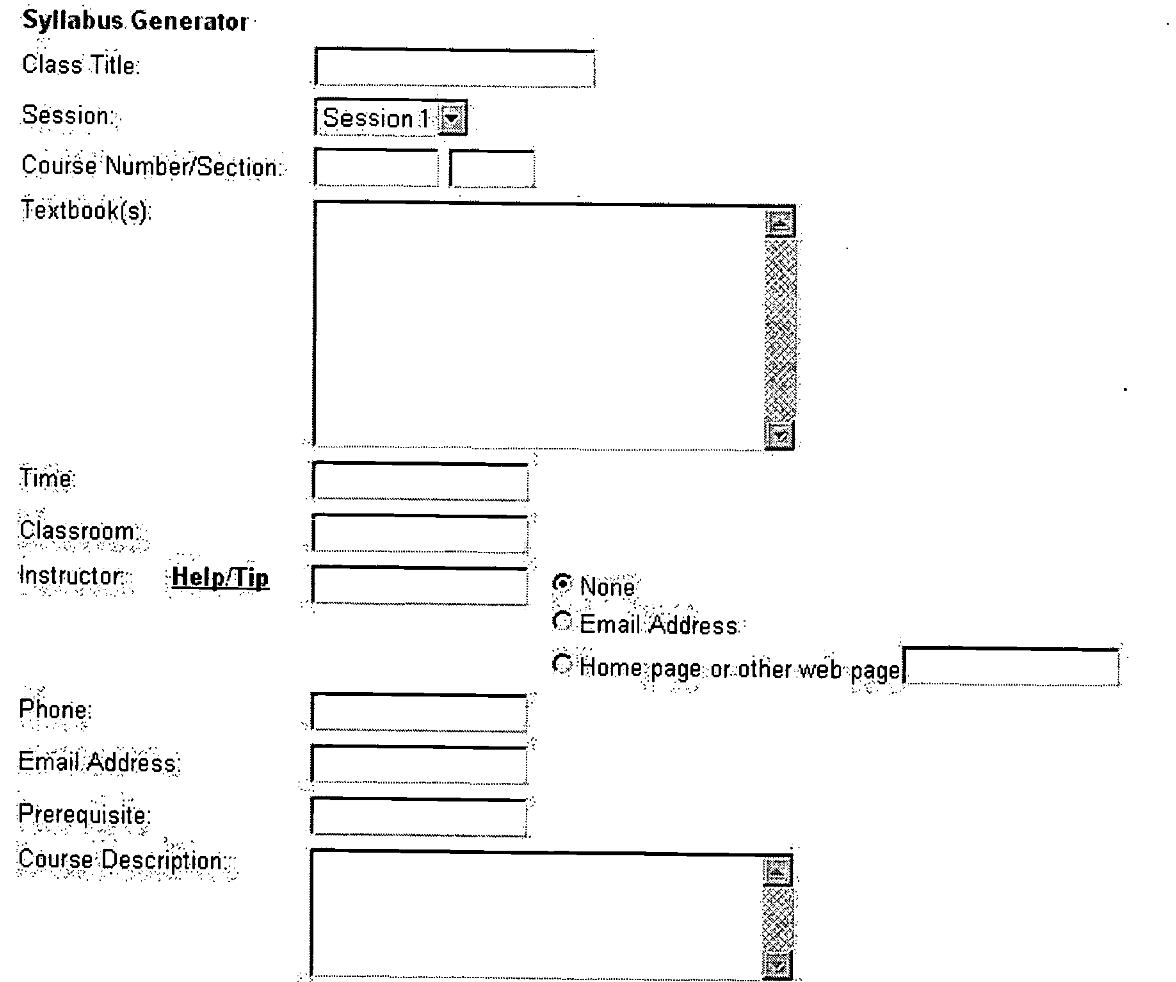


Figure 5: Help/Tip popup window

The success of Generator has been in part attributed to the high availability of the tool and ease of use. Often faculty pages are ready to be published to a web server in less than fifteen minutes. The FRC provides additional support for users wishing to develop specialized, more in-depth pages similar to those found in an online class environment.

Generator Features

Additional features of generator include the option to include a syllabus page (Figure 6). Syllabus generator uses the same online form style of Generator. The syllabus generator creates a syllabus page that links to the user main page created using Generator.


Syllabus Generator

Class Title:

Session: Session 1

Course Number/Section:

Textbook(s):

Time:

Classroom:

Instructor: **Help/Tip**

None

Email Address

Home page or other web page

Phone:

Email Address:

Prerequisite:

Course Description:

Figure 6: Syllabus input page

Conclusions

Feedback from evaluations of Generator has been positive and has helped the team to fine-tune Generator. Feedback has also helped to address the needs of users from the very technology savvy user to the beginner making a first web page. User feedback has also inspired additional page templates, images and other enhancements. The

biggest success of Generator has been the interest generated at the college in developing more sophisticated pages and the integration of web technology in general.

The development team has found that utilizing Generator's balance of good instructional design and interactive technology has resulted in an increase of the college community's web presence. This presence is experienced in the areas of academic support and new applications of technology.

Course Learning and Evaluation Management for Cyber Education

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Abstract: Cyber education is becoming a general education paradigm replacing the face-to-face education. In this paper, we propose a cyber education system as an open template education model where teachers, business educators or any persons who are not specialist could build easily their own cyber learning environments using our system. In order to provide an open cyber education system, we are analysed the characteristics of general cyber learning environments, the standardaization activities driven by IEEE LTSC and some international projects. We firstly describe the design approach for our education system and then its detail functions, focusing in special on the course learning and evaluation management. These two managers provide the supporting functions of evaluation, recording of performance, couch recommended by the international standardization group.

Introduction

Computer based training systems or cyber education systems are used more and more in order to replace or support the traditional education method (Kiho Lee, 1998) (Ron C. W. Kwok, 1999). A conceptual framework is suggested based on the integrated education system, especially focused on the web based training, as design guidelines of theses systems (Benathy, B.H., 1995) (Navin, Nuredeen, Ng, & Hubbard, 1995). Learning of student, plan and development of course, instruction media (communication), systematic structure, counseling of student, administration of course, and evaluation are considering as important factors to instructional design for the cyber education from the viewpoint of system design (holmberg,B., 1995) (Stenerson, J.F., 1998) (Armand St-Pierre et al, 1999). It is estimated that this cyber education system is more efficient and powerful if it is previously analyzed the relationship between these considering factors in the design phase. However, adapting the advanced technologies like multimedia and artificial intelligence not always means efficient to the usability of system. So many people tried to various evaluation methods to satisfy the user's requirements (Nadia Catenazzi, Lerenzo Sommaruga, 1999). Since a cyber education system is operated in global learning environments beyond the time and space, it must not be developed proprietary. IEEE P.1484 LTSC (Learning Technology Standards Committee) is developing the standards about the common components to share and reuse in cyber education environments (IEEE P.1484 LTSC, 1999). Its mission is to develop technical standards, recommended practices, and guides for software components, tools, information technologies and design methods that facilitate the development, deployment, maintenance and interoperation of computer implementations of education and training components and systems. It is developing the LTSA (Learning Technology Systems Architecture) as a reference model (IEEE P1484 LTSA, 1999). However, we

consider that LTSA is not a mature reference model enough to apply its functions to the education systems development. Analyzing the architecture and functions defined in the available LTSA standards, we developed an open cyber education system which supports an efficient learning environment between learners and instructors. Our system is composed by a set of different service managers named user profile manager, course manager, evaluation manager and bulletin manager. Among these service managers, in this paper we describe the detail design and implementation technical issues about the course and evaluation manager.

System Overview and Usage Environment

Our system is focused on the web based environment to accommodate the emerging Internet users, and is adapted the design principle of general cyber education system and the common functions recommended by international standardization group. With the result of it, we defined the detail functions of our system and components. Our system is consisted of User Profile Manager, Course (Educational Content) Manager, Learning Evaluation Manager, and Bulletin Board Manager. We classified users as system manager, instructor, learner, parent, and guest. The specific functions of the service are provided differently based on the user's role. It must be necessary web server and may mail server to support the e-mail services between users

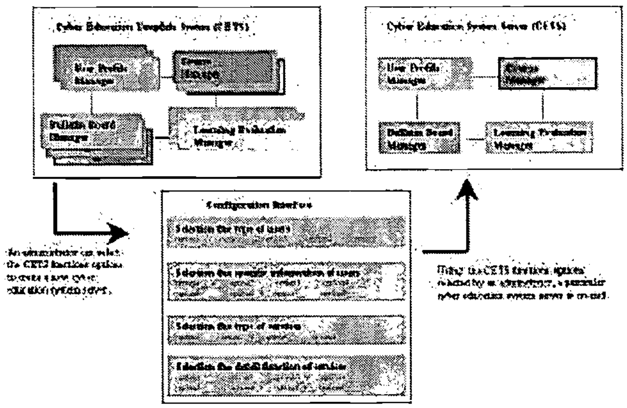


Figure 1 : Configuration Interface

In general, it is expected that there are various requirements of users depending on the goal of education and areas of application in constructing the cyber education system. By providing template of this kinds of cyber educational system, we thought that it is easy way for general teachers or not specialist to access the cyber education system. With this concept, we considered our system to support the function building for customized cyber education. System administrator can enter the requirements of constructing system through the configuration interface as the environment setting part (See Figure 1). System administrator selects the type of users, specific information of users, the type of services, detail functions of selected services in the configuration interface. We call our system as the Cyber Education Template System (CETS)

Our CETS system is easily adapted to build the cyber education system of various education style in regular education as well as business education, job training, continuing education, private education. Figure 2 shows the example building the cyber education in regular education area using CETS system. The left side of Figure 2 represents that elementary, middle, high school and various content providers are connected by educational network. The right side of Figure 2 represents shape of one school among the elementary, middle, and high school in the educational network. Cyber Education System Server (CESS) is constructed via the configuration interface within CETS set by system administrator. CESS and Clients used by general users such as teacher and students are connected by campus network. CESS is not only providing the useful education content to student in the school, but also providing additional bi-directional communication channel like evaluation of learning records, storing of performance information and analysis, and guidance. It also supports the bulletin board service to share information among instructors, and students and can circulate the official document among instructors.

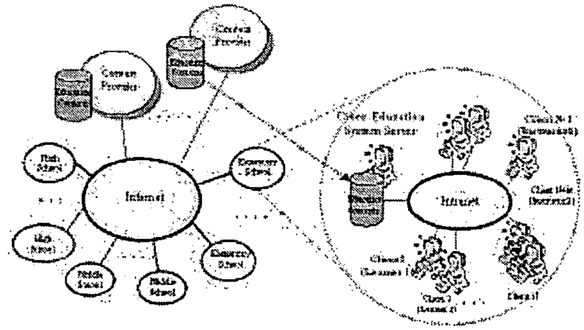


Figure 2 : Practical Use Environment

Design of Course & Learning Evaluation

In our CESS, course is a necessary content for education and is defined as a smallest manageable unit. In the regular educational process, course is classified of curriculum like literature, mathematics, language and science. For example, in case of literature, it can be true of poet, essay, and fiction. There are built in editor to modify the educational contents, which supported by the various content servers in this CESS. In the built in editor, it use '($!'and '!$)' tags which are not used in the general web browser. These tags are used to manage the information about question and answer contained in the course itself and overall course. The built in editor internally embeds parser to identify the tag. For the purpose of various utilization, we classified the course types as a web based contents, educational materials like CD-Title, and homework. Registration, modification, deletion and various retrieval functions based on the classification information are provided in our system. Learners answer the questions within course itself, make a question on overall course, and summit reports after learning.

In the evaluation of learning and management function, instructors evaluate based on the learning records of learner and record the performance information, and present the guidance. Our CESS enables the personal progress management, diagnosis and prescription function. Learners can confirm the guide information of instructors. In addition, our system provides the statistics functions based on the instructor's evaluation results to satisfy the various purposes by instructors. This function is able to derive the correct evaluation and guidance on learners according to the learning history of learners during overall education period. There are detail functions such as storing of learning and evaluation information, deletion, retrieval, and statistics.

Our CESS is designed as an object-oriented approach using Rational ROSE 98 (Rational ROSE, 1999). Rational ROSE is a software development process to adapt the Unified Modeling Language (UML) standards developed by OMG (UML, 1997). Actors, entity to interact with our CESS, are users (system administrator, instructor, learner, parent and guest) to utilize the CESS and DBs (profile database, course database and learning /evaluation database) to store the related information. There are derived Use Cases such as User Profile Manager, Course Manager, Course Learning, Learning Evaluation, BBS Manager, and Message Handler. Derived Use Cases are consisted of many classes. Figure 3 shows the class diagram of the CESS. In Figure 3, we omitted the relationship among classes within User Profile Manager and Message Handler Use Case because of too many relationships.

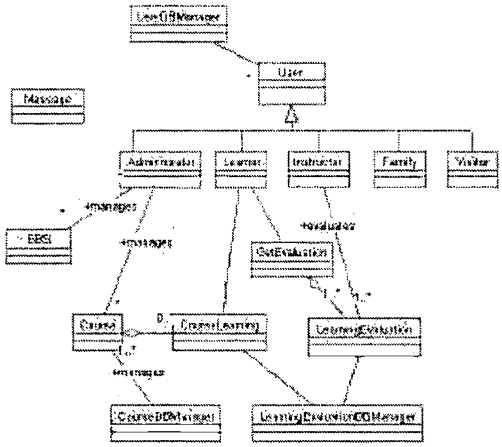


Figure 3 : Class Diagram of the Cyber Education System Server

Implementation

We designed our CESS as a web based education system in order to easily acquire the application, presentation tool within application and related protocol. We are developed the CESS using ASP language on the Microsoft Windows NT and utilized the IIS 4.0 web server. General user must have Internet web browser such as Internet Explorer, Netscape and may have mail client tool.

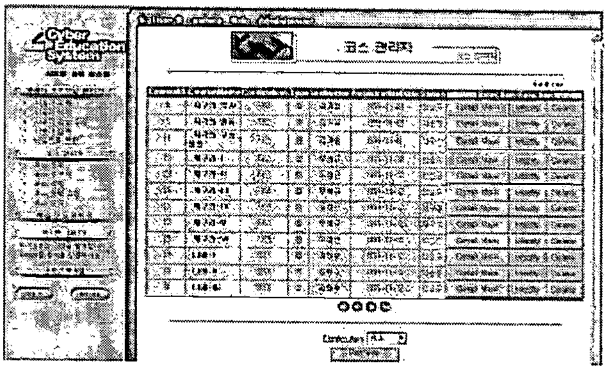
(A) of Figure 4 shows the appearance of course manager within CESS. It provides the registration, modification, re-edition, deletion and retrieval function. We are able to reconstruct the course in order to modify the question and answer field within course itself and overall course through the course re-edition fuction.

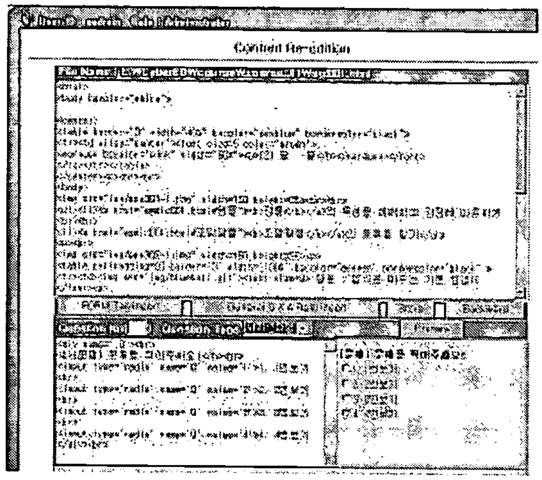
(B) of Figure 4 shows the appearance of the course re-edition function. Course re-edition function is a necessary one to reuse contents of various style provided by existing content servers. 'Form Tag Insert' is a tag insertion part automatically in order to recognize question and answer entry field within course by built in parser. If user the 'General Q & A Field Insert' button at the last page within course, general question and answer entry field is inserted to the page automatically. Question and answer within course is classified as a 4-sample question, question of short answer and long answer style. Users only replace the question number, question content and sample contents and can confirm their appearance according to the user's input via 'Preview' function. When the course re-edition function is completed, learners are able to study that course and instructors evaluate the learning records.

(C) of Figure 4 shows the appearance of the evaluation function. 'Learning Records and Guide Information Field within Course' and 'General Question (Homework Propose) and General Answer (Evaluation) Field' enable instructor to provide the evaluation and guidance information based on the learning records. At this time, Instructor can refer the correct answer information made by course registration process. Meanwhile, instructors want to statistics on the evaluation results based on the learning records of learner.

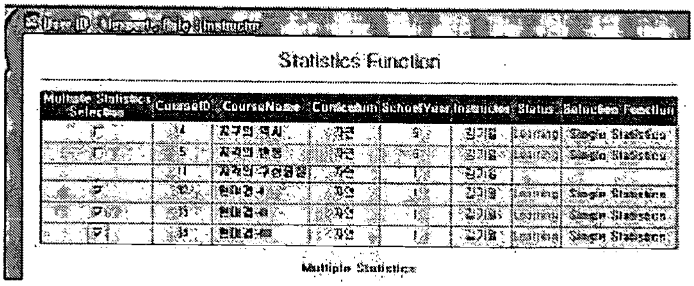
(D) of Figure 4 shows the appearance of the statistics function to satisfy the requirements of instructor. 'Single Statistics' provides the statistics information based on the evaluation information of the selected course. 'Multiple Statistics' provides the statistics information targeted on the selected multiple courses and their weights.

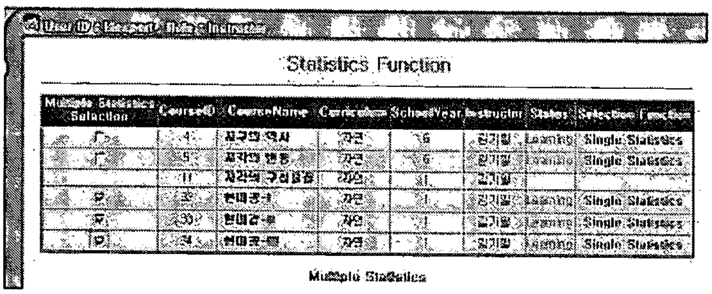
We tried to provide the function such as evaluation, recording performance and couch recommended by international standardization group through the re-edition function and Q & A mechanism within course itself and overall course.





(A) course manager (B) course re-edition function





(C) evaluation function (D) statistics function

Figure 4 : Implemented Cyber Education System Server

Conclusions

In this paper, we described an open cyber education system implemented using the international standardization works and design guidelines recommended by some international projects in education fields. Using our system, teachers, business educators or any persons who are not specialist could build easily their own cyber learning environments to provide some particular education services via Internet.

Making use of that open cyber education system, we also developed a Cyber Education System Server (CESS) which constructs a learning environment for a elementary school. CESS is in the field testing by elementary

students and we have a plan to develop specific cyber systems for different kind of education fields such as continuing education, job training, business education, etc.

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Web Site Evaluation Rubrics for K-12 Educators: An On-line Literature Review

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Abstract: A causal talk with a technology specialist with a school district reminded the authors to the urgent need of guidance for K-12 teachers in selecting quality web sites for their students. The paper will discuss web evaluation standards set up by the librarians, by the search engine companies, by the web site diagnostic services, and finally by educators or school districts. The on-line or print-based web site evaluation standards published by educators for students and other educators are the most useful to meet the urgent need of guidance for K-12 teachers in selecting quality web sites for their students. A good web educational web site need to consider not only the format (including user friendly, aesthetically courteous, and aesthetically appealing), the content (including credible, useful, rich, and interdisciplinary), but also the learning process (including higher-order thinking, engaging, and multiple intelligences or talents).

Introduction

A causal talk with a technology specialist with a school district reminded the authors to the urgent need of guidance for K-12 teachers in selecting quality web sites for their students. Some schools districts are already offering rubrics with detailed items and a weighting formula to assist teachers in evaluating educational software. With the advent of the World Wide Web and the huge amount of information that is contained there, teachers also need to be able to critically evaluate a Web page for authenticity, applicability, authorship, bias, and usability. The ability to critically evaluate information on Web has become an important skill in this information age for teachers. While software evaluation rubrics are widely used by school teachers as guidelines, many school districts are falling behind in recommending good web site evaluation rubrics for teachers. The purpose of this paper is to review the web site rating standards currently available on the Web to assist teachers and students in choosing good web sites for their classrooms.

The Librarians' Effort

Librarians were the first group of professionals to conduct a systematic research over the topic of Web sites evaluation. As libraries select Internet resources to be linked on their web sites, they decided that this process needs to be guided by a policy with stated criteria, just as book selection has been. For librarians, it is easiest to decide just which of these qualities typifies a particular resource if that resource has an analog in the well-established world of printed publications. The Librarian's Guide to Cyperspace for Parents & Kids (http://www.ala.org/parentspage/greatsites/selection.html) is suggested by the Children and Technology Committee of the Association for Library Service to Children, a division of the American Library Association:

- The purpose and content of the Web site are clear.
- A source is clearly identified.
- Contact information is provided.

- The content encourages exploration and thinking. It is appealing to, and suits the age level of, the children for whom it is designed.
- The site is easy to access. It loads quickly, and essential information comes on the screen first.
- The information is accurate and updated regularly.
- The site takes advantage of the possibilities of the Web - it does more than can be done with print. It contributes something unique or unusual.
- Parents should also examine Web sites for racial, gender and other biases they feel are inappropriate for their children.

Among the web evaluation efforts by the librarian, the monthly Rettig on Reference (http://www.hwwilson.com/retintro.html) by James Rettig and The Infofilter project (http://www.usc.edu/users/help/flick/Infofilter/) evaluate Internet resources, primarily Web sites with an academic or a general reference purpose. For example, The Infofilter project's review of THOMAS: Legislative Information on the Internet (http://thomas.loc.gov/) includes technical information (such as name of site, URL, developer, date site last updated, keywords), and a review written by graduate students, librarians, or university professors (see Figure 1). The sort of criteria implicit in these review services are explained in sources such as the Reference Books Bulletin Editorial Board Manual and Norman Stevens' "Evaluating Reference Books in Theory and Practice".

Nevertheless, since the web site evaluation templates produced by librarians are rooted in the established criteria of print reviewing traditions, and primarily with an academic or a general reference purpose, not all criteria are applicable to web sites. In some cases, they put weights on items that may not be as important to some of the web sites and are missing out the dynamic nature of the World Wide Web. And in most cases, the learning process (including higher-order thinking, engaging, and multiple intelligences or talents) of the viewer are not considered. For example, some reviewers with library put emphasis on having search function as a critical criteria for a good web site because they think search function is comparable to index, which is a must for a good printed book. The web site evaluation templates produced by librarians also compare visual medium on web sites to illustrations in printed books. Even though some genres on the web resemble the genres in print, the dynamism of the electronic medium and the ease with which related resources can be incorporated into a site through hot links require development of criteria appropriate to Web resources. There are many design issues peculiar to the web as a medium which are not taken into proper consideration. Besides, many of these templates also do not incorporate issues such as age appropriateness for children, content area subjects, equality issues, and so on. These criteria need to be modified before they can be successful applied to evaluating educational web sites for teaching.

The Commercial Search Engines' Effort

Other than libraries, search engines, web sites, or print-based trade magazines have also contributed to the topic of web site assessment. Some adopt start rating and others choose to review with text comments. Most of the commercial services' rating systems are proprietary. Besides, many of the web sites offering these rating systems do not provide on-line explanation of the evaluation standards neither the meanings of what those percentiles, 5 point scales, 10 point scales, or stars stand for.

Among the commercial search engines with built-in web site evaluation function, Lycos lists hits related with the user-entered keywords with text description written by volunteer editors. Users of Lycos search engine can also click on the top 5% pre-selected web sites to start their surfing activities. Both of the on-line version and the printed version of Yahoo! Internet Life (http://www.zdnet.com/yil/filters/channels/reviews.html) offer web site reviews which combine star ratings and text. A search on the keyword "lesson plans" was returned with more than ten "hits" or "results". A click on "Grolier Multimedia Encyclopedia Online" (see Figure 2) links the reader to a whole page of site review which includes information such as cost, user interface, and the like. Yahoo! Internet Life adds a nice feature by pre-sorting resources in approximately twenty categories, each devoted to a particular topic. A click on the "Kids & Family" category returned another twenty subcategories (see Figure 3). The user will follow the link and narrow down the number of hits they need to explore. This feature is very helpful when the topics are for general interest but useless for uncommon topics. However, it doesn't apply to situations when the reader already have a web site in question and just need to have assessment guidelines. The commercial services' rating systems do not come in handy when teachers or students have to evaluate a web site on spot.

The Web Site Diagnostic Services' Effort

In the commercial arena, an interesting web service has just arose to run automated diagnostics on any web sites upon requests. Web Site Garage (http://websitegarage.netscape.com) is one of these services. Among the items the automated diagnostics checked are link popularity check, browser compatibility, spell check, HTML check, dead link check, load time check, and other functions. The author requested a free service to evaluate on the University of Houston Downtown's (UHD) home page and are returned with two kinds of results. The web version of the diagnosis told me that the UHD home page overall is rated as "Good" from among Excellent, Good, Fair, and Poor. It also includes detailed diagnosis (see Figure 4). The results which are e-mailed to the requesters also include diagnosis and overall rating (see Figure 5). Both the web-based results and the e--mailed result can be used to evaluate or tune up web sites. A similar service, the result of SITEMARKETINGINSIGHTS.COM (http://www.sitemarketinginsights.com/) includes a report detailing a critique and specific suggestions for how a web site can be improved. This site of commercial web site diagnostic services are based on the features of a web sites which can be quantified but offer little help in judging the qualitative nature of a web site.

On-line and Print-based Bibliography on the Topic of Web Sites Evaluation

There are also on-line and print-based bibliography on the topic of web sites evaluation such are Evaluation of World Wide Web Sites: An Annotated Bibliography (http://ericir.syr.edu/ithome/digests/edoir9802.html) by Kathleen Schrock, and Evaluating Web Resources: Bibliography (http://www.science.widener.edu/~withers/wbstrbib.htm) by Jan Alexander and Marsha Ann Tate.

The Educator's Effort

As for efforts from the state level to meet teachers' demand for selecting quality web sites, the Texas state sponsored network for educators Texas Education Network (http://www.tenet.edu/), for instance, has a collection of annotated links to web sites organized by subject area under its "TENET Halls of Academia" heading. Yet it does not endorse any kind of evaluation standard. It provides what it thinks as "quality web sites" yet it does not endorse any kind of evaluation standard. Therefore, like Yahoo! Internet Life mentioned above, this kind of information is not helpful in situations when the reader already have a web site in question and just need to apply assessment guidelines.

And finally, there are on-line and print-based web site evaluation standards published by educators and dedicated to students and other educators alike. In most cases, rubrics designed by educators to students or other educators are more likely to be found on homepages developed and maintained by groups of schools, or school districts.

Loogootee Community Schools in Indiana, among the best of this kind, have disseminated on its web site (http://www.siec.k12.in.us/west/online/eval.htm) rubrics that either primary, intermediate, or secondary students can use to evaluate web sites. As print-based web site evaluation standards, the rubrics published here all employ a five points scale, with 1 indicating "poor" and 5 indicating "exceptional". In addition, they all have incorporated questions regarding a web site under evaluation in 4 categories: design, content, technical elements, and credibility. Using the 25 point evaluation guide provided on the web site, young children in primary grades can begin learning how to assess the content of Internet information by answering 5 questions regarding the four categories mentioned above (2 questions regarding content, and 1 question each for the other 3 categories). Step up from the primary rubric, and following the same pattern, yet with age appropriate vocabulary and questions, the 50 points rubric is designed for the intermediate grades and the 100 point rubric is designed for the secondary students. From the web site, educators can easily print out a copy of the rubric appropriate to their grade level and use it.

The most comprehensive web-based web evaluation rubric sponsored by the states for the educators can be found at http://www.open.k12.or.us/jitt/evalform.html#Aesthetic authored by the OPEN project (Oregon Public Education Network). The checklist (see Figure 6) is designed based on the characteristics of a good Web site found in the SDSU/PacBell Fellows BlueWeb'n Applications Evaluation Rubric (http://www.kn.pacbell.com/wired/bluewebn/rubric.html) which looks at the following components:

- format (including user friendly, aesthetically courteous, and aesthetically appealing),
- content (including credible, useful, rich, and interdisciplinary), and
- learning process (including higher-order thinking, engaging, and multiple intelligences or talents)

The score for these types of applications is weighted to yield a total possible score of 20 points: each "Poor" rating gets 0 points, each "good" gets 1 point, and each "excellent" gets 2 points, for a total of 20 possible points. This web rubric was originally designed to provide immediate feedback to the user. Unfortunately, the button for automatic totaling was de-activated as of November 17, 1999.

Conclusion

The on-line or print-based web site evaluation standards published by educators for students and other educators are the most useful to meet the urgent need of guidance for K-12 teachers in selecting quality web sites for their students. A good web educational web site need to consider not only the format (including user friendly, aesthetically courteous, and aesthetically appealing), the content (including credible, useful, rich, and interdisciplinary), but also the learning process (including higher-order thinking, engaging, and multiple intelligences or talents). It will be especially beneficial if there are more state sponsored projects such as the Open Project mentioned in the previous section which already have built-in mechanism with reliable web evaluation standards and immediate online rating feedback.

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Stevens, Norman. "Evaluating Reference Books in Theory and Practice," Reference Librarian, No. 15 (1986): pp. 9-19.

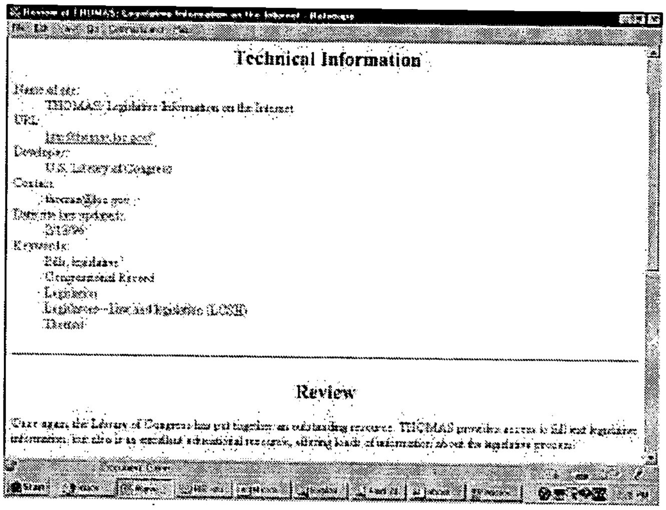

Figure 1: Review page of THOMAS: Legislative Information on the Internet

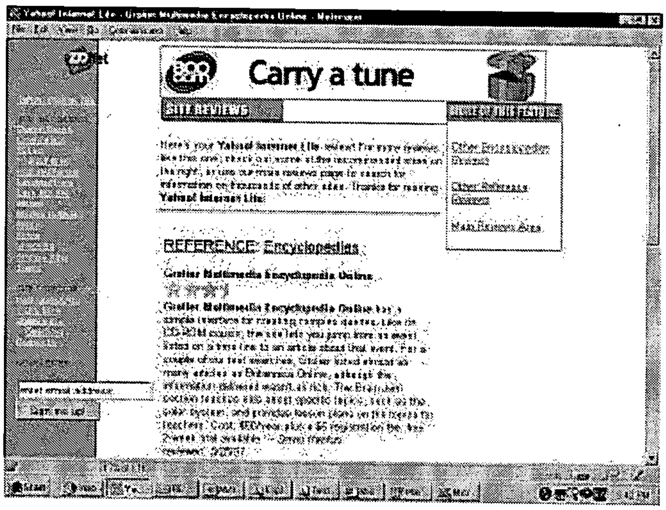

Figure 2: Review page of Grolier Multimedia Encyclopedia Online

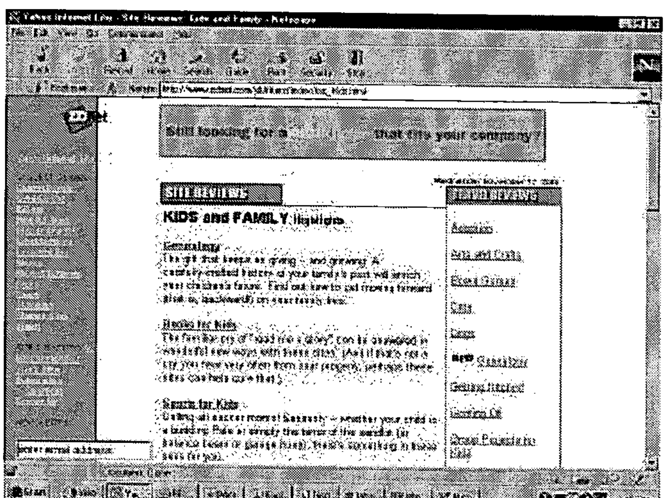

Figure 3: Site Reviews: Kids and Family Highlights

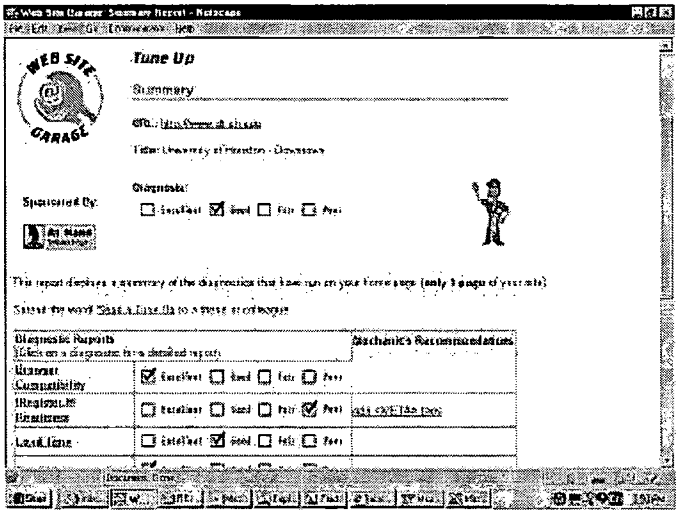

Figure 4: Site Reviews of University of Houston Downtown by Web Site Garage

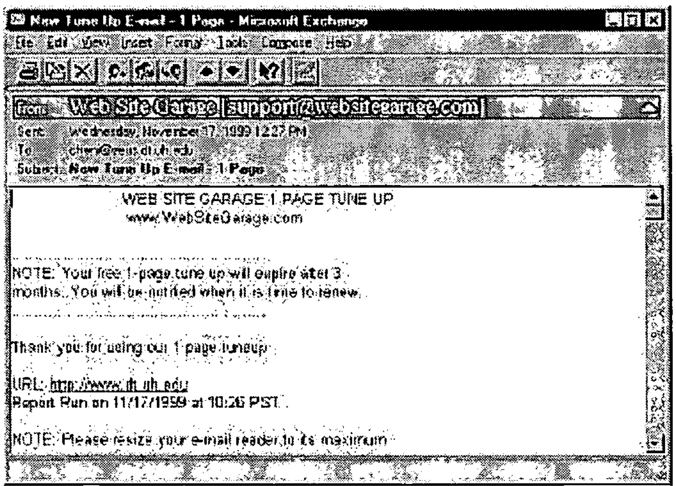

Figure 5: Site Reviews by Web Site Garage through e-mail

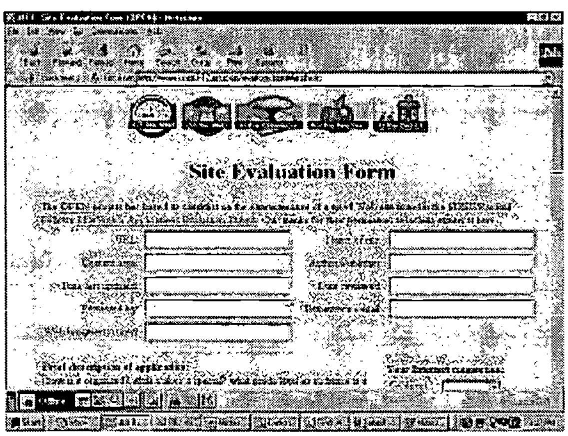

Figure 6: Open Project's Interactive Site Evaluation Form

Teacher and Student Perspectives of a Web-Based Course Using *Blackboard.Com*

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Abstract: As universities strive to extend the traditional classroom walls to meet the educational needs of more students technology is often the answer. The internet has quickly become an educational tool for teaching courses. In response to the campus wide interests, the Department of Exercise and Nutritional Sciences changed their introductory kinesiology course from traditional learning to asynchronous learning, using the Internet. After collecting data and exploring various pedagogical concerns from the perspective of the instructor and students changes were made to the course. A majority of the changes for the course focused on ways to create more interaction between students and also between the instructor and students. This project will report on the changes made in the on-line course design and presentation based on previous student responses.

Introduction

As universities strive to extend the traditional classroom walls to meet the educational needs of more students technology is often the answer. The internet has quickly become an educational tool for teaching courses. Courses delivered on the Internet provide "convenience to learners both in terms of time and freedom of space" (Schlough & Bhuripanyo, 1998). Beyond convenience, advantages included learners accessing and reading course materials at their own pace and richness of materials through linkages to other sites. Weaknesses of this style of instructional delivery included students having to be self-disciplined, the instructional style was not appropriate for all learners, and some course sections were confusing to use (Schlough & Bhuripanyo, 1998). As the use of Internet based instruction continues to develop it is important to examine the issues associated with this style of learning. Studies concerning instruction on the Internet have examined the student's perspective (Mory, Gambill, & Browning, 1998), provided suggestions concerning technical issues (Schuttloffel, 1998), and interaction guidelines (Boettcher, 1998; Carlson, Repman, Downs, & Clark, 1998). Several web based software programs (i.e. WebCT, Blackboard) have emerged in recent years to address the barriers identified in previous studies and projects.

San Diego State University has encouraged faculty to re-envision what post-secondary education looks like through the use of the multiple technologies available on campus. In response to the campus wide interests, the Department of Exercise and Nutritional Sciences changed their introductory kinesiology course from traditional learning to asynchronous learning, using the Internet. After collecting data and exploring various pedagogical concerns from the perspective of the instructor and students changes were made to the course.

A majority of the changes for the course focused on ways to create more interaction between students and also between the instructor and students. Typically e-mail is the tool most used to interact in web based courses (Abramson, Fornshell, Deziel-Evans, Marston, Pratt, Lipton, Sandiago, 1997). This course followed the notion presented by Gamas and Solberg (1997) of different time-different space learning environment, where learning could occur anytime and anywhere. Using Blackboard course software provided numerous tools that were used to address the lack of interactivity of the course. This project will report on the changes made in the on-line course design and presentation based on previous student responses. Additionally, feedback and highlights concerning the use of Blackboard CourseInfo product line will be presented.

Methodology

This paper is reporting preliminary data collected during the first semester of a web base course designed using Blackboard CourseInfo product line. Information for the course (syllabus, lecture notes, assignments, announcements, etc.) were organized using the menu format within CourseInfo. The use of Blackboard CourseInfo provides access to tools that were not contained in the previous web pages used for the course. These tools include an electronic discussion board, student homepages, e-mail, a digital dropbox, and grade access. Other tools are included in CourseInfo (i.e., chat room) but were not selected for implementation in this course. In addition to the use of CourseInfo the web-based course was supported through two weekly class meeting times where the instructor was available for assistance. Further communication between students and instructor occurred through e-mail, telephone, and office hours.

Throughout the first several weeks of the semester, notes concerning the implementation of the new course program were kept by the instructor. Data sources include instructor notes, student perceptions, instructor response to student feedback, and past student perspectives on the new format. Student perceptions were documented through e-mail, discussion board postings, conversations, anonymous feedback, written evaluations, and course evaluations. In-class interaction and phone calls were documented by the instructor and include the content or technological issue at the heart of the interaction. Students who had used the previous course model verbally evaluated the course and commented on the new tools. This data provided a student perspective on the new tools and use of CourseInfo.

Data Collection and Analysis

CourseInfo contains a tracking element that provides the number of hits (or entrances) into a particular site or page both by individual student and the class as a whole. These data will be used in conjunction with other data sources to provide a rich picture concerning the web-based course. Student work, teacher generated documents, transcribed interviews, and teacher notes will all be analyzed using document analysis (Rossman & Rallis, 1998). To organize analysis of these documents, the theoretical perspectives and methodological approaches of structuralism will be enlisted. Structuralism views "documents" as "texts" (Manning & Cullum-Swan, 1994, p. 467). As such, once the data is accumulated in written form, it will be read through several times. With each reading a set of tentative themes will be developed and refined. The emerging themes and issues arising from the readings will create the codes or interpretive frames that will guide and structure the analysis. Trends and commonalties will inform researcher understandings of students' perceptions of the internet based course.

Results

Data for this project was collected during the fall of 1999. Preliminary results will be reported in this paper with additional insights and interpretations available during the SITE conference. With two thirds of the semester completed the Blackboard CourseInfo site had received approximately 59,000 hits as reported through the internal tracking system. These hits were only from the 200 students enrolled in the course since the course is password protected. The course documents and tools are separated by the program into three main areas; content, communication, and students. Content represented the greatest number of hits with 44,000, students and communication were both around 3900.

The area labeled content encompasses the announcements page, course information page (location of syllabus), staff page (contact information for the professor), documents (all of the lecture notes) and assignments. Course documents received the greatest number of hits with over 17,000 while announcements and assignments each had about 12,000.

Communication referred to e-mail, homepages, and the discussion board. Homepages were accessed approximately 3100 times, followed by discussion board with 530, and e-mail (200). The student section

referred to pages which allowed students to send files to the instructor, edit their homepage, and check their current class grade. The most accessed page in this area was the tool that allowed students to check their grade (2620 hits).

Student work, teacher generated documents, transcribed interviews, and teacher notes have not been analyzed to date and therefore can not be reported at this time.

Discussion

The above presented numeric data were collected with two thirds of the semester over, yet provide a beginning indication of the tools used the most by students. It is apparent that the students were accessing and using the web site primarily for course content. However, it is important to note the high number of hits to homepages and grades. A partial explanation concerning homepage hits could include that creating an internal homepage was an initial course assignment and that to grade the homepages each had to be accessed by the instructor. However, this would only account for about 220 hits and leaves over 2800 hits that have occurred by the students enrolled in the course. This might indicate that students are curious concerning their classmates and used this site to begin connecting.

Use of the discussion board has been sporadic. Initially students used the discussion board frequently and this is probably a result of novelty. However as the semester has continued there are posting occurring daily, just not multiple postings each day. This pattern of use is supported by the finding of Gamas and Solberg (1997) when they indicated that online discussions "had a typical life of no more than nine days with peak participation in the

While no data has currently been analyzed concerning the tools available in this course there have been students who have offered comments about the course. Several seem to enjoy the interactive component but tend to be observers more than participants. This means when a subject is posted to the discussion board they read about the topic but might not post to the site. Individuals displaying this behavior have been referred to in the literature as "lurking".

Overall I believe the implementation of CourseInfo has been a positive transition for this web based course. Of course numerous students still do not like the notion of web based instruction regardless of the number of opportunities provided for them to engage with each other and the content. Throughout the semester of implementation there has been a greater retention of students than in previous semesters. It will be interesting to assess the percentage of successful grades in comparison to past semesters upon completion of the course.

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The E-Rate Program: An Update

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Abstract: This paper is a report on the status of the E-rate (Education Rate) program. The E-rate program was created as a result of the Telecommunications Act of 1996. This program is helping schools and libraries install modern telecommunications systems in their facilities. There may be questions about whether the present application process is allowing many schools and libraries to take advantage of the program. The program was specifically designed to promote the installation of modern telecommunications systems in lower socio-economic status (SES) schools and libraries.

Introduction

In 1996, the 104th Congress passed the Telecommunications Act of 1996 (U.S. Government, 1996b). The primary purpose of the act was "to let anyone enter any communications business -- to let any communications business compete in any market against any other" (Federal Communications Commission, 1999). The legislation was supported by most of the major companies in the telecommunications field. Yet, in order to make the passage of the legislation more likely, a provision was introduced *redefining* what was formerly known (since 1934) as *universal service*. In the end, the legislation enjoyed widespread support since it passed the House on a vote of 414-16 and the Senate by a vote of 91-5) (U.S. Government, 1996a). Aufderheide (1999) has described the legislative maneuvering that occurred for both the House and Senate bills.

The concept of universal service was originally established in 1934 when Congress passed the legislation that created the Federal Communications Commission. The initial premise of universal service was to guarantee affordable telephone service to all citizens regardless of their location. Simply put, universal service works by charging customers in *easier to service areas* a proportionally higher fee (put into the Universal Service Fund – or USF), and then using these accumulated funds to subsidize the costs of providing basic telephone service in *harder to service areas* (primarily rural locations). The program is generally recognized as being quite successful although there is evidence of disparity in access depending on household income (Aufderheide, 1999, p. 17). Today, telephone service is generally available in most of the United States. The *new* USF was meant to update this concept in order to take advantage of new and developing data and telecommunications technologies.

One of the new components of the Universal Service Fund has come to be known as the *E-rate* (for Education Rate). The E-rate program was meant to accelerate the rate at which classrooms, libraries, and hospitals were connected to the emerging national telecommunications network known as the Internet. The White House web site (U.S. Government, 1996b) describes the E-rate program this way:

> The President and Vice President want to ensure that all Americans have access to the benefits of the information superhighway. The Act ensures that schools, libraries, hospitals, and clinics have access to advanced telecommunications services, and calls for them to be connected to the information superhighway by the year 2000. It will help connect every school child in every classroom in America to the information superhighway -- opening up worlds of knowledge and opportunities in rural and low-income areas.

The E-rate program is a subsidy, or *discount* program, designed for schools, libraries, and certain medical facilities, in order to receive discounts on certain specific telecommunications products and services. Table 1 shows the discount rate that a school was eligible for based on the number of students qualifying for a free or reduced lunch.

There are three specific types of services that qualify for the discounts: telecommunications services, Internet services, and internal connection (networking) services. Within these three types of services priority was given for telecommunications and Internet access over internal network connections. The program is designed so lower socioeconomic status (SES) schools receive a larger *discount* on qualifying products and services. However, the E-rate program was devised so that every school is eligible

for some level of discount. When the legislation was proposed and deliberated, the E-rate component was not controversial because there was something for virtually everyone. The telecommunications industry initially supported the USF because its members thought that they would be the main providers of the discounted services. They viewed the USF as an investment in their own economic future. Also, since every congressional district has schools and libraries, every congressional district stood to receive some benefit from the program.

Percent of Students Eligible for School Lunch Program	**Discount Rate**	
	Urban	Rural
< 1 %	20 %	25 %
1 - 19 %	40 %	50 %
20 - 34 %	50 %	60 %
35 - 49 %	60 %	70 %
50 - 74 %	80 %	80 %
75 - 100 %	90 %	90 %

Table 1: E-rate Discount Rates

In the 1996 legislation, Congress charged the Federal Communications Commission (FCC) with responsibility for the universal service aspects of the Telecommunications Act of 1996. To administer the program, the FCC created the Schools and Library Corporation (SLC). However once the SLC came into existence, it almost immediately became the target of political attacks. The program seemed to be a particularly attractive target for political conservatives. Perhaps sensing the political vulnerability of President Clinton because of personal and political problems, notable E-rate program opponents included the radio talk show host Rush Limbaugh, and then House Speaker Newt Gingrich. In the new political climate, the original bipartisan support for the E-rate program was no longer apparent. After a series of administrative and political negotiations, the original function of the SLC was transferred to a new entity known as the Schools and Library Department (SLD).

Program Status

Despite the troubles at the beginning of the E-rate program, the SLD is now disbursing funds for schools and libraries that submitted satisfactory applications. In late 1999, the program entered its third program year (PY3). It is worth noting that in neither of the first two program years did the funding levels reach the Congressionally authorized maximum of $2.25 billion per year.

In PY1 the total amount obligated by the SLD amounted to slightly more than $1.66 billion, which was less than the $1.97 billion the FCC authorized. In PY1 there were 25,785 successful applications (out of 31,127) and the average amount awarded per application was $64,378.86. In PY 2, the FCC authorized $2.25 billion, and the SLD had obligated $1.97 billion as of November 22, 1999. In PY2, there were 31,127 (out of more than 32,000) successful applications and the average amount awarded per application dropped slightly to $61,916.48 (Schools and Library Division, 1999). The higher success rate in PY2 may indicate that applications were more complete and that the application process may have been less confusing.

The higher number of successful applicants in PY2 could also be attributed to several other factors. It may be that the additional time allowed more schools to prepare an effective and complete application. In addition, because the program was a *discount* program, schools used the additional time to come up with their *non-discounted* portion of the E-rate program costs. Since PY1was initially announced and implemented so quickly, it is likely that many schools lacked the time to identify local funding, prepare technology plans, survey their existing network infrastructure, prepare contract announcements, determine costs, and navigate the often confusing and sometimes-contradictory E-rate application process. The slightly higher number of successful applicants for PY2 seems to indicate that some of these obstacles may have been overcome. An additional factor may be that many schools perceived a better chance of receiving funding since there were fewer challenges to the E-rate program during the time of the application period for PY2. Also, the SLD was able to establish a more consistent application procedure. Finally, by the time of PY2, with the bureaucracy established, the application procedures more consistent, and regular

communications channels set up, educational technology consulting firms may have been better prepared to assist schools in preparing their E-rate applications.

It is interesting that, given that more time was available, that there were fewer successful consortia applications during PY 2 (989 compared to the 1019 in PY1). Intuitively, one might have expected that the additional time to prepare for PY2 would have allowed more consortia to submit applications.

As far as the future of the E-rate program, while there are still likely to be appeals, it does seem as though the immediate future of the program is secure. In July of 1999, in a case that had clouded the future of the program for more than two years, the 5th Circuit Court of Appeals ruled that the legality of the program was not in question (U.S. Government, 1999). There have also been ongoing efforts to link E-rate funds to the federal requirement that schools and libraries use "filtering" software/hardware in order to limit the types of material to which students and library patrons have access. Groups such as the American Library Association (ALA) have opposed these efforts. In a May 1999 letter to the FCC the Chair of the ALA E-rate Task Force requested that any filtering decisions be left to local officials (Bolt, 1999). So, despite continued challenges, it seems likely that the E-rate program will continue into the future.

Interesting Questions

Now that the E-rate program is entering its third year, it may be useful to consider a number of questions. Given that the program is disbursing almost $2 billion per year, there is probably no question that the E-rate program is assisting many schools and libraries in helping to build a networked infrastructure. However, what about the many schools that are eligible to apply for E-rate funding but have elected not to participate in the program? One of the original purposes of the E-rate program was to address the issue of what is now becoming known as the "digital divide." This concept refers to the idea that not everyone is becoming skilled and employable in a so-called "information economy."

The sliding discount rate approach was specifically designed to assist less wealthy schools with bringing modern telecommunications services to their students. What factors might have caused otherwise eligible schools to elect not to participate in the E-rate program? Identification of these non-participation factors may enable E-rate program administrators to make changes in the application process to enable more of these targeted schools to participate in the program.

One of the main advantages of installing data networks is that they permit the relatively easy sharing of data and information. It is somewhat ironic that schools were hesitant to form consortia to apply for E-rate funds in order to obtain the services that would let them more easily cooperate and be able to share networked resources. Or, perhaps this is evidence that this is a case of putting the cart before the horse in that in order to (relatively quickly) form consortia, there needed to some mechanism in place (a telecommunications network?) to facilitate the consortia forming process? The drop in successful consortia applications in PY2 may indicate that the schools that were ready to work cooperatively on E-rate applications were able to move quickly and these consortia were able to receive funding in PY1.

It is also interesting to look at some of items that were ineligible for E-rate funding. For example, even though distance learning is now a very popular approach for adult learning, most of the equipment necessary to enable schools to capitalize on this technological development was, for the most part, ineligible for the discount rate. In addition, some peripheral items, like a lightening arrester, which would help to protect equipment that WAS eligible for the discount was not covered by the program. Thus, even though schools could receive consideration for most of the costs associated with a telecommunication project, not everything was necessarily covered. Therefore, many schools probably faced a larger financial contribution than might otherwise be expected.

Finally, one of the biggest obstacles many schools face in installing modern telecommunications services and equipment is that many school buildings are so old that they lack the necessary electrical and ventilation systems to permit the equipment to be installed and operated without creating unsafe conditions for students and staff. In addition, the act of installing cables and other equipment often results in unanticipated problems such as disturbing the asbestos insulation found many school buildings. Costs associated with upgraded heating, ventilation, and air conditioning systems, and asbestos abatement were all declared ineligible for E-rate funds. Thus these often-substantial costs needed to be addressed and covered *before* beginning any E-rate eligible projects. For many schools it may have been impossible to cover these costs and also assume the non-discounted costs for otherwise E-rate eligible projects.

Conclusions

While the E-rate program does seem to be meeting the goal of helping to build a network infrastructure in many schools and libraries, there do seem to be a number of questions that need to be addressed. Many of the PY1 E-rate projects are now just coming online. There are many research opportunities to examine these projects in terms of whether they are helping to meet the goal of ensuring "that all Americans have access to the benefits of the information superhighway." As PY2 funds are expended, and schools bring these projects to fruition, it will also create similar research opportunities.

However, in my mind there is still the larger question about why some schools have elected not to participate in the E-rate program. Given the high success rate of both PY 1 & 2 applicants, why is this the case? Is there a flaw in the application process? Are schools simply uninterested in the program? Is it a case of schools being unable to divert the resources necessary to prepare an E-rate application?

As I pursue research on these questions it is my hope that I may be able to provide at least partial answers to some of these questions. In researching the E-rate program, I have found a fascinating confluence of politics, technology, and the cultures of business, education, and schools. As a result of my work, I hope to be able to offer guidance to policymakers as the E-rate program, and other similar initiatives, continue to bring modern telecommunication services into schools across the United States.

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The Network Computer in Education: The Equal and Affordable Technology Solution

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Abstract: This paper explores the concept of Network Computing as the educational computing model of the future. In it we address the state of technology in today's educational environment including the concepts of total cost of ownership, how the network computer will help schools realize their goals as they relate to technology and the how this model will transform the teaching and learning process. Also discussed are the factors that prevent these changes from occurring within the restraints of the current computing model.

Computing In Today's Educational Environment

Today's rapidly changing technological environment requires that we reevaluate not only computing in education, but also the networks that these computers reside on. Just a few years ago, school computers were rarely networked simply because of the expense. Today, however, with the exponential growth of the Internet and the new teaching opportunities it brings, integrating "connected" computing into the classroom is becoming a requirement for even the smallest of schools. Most schools are now in the process of purchasing the necessary hardware and network architecture to support these new computing needs, placing a tremendous financial burden on them. Unfortunately, the current model of replacing each computer every three to five years will keep this burden on the educational horizon indefinitely. In order for schools to succeed, a new model must be found that breaks this repurchasing trend.

Whether or not the computer should play a role in today's classrooms is no longer a point of debate. Research shows that computers fundamentally change the way that we live, learn, and interact in our world. In fact, the Presidential Committee on Science and Technology reports that, "Most researchers and practitioners in the field of educational technology are already convinced that information technologies have the potential not only to improve the efficacy of our current teaching methods, but to support fundamental changes in those methods that could have important implications for the next generation of Americans" (PCAST, 1997).

With the onslaught of sub-$1000 computers, we now see more computers in the classroom than ever before. Unfortunately, because technological innovations occur at such a rapid pace, the computers that we purchased six months to a year ago are already outdated. The problem lies in the fact that schools typically view hardware purchases as one-time, one-expense endeavors. They do not take into account the concept of Total Cost of Ownership as it relates to computing technology. While schools may be able to purchase computers cheaper than they have in the past, they fail to understand that those same computers have an average life-span of just under 5 years and that the total cost to maintain each computer is approximately $2,251 for each unit each year of its life (IDC, 1997). This coupled with sub-standard support in schools points to why computers thus far have had a limited impact on education. Business and industry, unlike education, invests heavily in end-user support, maintenance, and upgrades. Education buys the computer, puts it in a classroom, and tells the teacher to teach with it and maintain it with very little training or support. Should we even question why the

computer has not had more of a significant impact on education? Clearly, a change in the educational computing model needs to occur.

The educational computing model of the future calls for low to no maintenance at the individual desktop, hardware prices that allow us to meet the goal of one computer to every five or fewer students, simplicity of use, curricular support, and increased bandwidth. How can this be accomplished? With network computing, we can realize these educational technology goals, and in the process close the "digital divide" that is growing in our society.

Network Computing

Network Computing, a concept introduced in 1996 as a joint venture between the computer and electronics industries, has created a new paradigm in computing – the next logical step in the evolution from mainframes to minicomputers to PCs, and now to the network computer.Ê The underlying concept of the network computer (NC) is that all of the software required to run the computer and all of its applications reside on a server. Unlike "dumb" terminals of the past, new thin-client technologies will allow students and teachers to use NCs to run the same applications that they are accustomed to running on their more expensive desktop machines. Effectively, virtually everything is taken off the desktop and moved to a place where the organization's (i.e. schools and school districts) network administrators manage upgrades, software installations, system crashes, etc. – everything that currently stands as a barrier to true integration into the classroom curriculum. In turn, teachers are freed up to teach students how to use the technology as a tool in their pursuit of knowledge rather than spending precious time maintaining their classroom computers.

The prohibitive factor in the current model of purchasing computers is the acquisition of enough up-to-date computers needed to see a difference in teaching and learning. To compound the problem, schools rarely look at what a piece of hardware or networked device will cost them over the total period of ownership. When you examine this information closely, you find the average Total Cost of Ownership (TCO) for a computer in the educational setting is $2,251 per year per computer, according to a study by IDC (1997). The same study revealed that the same computer had a total life of just 4.95 years and required an upgrade after only 2.9 years. At an average school with 100 computers that cost $1,000 each to purchase, a school would spend over $1.2 million to maintain and support these computers over their average life span. Even more staggering is that business and industry spend approximately twice as much per computer per year in TCO. Much of education's failure to fully realize the benefits of computing can be attributed to the fact that education spends less than half of the amount that is required in business and industry to support the same computer over the total period of ownership. When you take into account that the ratio of technical support personnel to end-user is roughly 1:500 in education as compared to 1:50 in business and industry, you begin to understand why the centralized computing concept is exactly where the real savings are found.

With a price tag of $400 to $600 dollars (not including a monitor) much of the savings of the NC versus a traditional PC come over the life of the unit. With no applications installed locally, no components to upgrade and a centralized administration and support model, NCs run virtually problem free from the end-user's point of view. And when replacement or repair is needed, downtimes are minimized because any other NC can be substituted without having to copy programs or operating systems by simply plugging it in.

The network computer vision is modeled after the cable system in which the end-user "box" merely connects to a powerful infrastructure. The individual NCs are easy to install and manage, unlike traditional PCs. Thin-client technologies now allow network computers to run nearly any application over any network, including the Internet. The reality of network computing is that it will end up saving educational institutions millions of dollars in hardware and software purchases and maintenance.Ê A study by the Meta Group (Kirzner, 1997) shows that the average annual cost of administering a NC is 23% less than the cost associated with administering a traditional PC. Additionally, these savings will magnify substantially over time, as NCs need not be upgraded on the same schedule that the PCs of today require.

Network Computers in Schools

With network computers, teachers and students will be able to access their work from locations throughout the school and from home. There will be no problems accessing needed software applications, as it

will not be necessary to have software installed on individual computers. Gaining access to resources, from school or at home, will be as simple as entering a user name and password. This simple model of adding users to the network creates a digital community at each school. Bob Metcalfe, the inventor of the network card, is popularly known for his theory on networks. Simply stated, the theory claims that as more computers are added to a network, the power of that network grows. NCs will allow the educational network community to grow, while encouraging collaboration amongst students, teachers, and the remainder of the school. As teachers are able to move away from the pitfalls of unequal access and individual computer management, to simply *being users of technology*, they will be able to concentrate on using technology in more constructivist ways.

One of the most discussed shifts in the education model is the shift from teaching-centered education to learning-centered education. Accelerated by the technology and information explosion, this shift will eventually transform learning into an inquiry-based activity where the student becomes an active, self-directed learner guided and assisted by instructors. Important in this process is adequate connectivity to the Internet for all schools. Already, as a result of E-rate funding and other initiatives, we are seeing high-speed Internet access being offered at many of our schools, yet the need for high-speed connectivity will only grow in the years ahead. The savings in using network computers in education will allow for resources currently allocated for computer purchases to be redirected to increasing connectivity in schools. Delivering the most popular educational software packages over the Internet directly to a desktop without regard to operating system or platform will not only add credibility to the adage "anytime, anywhere computing," but will truly set the stage for a completely new computing model. Software manufacturers are currently producing software that will run under this model that are not platform or operating system dependent – meaning these applications can be served to any computer anytime. Members of a school community will be able to have free and equal access to school technology resources, thereby eliminating the dilemma of the "haves" versus the "have nots" that exists today. Furthermore, as television, radio, telephone, and the Internet fuse together, affordable network computers will be as commonplace in the American home as today's telephone.

Conclusions

The benefit to the end-user (the students and teachers) of using network computers in education is that they will have equal access to the latest software on the server without the burdens of acquisition, installation, administration and maintenance. The learning community will be expanded beyond the walls of the classroom, as tools previously only accessible on a few select computers will be accessible virtually anywhere. "Managing" technology will be replaced by "using" technology. Teachers will spend more time concentrating on using technology for instructional purposes. Students will utilize the vast global network of the Internet to research and collaborate with each other. Parents will be able to play a more active role in the education of their children.Ê

There will be strong opposition to the network computer in the years ahead, and many schools will mistakenly continue to purchase more expensive personal computers, but in time, the benefits of adopting the network computing model in education will prevail as a viable solution for advancing the state of public education in America.

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Designing the next generation of tools using an open systems approach: A usability study

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Abstract. Educational technology is at a crossroads. The Internet was originally designed for the needs of the science and military, not for the purposes of sound instruction. New and more powerful protocol schemes are needed to truly realize the potential of networked-based instruction. A new technology that holds a lot of promise is XML. XML provides a more structured and dynamic approach to content creation that allows the developer to define and order data instead of merely displaying it. We were interested in some of the issues in using a new technology such as XML for instructional applications. In this study we found that the Internet and XML were suitable for this type of application. We found no difference in performance from either local accessed classes and those delivered from an Internet server.

Introduction

Educational technology is at a crossroads. Rapid development of computer technology has provided the individual with an unprecedented access to information and resources that only a generation ago was the stuff of science fiction. Never in our history has technology been so important in the success or failure of our students. However, the Internet was originally designed for the needs of the science and military, not for the purposes of sound instruction. Consequently, newer tools and protocols are needed that truly facilitate teaching and evaluation and put into the hands of teachers the power to design. One area that is critical to student success is student assessment. This paper reports on the results of a usability study that investigated the suitability of using an open systems approach for developing an online assessment application. We were interested in the following issues: ease of use, security, effectiveness and ease of maintenance.

XML and data encapsulation

The pioneers of the Internet needed a blueprint for a system that relied on a simple message format in conjunction with simple interactive software. They created a system that would work even though they had incompatible computer resources. An environment evolved that fostered interoperability and sharing at the hardware, software and human levels" (Berger, 1999 p. 27). Secondly, they created standard interaction protocols that were "independent of the particular transmission subsystem and requires only a reliable ordered data stream channel. (Postel, 1992). With this information anyone who can write a computer program, in almost any language, can communicate through the Internet as long as the proper interaction protocol is maintained.

The protocol model greatly increases access because it separates content from the delivery technology. By ignoring the delivery platform, incompatible systems can communicate and share information. This approach is superior to the traditional courseware development model because it increases access, improves flexibility and adaptability as well as reducing cost through more efficiently maintaining the installed technology base. What is needed is a mechanism for developing the appropriate educational protocols.

The open protocol model is at a great disadvantage because the classroom has many distinct instructional paradigms for content delivery such as the lecture, class recitation, or small-group collaborative discussions as well as for student evaluation. Programmers working within the traditional method of courseware development were much better able to manage the sequencing of lesson content because they controlled how a specific user interacted and navigated through the content.

A further problem is with HTML, the underlying encapsulation language. HTML was designed to simply display static document types such as reports or journal articles. It was never designed to structure, order, or define data. "HTML formats how you present a Web page's data and it

is not designed to work with <u>what</u> that data represents." (Holzner, 1998, p. xi) Recognizing this discrepancy there has been a call for the development of better markup languages that could represent not only the format but also the structure of the data. This would allow for a much more dynamic and flexible data delivery system.

The World Wide Web Consortium (see W3C) is developing the Extensible Markup Language (XML). XML is similar to HTML in that it is a simple text-based system. However, XML provides a more structured and ordered approach to content creation. XML is "most often used as data-description language allowing us to organize data into data structures - even complex data structures...You can tailor the data as you want it; the most attractive feature of XML is that you can create your own tags." (Holzner, 1998", p.4). This lets an author structure data into appropriate elements "without having to restructure your data to fit a predefined markup language." (Holzner, 1998, p. xi).

Because the markup tags in XML are not fixed ahead of time, as they are in HTML, the language needed a way of informing the browser how to read the document structure. For example in a set of hospital records, the browser would need to know when a patient record ended and a new record started. Further the browser would need to know what type of data defined a patient, such as name, physician's name, room number or the medication they were taking. XML solves this problem through the use of the Document Type Definitions (DTD). The DTD (see Figure 1) defines not only the overall structure of the document, but also individual elements within the document.

```
<?xml encoding="US-ASCII"?>
<!ELEMENT patientRecords (patient)*>
<!ELEMENT patient (name,doctor,room)>
<!ELEMENT name (#PCDATA)>
<!ELEMENT doctor (#PCDATA)>
<!ELEMENT room (#PCDATA)>
```

Figure 1: Sample Document Type Definition

In this example the DTD defines the document's data as a collection of patientRecords. These patient records are a compilation of individual patients that are identified with a name, a doctor and a room number. The DTD then further refines that definition in that all of those elements are typed as PCDATA (parsed character data). A browser would have no problem using this data to correctly display the information . Further, we could easily determine the number of beds currently occupied, patient names, and which physicians were caring for them.

The DTD can be carried by the document so that the browser could properly determine the unique structure of the document. However, the DTD can also be referred to as an external file located on the Internet, which could define a whole class of documents. As long as the documents are properly formatted, a browser could determine how to use them. Consequently, XML is perfectly designed to represent an e. e. cummings poem, as well as, a student record database. Using open standards, schools would be able to maximize their installed technology base while integrating effective and congruent instructional solutions.

Developing the prototype

XML provides a good model for courseware development because it allows content experts, software developers and even classroom teachers access to the same educational material. Because of the DTD, XML provides a mechanism for shaping and disseminating the required protocols to standardize the delivery of instructional content.

In order to explore the implications of how the new open protocol approach to authoring would work we selected a simple multiple-choice exam to prototype and study. This type of exam is used in a variety of educational settings and is generally well understood. Multiple-choice exams are constructed around a statement with a set of possible answers of which only one answer is correct.

We configured a Pentium 166 to run the Apache Web Server 1.3 under Red Hat Linux 6. The Pentium was also configured to use the Blackdown Java port of Version 1.1.7 for Linux. A simple threaded Java Server was authored that processed individual student and exam data and saved it to a file located on the server. In addition, we used the IBM XML Classes 1.1.16 to facilitate the parsing of the exam data within the Java Applets. The browser for all the groups in the study was Microsoft's Internet Explorer 4.5 for the Macintosh. Internet Explorer allows for local access of additional class resources through the Java Preference window.

The Study

XML and Java are new technologies. We were initially interested in investigating the effect of bandwidth on user performance. Secondly we were interested in some basic screen layout issues. We wanted to investigate the effect of item layout on student performance in a multiple-choice test.

The study was designed as a usability study that investigated the issues of screen layout and bandwidth on student performance. Usability testing (Hom, 1999) uses a mixed mode methodology that incorporates both quantitative as well as qualitative methods. Therefore, besides server log data we also video taped each exam session, maintained a session journal and interview students at random.

The first group used a Java Applet that accessed local XML classes through the individual student's browser that used a non-wrapping screen layout as illustrated in Figure 2.

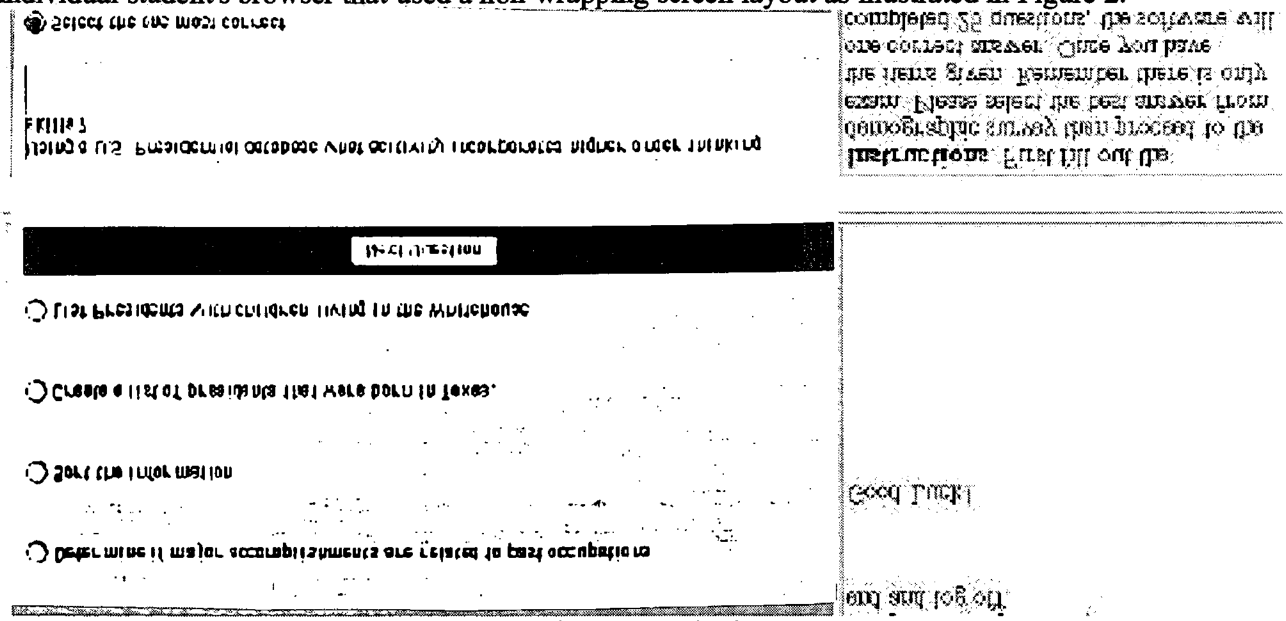

Figure 2: Non-wrapping items

The second group as illustrated in Figure 3, also accessed the set of local classes through the browser. The difference in this group was in the screen layout, which used a centered wrapping text design.

Groups 3 and 4 accessed the required XML classes that were embedded within the Java Applet code. This resulted in an applet that was 17.55 times larger for groups 3 and 4 in contrast to groups 1 and 2 (351 Kilobytes versus 20 Kilobytes). Group 3 used the non-wrapping text interface while group 4 used the centered wrapping text interface.

Participants: The participants for this study were 68 pre-service teachers taking a technology integration course. During the course the students are required to pass a simple multiple-choice test based on primarily factual information from the textbook, class lectures, discussions and software specific skills.

Materials First we created the Document Type Description for the exam as described in Figure 4. XML allows for the definition of new data structures.

```
<!ELEMENT exam (question)*>
<!ELEMENT question (query,items,answer)>
<!ELEMENT query (#PCDATA)>
<!ELEMENT items (a,b,c,d)>
<!ELEMENT a (#PCDATA)>
<!ELEMENT b (#PCDATA)>
<!ELEMENT c (#PCDATA)>
<!ELEMENT d (#PCDATA)>
```

<!ELEMENT answer (#PCDATA)>

Figure 3: Document Type Definition (DTD)

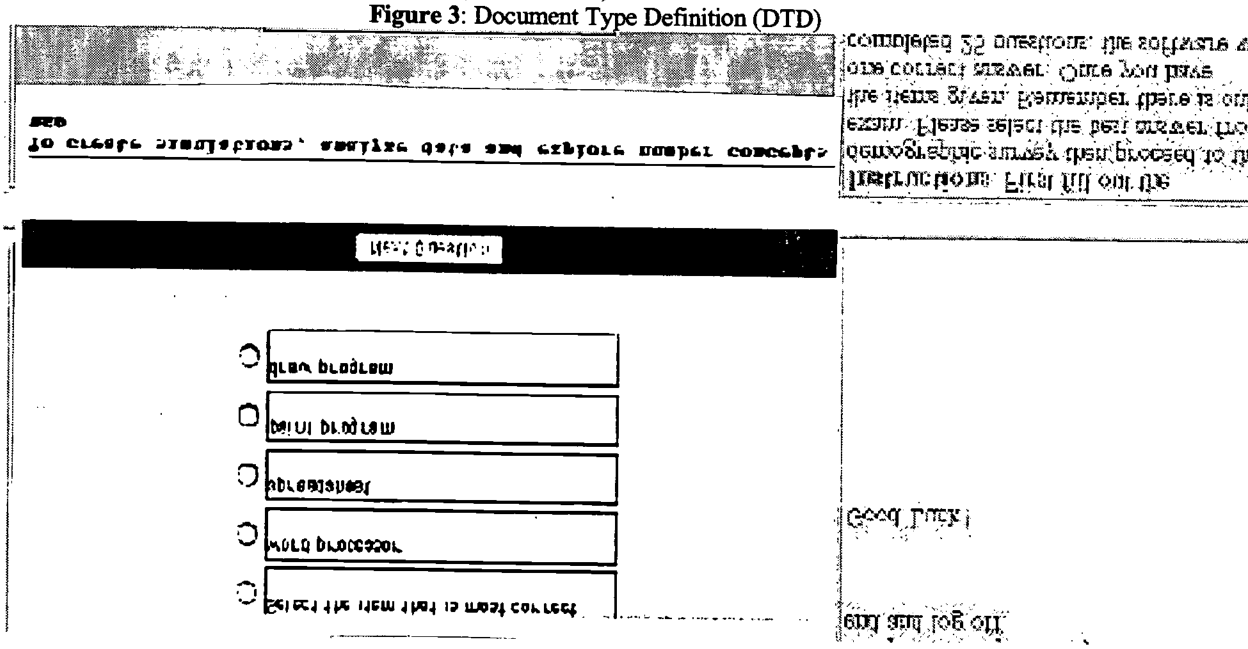

Figure 4: Wrapping item list

The data set was then encoded using the DTD as the framework and saved in a simple text file on the server. We designed a test bank of 25 questions that was based on factual information taken from the textbook, class lectures and discussions. For example, consider the following question:

```
<question>
        <query>One kilobyte is equal to _______ bytes of data.</query>
        <items>
                <a>1000</a>
                <b>1024</b>
                <c>2000</c>
                <d>2224</d>
        </items>
        <answer>a</answer>
</question>
```

Notice how the question is designed. XML requires complete start and end tags, so that each question is required to be marked by <question> and the </question> tag in order to create a well-formed document. Remember that the exam is made up of questions and each question has a query, item and answer elements. As we can see the query is a simple string that makes up the actual question. Next we define the four items from which the student must select the correct item. The answer is provided in the answer tag. This allows the applet to track the individual student performance within the exam.

Procedure

There were 24 sequentially numbered Macintoshes in the computer lab. As a student entered the lab they were asked to sit at the next open computer in sequence starting with computer 01. The instructor proctored the exam and instructed them to open and read a simple web page located locally on their machine. The web page consisted of a set of instructions and acted as a gateway so that they would enter one of the four groups. Half of the machines accessed either the remote or local classes and half used the non-wrapping or wrapping screen layout.

Once the student had read the instructions they continued to the next screen that displayed a simple demographics survey as shown in Figure 5. The students entered their name, the computer's number, their section, age, gender, and estimated internet usage.

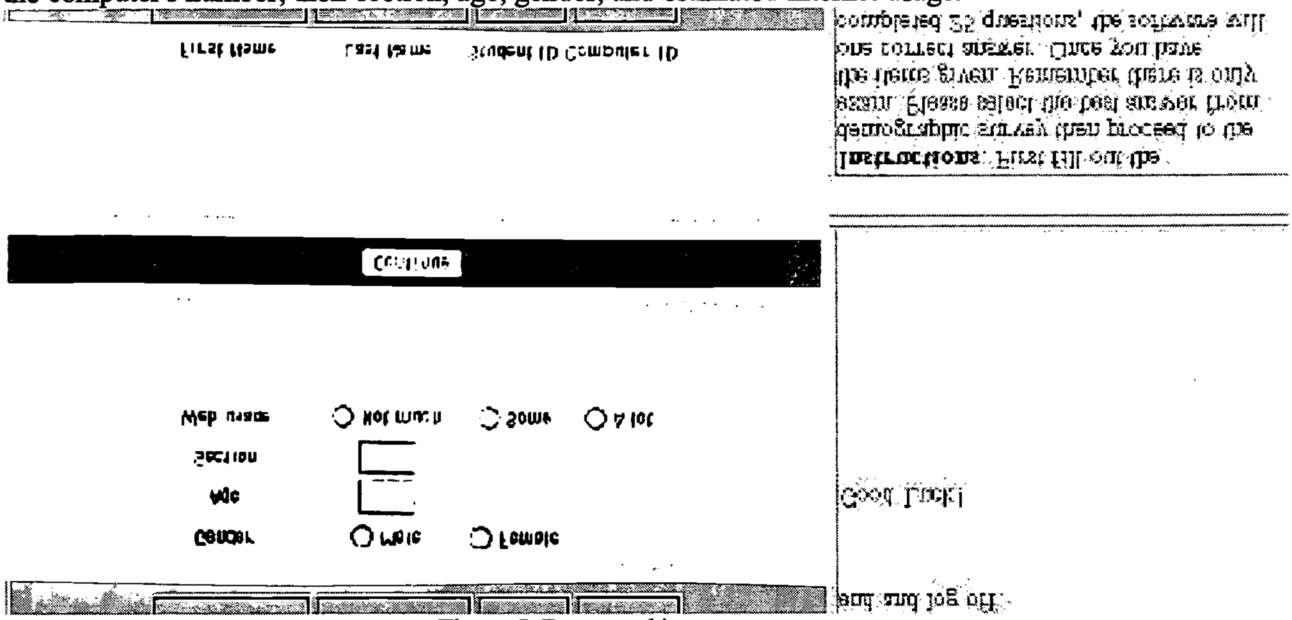

Figure 5: Demographic screen

Once the student had finished answering the survey questions, they began the exam.

Each student was presented with 25 questions in a random sequence. Once they had answered the questions they were presented with their score and then instructed to log off. The data was then transmitted to the server for recording. In addition to the demographic data we recorded the time that the demographic page was displayed, the order of questions, the student's individual responses and the student's total exam score. By identifying each individual computer number we were able to correlate the access time based on the server logs for each student. These were then arrayed with the other data. In addition to the server-based data we also videotaped each exam session, logged any problems that the students may have had. At the conclusion of the exam session we also interviewed a group of randomly selected students.

Results

Results indicate that an open systems approach is a feasible way to design instructional tools. Data encapsulation using XML was easily created, maintained and modified thereby allowing for a seamless interaction on the part of the faculty. The students reported on the exit interviews that taking the exam was easy and they liked the convenience of immediate scores.

One technical problem did surface while using the software. The current version was designed so that the students could not return to a previous question once they had posted their selection. This was an option that students consistently voiced in the exit interview. However, only one student attempted to return to a previous question by clicking on the browser's back button. To her dismay the exam restarted. That was a design flaw in the implementation. One possible solution would be put the exam applet in a separate window and disable the back button.

The location of the required classes was not a factor in the student exam performance. On average the Java Applet took about 5.5 minutes to load once the students accessed the web site. Students who used the remote classes scored, on average, 21. 8 while those that used the

local classes had an average score of 22.0. This difference was not statistically significant ($p = .81$).

According to the data, XML is suitable for developers of instructional software because we found no performance difference in using local or remote classes. If you can control the lab situation local classes would be preferable simply to reduce server load whereas if you are delivering the exam over the internet then you can guarantee access by including the required classes. Security still poses a problem, however. The Apache web server supports session tracking so that we can program a more robust authentication scheme for a more secure access.

Educational Implications

The implications for an open protocol-based educational technology system are crucial. First it separates content from the delivery technology which allows the development of appropriate educational material regardless of the available delivery technology. Developers would be free to concentrate on effective and appropriate instructional materials targeted to what teachers need for the classroom. Further it would provide teachers with the ability to construct, modify or share computer-based materials for their classrooms. This would reduce the time needed to create course materials thereby substantially lowering costs. Much work needs to be done, because the Internet was developed to support science and industry. Issues of message structure, educational protocols and effective content handlers must be developed before the real transformation takes hold. These items keyed the rapid rise of the Internet for business and science because they created portable sources of information. The tool you choose to complete a job is intimately tied to your success or failure. Matching user skill with the correct tool creates an optimal situation guaranteeing the most effective, efficient and elegant solution. (Simon, 1996). If education is to emulate the growth of the Internet, there is a need for similar tools that truly match the needs of instruction.

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Seven Year Update Of The End-User Of Internet

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Abstract: This paper addresses the successes and limitations of "turn-key" technology training in nine K-12 Educational sites in the Mid-Atlantic Region. It is a follow-up study, seven years after an original year-long, 1993 investigation (Goss, 1995) of Internet use in K-12 schools and regional support centers. The 1995 study of turn-key users of Internet, five key factors emerged that determined the success of their scale-up efforts.

This follow-up study revisits those early Internet adopters. Through analysis of survey and interview data, the study sheds additional light on earlier findings, while illuminating the successes of those with broad-based administrative support and a thoughtful technology dissemination plan.

Background

A year long study (Goss, 1995) examined, described, and analyzed the partnership between Internal Change Facilitators (ICF) and an External Change Facilitator (ECF) working together to integrate Internet use at educational sites in 5 states: Pennsylvania, New Jersey, Delaware, Maryland and the District of Columbia. The purpose of the partnership was for practitioners to learn basic Internet skills, use the Internet, and then turn-key the use of Internet to others.

Recently there has been increasing recognition that teachers and teachers' knowledge gained from and imbedded in their everyday work, should be at the center of reform efforts and professional development activities (Darling-Hammond, 1994; Leiberman, 1995). This connection to the real-life work of teachers is imperative for lasting learning to take place. In this early pilot study of K-12 Internet use, much of the technology integration learning had to take place in the classroom environment, where experienced teachers could make the connections between student learning and new on-line resources available through this medium.

As Joyce and Calhoun (1995) point out, "staff development must not be offered as, "Here is stuff that has been researched, so use it!" Rather, effective staff development requires opportunities to be enriched by what Meier (1995) refers to as "the power of each other's ideas." As Fullan (1993) observed, "It's not a good idea to borrow someone else's vision." Thus a certain amount of time spent to establish each person's own vision and plans for technology integration is considered a vital part of staff development by many educators.

Peer coaching provides additional avenues for teachers to share expertise perspectives, and strategies with each other. Cohen, Talbert, & McGlaughlin (1993) point out "the importance of understanding how teachers respond to an ever-changing situation with knowledge that is contextual, interactive, and speculative." For this reason, teacher development programs should be structured around peer-coaching or mentoring in which the relationship between learner and coach is grounded in actual classroom practice. Learning new practices (such as technology integration) often involves changing old habits that have made teaching comfortable and predictable. This idea of a "buddy-system" proved helpful as the External Change Facilitator (ECF) offered technical assistance to the Internal Change

Facilitator (ICF) and began the work of designing a turn-key training program that would have lasting effects on these educational organizations.

In this study, the External Change Facilitator (ECF) initiated the professional development activities with turn-key strategies in mind. The study examined four key themes:

- First, the role of an outside agency to provide for successful Internet use by the ICF at each site,
- Secondly, to identify benchmarks that would indicate successful Internet integration for improved learning,
- Thirdly to identify the elements of a successful turn-key model,
- Finally a fourth goal was to identify successful dissemination strategies.

Eventually a model could be constructed and applied at other sites across the United States in order to scale-up the integration of Internet use for more teachers and their students.

The original pilot study was funded through the Office of Educational Research and Improvement (OERI), United States Department of Education. Two External Change Facilitators, Marlene Goss and John Kinslow, were assigned by Research for Better Schools, an OERI-funded, Regional Educational Laboratory to work with educational sites while providing Internet training.

The year long, 1995 study examined, described, and analyzed how the ICF learned basic skills, found time to use Internet, and integrated and applied new skills professionally. The study also examined what role the partnership between the outside agency and the ICF played to provide professional development and educational change at the site. The success of a turn-key model to disseminate the use of Internet to others was analyzed.

The results of the year-long study suggested that end users learned to use and apply Internet when the following factors are addressed:

1. **Access:** There is a dependable, consistent, and secure connection to Internet.
2. **Skill Building:** End users' skills are built through practice using telecommunication tools that align professional goals, school curriculum and classroom strategies with student needs for increased learning.
3. **Ongoing Support:** provided by an outside agency that is responsive. This supports users' risk taking and serves to inform and enhance systemic change.

Limitations recognized by participants concerned:

1. **Equity:** All participants were already in possession of computer hardware. This led to participants' concerns about schools being unable to participate if they didn't have basic equipment.
2. **Time:** More time was needed for initial training of basic skills and for practice, planning and integration into classroom activities.
3. **Costs:** If costs were not covered initially by outside funds, participation would have been impossible.

Update

Seven years after the initial study when each of the Internal Change Agents were given their first Internet account, each site was revisited to determine what happened since the original study was completed. Goss and Kinslow contacted each of the original ICFs, initially through e-mail, requesting that the participants answer the same survey that was used to collect data in 1993; additionally, each was asked to reply to an on-line survey, http://www.cyberseedannie.org/survey

Survey Questions:

1. Current Use: Have you been using your Internet connection? How? If not, why not? Problems?
2. Intended Use This Year: How do you envision your use this year? Who do you expect to train at your site? Have you devised a plan?
3. Linkage/Relevance at Site: Is the use of Internet connected to any initiatives currently focus on in the school? Has Internet fit in with the current plans of teachers or staff developers at your school?

4. Internal Support: Has the school administration supported or acknowledged your work with Internet? How about next year? What feedback do you get from administration? What does administration do to support new initiatives?
5. External Support: What support systems do you use? What support are you looking for in order to accomplish your goals?

Survey Replies:
The following is a selection of replies received for each survey question from participants.

1. Current Use:

D.B. "Over the past 7 years I have probably trained and coordinated thousands of educators throughout the state of New Jersey. I have worked in three school districts these past 7 years and have been active on the county technology consortium. I can't even imagine creating a training session involving curriculum that does not include a component of the Internet. As director of the Gloucester County ETTC for the past 2 years, I have worked with 28 public school districts employing over 3500 professional staff."

P.B. "I can't begin to capture the growth and knowledge gained since I first stood with glazed eyes as your captured telnet site whizzed by on my ancient MAC. Two web sites, status as a mail administrator, training to assist with network administration, maintaining a mailing list, adding a whiteboard to our website, hundreds of training workshops for teachers, presentations at major conferences, electronic databases, software preview center - all things that I believe came out of that pilot! Who would've thought…"

C.S. "As Curricular Technology Specialist for Germantown Academy, I assist teachers (150) in their efforts to integrate technology into the curriculum. I conduct large group staff development workshops, plan and develop technology integrated lesson plans with individual teachers, assist with classes as they implement technology integration, or develop application specific tutorials and rubrics to be used by teachers and students. This experience, along with the many in-service workshops I have conducted for my regional Intermediate Unit, the state technology initiative, "Link to Learn," regional district technology days, and presentations I have given at Connected Classroom Conferences in Los Angeles, Valley Forge, Atlantic City, Baltimore, and Chicago, SITE'98, PETC '98, PETC'99, Tel.Ed '98, South African NECC'98 and NECC'99 qualify me to give this workshop....my work and that of my colleagues at Germantown Academy is being used by the Link 2 Learn initiative of Pennsylvania as a prototype for other teachers and my curricular technology site, http://www.ga.k12.pa.us/curtech/curtech.htm, is being included on a new CD to help educators in their integration efforts."

H.J. "Yes, we've been using the Internet connection. Every IU employee (approximately 150) at this site has Internet to their desktop. They have been trained. Our internal mail is through the Internet. Many people use Internet web sites as part of their daily work. (equipment specs, special needs information, PDE information, USDOE, vendors, grant info....."

S.L. "We use our Internet connection every day. Teachers are constantly in the office looking up info on the Internet. In addition, many students come in, not only from science classes, to research topics for their papers and reports. It is used more than in the past!"

2. Intended Use This Year

S.L. "I am going to show my classes and other science classes how to use the Internet. I will go into the classrooms with a large screen TV and Internet hookup. This should increase our use greatly. I am also planning a workshop for teachers on how they can build a web page."

H.J. "The MCIU consortium has grown to include 16 public school districts, AVTS and private schools connected via T-1 lines. This year, we are upgrading those lines and will have dedicated T-1 lines and a 10 mb SMDS line to the Internet. There are approximately 12,000 computers on this network."

3. Linkage/Relevance at Site

S.L. "Nothing formal has been established in our school."

H.J. "Schools and districts use the connections for classroom projects, CU-SeeMe, administrative tasks, and a wide variety of functional uses. Training for the Internet is on-going. We have training for support and administrative staff as well as instructional staff. Training materials are posted on the web for district trainers to use. The MCIU website has them posted at the following location: http://mciunix.mciu.k12.pa.us/~tech/ITS/ProfDev/wrkshmat.html#Handouts. In addition, the MCIU technology committee produced a series of competency checklists for staff to self determine what workshops they should enroll in to learn technology skills (also posted on the website)."

4. Internal Support

H.J. "The MCIU administration fully supports the Internet node for the county and has provided additional funding when needed. We have upgraded the network several times over the past few years and have had no problems getting our plans through. The MCIU webpage is robust and reflects the internal support through the IU divisions of the Internet connection."

S.L. "We have support from central office. Administration at our school encourages its use! They do provide funding for Internet projects. In addition, we have a technology committee which is responsible for bringing an Internet lab into our school."

5. External Support

D.B. "Technical. Administrative. Government. Business. Technical because valuable time is lost when the technology is not working. Having the educational technology specialists in a building use their time to "fix" problems is a horrible waste of time, money, and talent. Districts need to understand when they purchase the tools they need to budget for the technical support and not rely on in-school support. Administrative support is imperative in order for any educational technology goals to be achieved. Government needs to assist the districts caught in the middle - - too poor to receive generous gifts of support from their community - - too rich to receive the dollars doled out to help disadvantaged students. The schools caught in the middle stagnate due to the "middle class" dilemma. Business needs to lend a hand. There are many ways to forge partnerships with schools. Business is now having to take graduates and train them. Business has to help schools prepare their incoming employees."

H.J . "We have good technical support through vendors and consultants, curricular support through other professional collaborations. Many MCIU staff members are trail blazers and work out problems to facilitate use of the Internet by educators throughout the county."

Analysis

All replies were analyzed looking for patterns which would help identify recurring themes or indicators. By comparing these themes with the results from the first (1995) study, a set of consistent indicators for success begin to emerge as a series of benchmarks. These benchmarks would help identify the necessary guideposts an educational site would use in order for one person at their site to have a positive impact for disseminating Internet use.

Analysis through triangulation identified the following indicators of successful systemic and turn-key use of turn-key dissemination of Internet through an educational site. These benchmarks appear to be important to help other sites successfully plan and initiate Internet use by replicating the successes of these pilot sites that have had sustained success. Save time and money.

The following benchmarks are indicators of successful turn-key technology integration:

1. Professional development programs are based on research, guided by an Internal Change Facilitator, in response to identified needs and aligned with curriculum.

2. Long term and short term technology integration plans are actively supported and funded by efforts of administration and other policy makers.
3. Outside Partnerships exist for successful grant writing, tech support, sustaining infrastructure and professional development, catalyzing and energizing internal efforts.
4. On-going assessment and evaluation is readily available to discern the impact of technology use.
5. Opportunities to tell their story through showcases, newsletters, conference appearances, and personal contacts.

These findings confirm the results of the earlier 1995 study with additional insights.

There is a direct relationship between the identified benchmarks and an ICF's ability to integrate technology systemically at an educational site. The ICF at sites without active administrative support dramatically struggle to disseminate the use of technology. Although, each pilot site's liaison is a dedicated user of Internet and an enthusiastic supporter of its integration into every classroom, without administrative support the barriers to systemic dissemination are too great for any individual to overcome.

Each Internal Change Facilitator has become a leader directly responsible for the professional development of many more teachers than were involved in the original 1995 pilot study. As a result of efforts through the application of "turn-key" methods for dissemination of Internet knowledge and skills, there are now thousands of teachers involved in regional school improvement efforts through technology integration, and especially through the use of Internet.

Closing Comments

In a 1995 study of turn-key users of Internet, five key factors emerged that determined the success of their scale-up efforts.

Research has shown that turn-key training, when used effectively, can help scale-up or increase the effective use of technology innovations in education (Joyce and Showers, 1988; Fullan & Miles,1992; Scrogan, L., 1997). Results from this study confirm that professional development focused on the use of Internet is a catalyst to dissemination of systemic Internet use for distribution of resources for students and teachers.

This follow-up study revisits those early Internet adopters. Through analysis of survey and interview data, this study sheds additional light on earlier findings, while illuminating the successes of those with broad-based administrative support and a thoughtful technology dissemination plan.

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THEORY

Theoretical Models for Evaluating the Significance of Information Technology in Schools

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Abstract: In this paper, we introduce a theoretical model for classifying the rationales of using computer in teaching and two theoretical models for evaluating the significance of such a use. The models are developed on basis of a model and frameworks utilized in information management science to classify the rationales for using information technology (IT) and to evaluate the significance of IT in industrial and business organizations. Also, we introduce the empirical findings of our small scale tests of the models in the Teacher Training School in Rauma (TTSR, a primary school with about 260 pupils and 19 teachers, Faculty of Education, University of Turku, Finland). According to the results of the tests, the models seem to work satisfactorily. However, we are aiming to develop the models further to apply to evaluate the significance of using IT in teaching at different levels of school (primary, secondary etc.).

Introduction

According to the national information strategy of the Ministry of Education in Finland, *the task of the school is to give for every girl and boy basic skills of knowledge acquisition, maintenance and communication needed in information society and further studies. Education at all levels has to take care of that these skills are up-to-date.* Teachers' professional skills are absolutely essential in implementing information technology (IT) in teaching. Teachers need not only know how to manage and communicate information in their own field(s), but they also have to be able to teach methods of obtaining and using information to enable learners to work independently. Teachers should have the ability to use the media necessary for open and flexible learning and be able to modify and develop material in ways that make it suitable for them to use. The prerequisites and content of basic and supplementary teacher training must be developed to respond to these requirements. (Finnish Ministry of Education 1995, 39-41)

The strategy seems to offer rationales for utilizing IT or computer in teaching. However, the rationales for computer use in teaching have often been mythical and based on faulty conceptions of the possibilities offered by information technology. An often used argument in an endless-seeming computerization race has been: the school has to be equipped with computers of the newest generation because of the coming of the information society. The race is catalyzed by hard competition between various brands and suppliers in the market. Potential customers are persuaded by tempting offers to buy "right now, when it's favorable". The market is characterized by a strong IT -push, which is still multiplied by obscure or faulty positive images (e.g. "It pays to be the first mover", etc). In the Finnish school system, now in the late nineties, huge investments are being made in IT nationwide according to the information strategy of the Ministry of Education. Although the school need not be profitable in the sense of normal investment calculations, some kind of economical housekeeping must be targeted in its work. This presupposes that appropriate measures are developed and utilized.

In this article, we introduce a theoretical model for classifying the rationales of using IT in schools in education and two theoretical models for evaluating the significance of such a use. Also, we introduce an empirical pilot study to test the two latter models. The introduced models are developed on basis of a model and frameworks utilized in information management science to classify the rationales for using IT and to evaluate the significance of IT in industrial and business organizations.

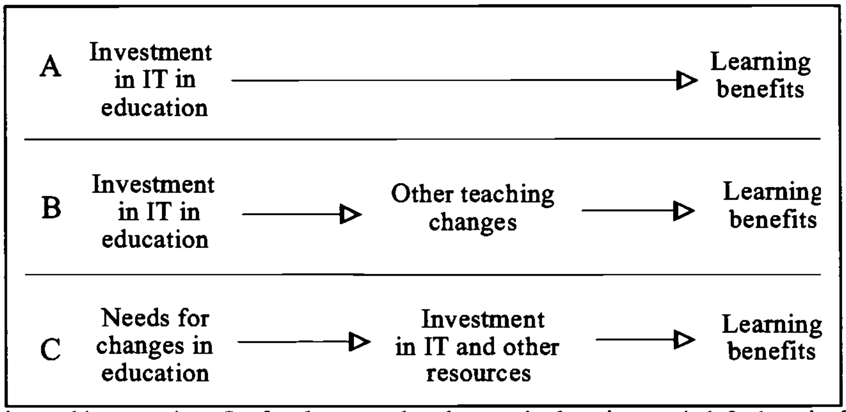
The rationales of using IT in schools

Earl (1989; 1990) introduced a theoretical model for classifying the rationales of using IT in business and industrial organizations. There are three categories of rationales in the model, first two of which (A and B) are based on technological imperative and the third one (C) is based on organizational imperative. Earl's (1989; 1990) model was developed for industrial and business-life purposes. Earl realized that the promises of IT have

too often turned out to be highly exaggerated. When promises and expectations have been strong (e.g. competitive advantages, economical savings, rationalizing the routines, etc.) and yet there have often been disappointments, frustration has been the result. Decision makers have begun to doubt the possibilities offered by IT in industry and businesses, and as a result of this it has become harder to get the financing. (Earl 1990; Clark 1983)

We modified Earl's model to be used in connection with classifying the rationales of using IT in schools in education (Fig. 1).

Fig. 1: IT in its place in education (Alajääski 1996; 1999)



In category A, alongside with acquisitions of information technology, learning benefits are expected to occur, or even all the problems in the school are expected to be solved without any further developments in teaching practices. It often happens that the acquired equipment is left alone in the backroom to get dusty and out-of-date. In category B, teaching is being adjusted to the needs of acquired IT and at the same time learning benefits are expected to follow. Typically IT, keyboard skills, techniques of the devices and the operation of various software programs are taught. The system designers' aims and information processing needs serve as starting points and the school must reconcile itself to the demands of IT. In category C, the aims and settings of the school are the starting points of the process in which IT is acquired to the school. Maintaining the learning benefits is attempted by investing in various appropriate facilities including IT. The school's future visions and problem areas in teaching have to be investigated first. Then, the use of IT can be regarded as one option among others. The purposes, settings and IT together will determine the use of IT.

Evaluating the impact of IT in schools

In industrial and business organizations evaluating the impact of IT is regarded as important because of e.g.: 1) increasing understanding of using IT, 2) finding out the significance of IT to the organization and 3) analyzing the right way to manage IT. The same rationales also apply to evaluating the impact of using IT in schools.

The IT -strategic grid

McFarlan et.al (1983, according to Earl 1989) introduced a method, in which subjective evaluations of the strategic impact of existing and future IT -applications serve as a basis for classifying organizations into an IT -strategic grid. In this method the significance of both current and future applications are evaluated in a low-high -scale. The actual evaluation is done by answering two questions: 1) What is the strategic impact of existing applications? and 2) what is that of future applications? As a result, organizations fall into one out of four possible categories, for which McFarlan uses metaphors: support, factory, turnaround and strategic. As examples of typical industrial and/or business organizations in the different categories Earl (1989) gives the following: 1) a cement company (support), 2) a steelworks (factory), 3) a retailer (turnaround) and 4) a credit card company (strategic). However, as Earl (1989) states, the organization's position in the IT-strategic grid is dynamic, and the analysis should be renewed periodically.

In our modification of McFarlan's model, to fit the evaluation of the impact of using IT in schools in teaching, the following questions must be answered: 1) What is the strategic impact of existing IT-applications in teaching? and 2) what is the strategic impact of future IT -applications in teaching? The response scale is in both dimensions (existing, future) 1-5 (very low- low - medium - high - very high). As a result of the analysis, schools fall into one out of four categories of the IT -strategic grid of teaching (Fig. 2).

		Strategic impact of future IT -applications in teaching	
		LOW 1	HIGH 5
Strategic impact of Existing IT-	LOW 1	***(1. Support)***	***(3. Turnaround)***
Applications in teaching	HIGH 5	***(2. Factory)***	***(4. Strategic)***

Fig. 2: The IT -strategic grid of teaching (Alajääski 1999)

In support -schools the strategic impact of existing and future applications is regarded as low. In factory-schools the strategic impact of existing applications is high but that of future applications is low. The school is in some kind of a state of equilibrium, and it is believed to carry on with its teaching unchanged so that no new applications are needed. In turnaround -schools, the strategic impact of existing applications is low but the expectations set on future applications are high. The schools in this category have moved or are moving to a new IT-atmosphere. In strategic -schools the strategic impact of both existing and future applications are evaluated to be high. The schools in this category are constantly watching and predicting the future and they have a novelty-seeking and creative IT -atmosphere. (Earl 1989; Ruohonen 1988)

Also, a school's position in the IT -strategic grid of teaching is dynamic. So, the school's position in the grid may change within a category and also from a category to another. Thus, the analysis must be renewed periodically. The analysis may be executed also by school subject (mother tongue, mathematics, history, etc.) and/ or by IT 's sub -field (wordprocessing, spreadsheet, W3, etc.).

The d^4 -schemas and d^4 -profiles

Another implementation of evaluating the impact of using IT in an organization is based on classifying the organization subjectively into one out of four optional categories depending on the role of IT -applications in the organization's work. The alternative categories are the following: 1) IT is the means of delivering goods and services (delivery), 2) business strategies increasingly depend on IT for their implementation (dependent), 3) IT potentially provides new strategic opportunities, but is not necessary (drive) and 4) IT has no strategic impact (delayed). (Earl 1989)

We modified this analysis as follows: In the school to be analyzed, goodness-of-description -evaluations are made for all the four categories by responding to the question: "How well do you agree with the following statements describing the role of IT in teaching in your school: 1) IT is the means of teaching (delivery, d1), 2) teaching increasingly depends on IT (dependent, d2), 3) IT provides new alternatives for teaching (drive, d3), and 4) IT has no strategic impact on teaching (delayed, d4)". The response scale is 1-5 (totally disagree - disagree - neutral - agree - totally agree).

The d^4 -schema of the school is defined by an ordered list of the categories according to the descending order of the goodness-of-description -evaluation means/medians, e.g. d1d2d3d4. The d^4 -schema describes the type of the school in respect to the significance of IT in teaching. In the d^4 -schema of schools with a low significance of IT in teaching (type L school), the categories d3 and d4 are ahead of the categories d1 and d2 (e.g. d3d4d2d1), and in the schema of the schools with a higher significance of IT in teaching (type H school), d1 and d2 are ahead of d3 and d4 (e.g. d1d2d3d4). There are of course mixed types, too.

The d^4-profile of a school is defined by a line diagram sketched by the goodness-of-description -evaluation means and/or medians for the categories d1, d2, d3 and d4. The analysis may be executed also by school subject (mother tongue, mathematics, etc.) and/or by IT 's sub -field (wordprocessing, spreadsheet, etc.).

The d^4 -schema and d^4-profile of a school are dynamic. So, the development of the school in respect with the role of IT in teaching can be followed by defining the d^4 -schema and d^4-profile of the school periodically.

Case study

The research problem

We tested the models introduced above in small scale in the Teacher Training School in Rauma (TTSR, University of Turku, Department of Education), a primary school with about 260 pupils (from 1st graders to 6th graders) and 19 teachers. The pre -test was executed in February 1997. In the summer (July) 1997 the school received a new school building with modern IT -based teaching environment. Then, the follow-up post- test was executed in March 1999.

The research problem was the following: How does the significance of using IT in teaching develop in a school with modern IT -based teaching environment as evaluated by the teachers.

The development of the school's position in the IT -strategic grid

In the following figure (Fig. 3) the positions by subject and by application field of TTSR in the IT - strategic grid both in -97 and in -99 are shown.

		Strategic impact of future IT -applications in teaching	
		LOW 1	HIGH 5
Strategic impact of	LOW 1	*(1. Support)*	*(3. Turnaround)* *AS*
Existing IT-applications In teaching	HIGH 5	*(2. Factory)*	*(4. Strategic)*

Fig. 3: The approximate place of TTSR in IT-strategic grid by application field (A) and by subject (S) both in the pre- and post -test

In the pre-test (-97), according to the teachers' average evaluation -means TTSR fell into the turnaround - category both by application field ($A_{mean,97}$ = (3,0; 3,5)) and by subject ($S_{mean,97}$ = (2,8; 3,5)). In the post-test (-99), the coordinates were $A_{mean,99}$ = (2,8; 3,5) and $S_{mean,99}$ = (2,7; 3,3) respectively and the school was still in the turnaround -category. Theoretically, both in the pre-test and the post-test, TTSR was in a state of novelty-seeking IT -atmosphere or IT -culture and may be moving to a creative state (Ruohonen 1988, 56).

For existing applications, no statistically even almost significant differences between the pre- and post-test medians have been found in the strategic impact of IT or any of its sub -fields, except W3. The same also applies to the medians of the future applications, not even W3 makes any exception.

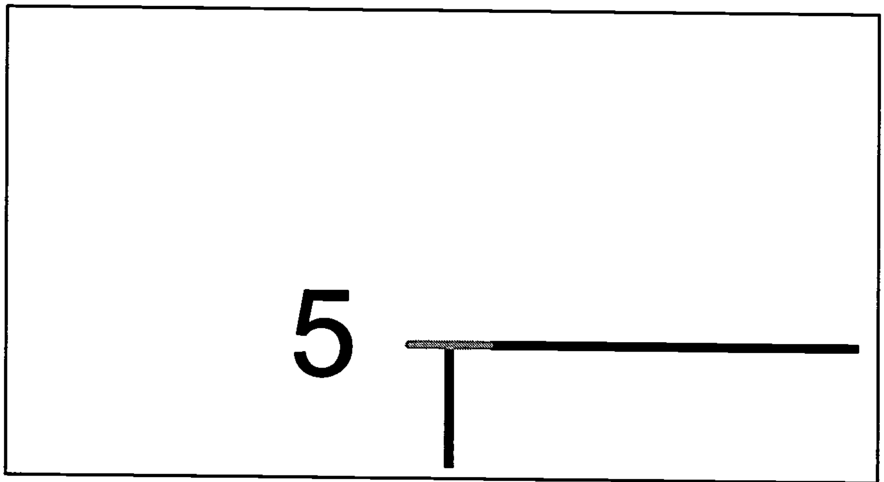
No significant development in the position of TTSR in the grid was seen despite of almost two years time in the new modern IT -based teaching and learning environment.

The development of the d^4 -schemas and d^4 -profiles

In the next figures (Fig. 4 and Fig. 5) the d^4 -profiles of TTSR in pre- and post -test are shown. The means/medians of the evaluations are higher for future applications than for existing applications for delivery- and dependent -roles. For drive- and delayed -roles the evaluations are higher for existing applications than for future applications. When the scales on both axes are interpreted as interval scales, the regression can be specified. In the pre -test the regression coefficients are 0,55 (for existing applications) and -0,08 (for future applications). Similarly, in the post -test, the coefficients are 0,70 (existing applications) and 0,13 (future applications).

Fig. 4: Median and mean d^4 -profiles for existing applications in TTSR (pret. = pre -test, post. = post -test)

Fig. 5: Median and mean d^4 -profiles for future



applications in TTSR (pret. = pre -test, post. = post -test)

For existing applications, the d^4 -schema of TTSR is d4d3d2d1 both in the pre- and post -test (Fig. 4). So, for existing applications, both in the pre- and post -test, TTSR is a type L school. For future applications, the d^4 -schema of TTSR is d3d2d1d4 in the pre -test and d3d2d4d1 (or d3d2d1d4) in the post -test (Fig 5). For future applications then, both in the pre- and post-test, the type of TTSR is mixed, with a minor change towards the type L from the pre -test to the post -test.

Conclusion

Empirically, no significant development of the significance of using IT in teaching seem to occur in the TTSR despite of the utilization of a modern IT -based teaching environment. The result is in accordance with the result that of primary importance for learning is the method of using technology rather than sophisticated capabilities of the technology (Leidner et al. 1993, 48).

Theoretically, the developed models to evaluate the significance of IT in teaching in schools seem to work satisfactorily. Next, more experiences are needed about the usability of the models at different levels (primary, secondary, etc.) of school.

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The New Production of Knowledge: A return to philosophical principles

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Abstract: This paper presents some considerations on the subject of new technologies and its role in the new production of knowledge. The main objective is to show there is not a single angle to look upon the issue. There must also be, as a starting point, the assumption that to deal with the new configuration of the world and the relations established by and under its main streams, is to deal with the existence of human beings from an ontological point of view. In this sense, we argue for the imperative necessity of a philosophical approach in discussing the ways the contemporary world has brought to bear with knowledge.

Introduction

The discussion about knowledge is not a new one. As a matter of fact, knowledge and as consequence, the relation between subjects and the objects, is one of the oldest, if not the oldest question which hangs over mankind since ancestral time. Ancestral as it is, the look men have laid over nature, over the world and its mystery was the starting point for the reflection of what has been known as philosophy. But what is this that men have been doing and still do? What is philosophy? In order to develop my arguments in this paper, I would say that it is not possible to define properly what philosophy is, unless you live it. For example, you may give an accurate description of San Diego's streets, restaurants and so, by reading a good city map. You may even know the names of the streets around this place and give a good idea of its location within the city. On the other hand, someone like us, who are here, who have been walking on the streets, going to its restaurants, can give you more than a mere description. Someone who had been here can give you a *living* of what San Diego is, can fell it as an object full of life. No city maps, no photos can replace it, but the city itself. As had Professor Manual Morente (Morente, 1960) pointed out, philosophy is a *living experience of the object*, it is an exploration crossed by our *being-in-the-world*. The description gives you an idea, a representation, a concept, an intellectual elaboration while the *living* gives you an experience in the presence of the object.

If we agree, then, that information technology (IT) has pervaded all recess of our ordinary life, directly or indirectly, we could say that we have been living in technology. Technology has become not only an intellectual abstraction but also a lived experience It has become part of the *essence* of human beings in the turn of the century. Discussing IT is also discuss the *consistency* of men and, in this sense, it is an *ontological discussion*. On the other hand, it is necessary to say that this is not an easy task, "...We are always within the situation, and to throw light on it is a task that is never entirely completed. This is true also of the hermeneutic situation, i.e., the situation in which we find ourselves with regard to the tradition that we are trying to understand.(...) To exist historically means that knowledge of oneself can never be complete." (Gadamer, 1975, p.268-269). Gadamer sees in this essential historicity of our being the cause of our inability to achieve full explicit understanding of ourselves. Plato would argue with his *theory of ideas* to justify our imperfect comprehension. Whether attributing to our historicity or to the platonian *transcendence*, the search for the knowledge and comprehension of being is still a major challenge but we shall face it the best we can.

A question of method

The discussion on knowledge implies the discussion about the methods of science. Historically, the concept of science is related to the natural science and its procedures. In the search to achieve the status of

scientificity the human and social sciences have looked upon the methodology of its counterpart as the method *par excelence*. This positivism has impregnated the history of science and the behavior of human scientists as well. Substantial and innumerous discussions have been held on the topic but, more recently, some epistemologists have brought new approaches to the debate. The main core is the defense of a methodology of its own to the social and human sciences not necessarily mirrored on the procedures of natural sciences. On the other hand, natural scientists were / are seduced or challenged by the purpose of finding the common roots for their practices due to the influence of *phenomenology* or the *philosophy of existence*. Similar to what Husserl, on the thirties, had discussed about European science's crisis, not as a result of a question of method but as a result of the oblivion of a funding subjectivity first and undeniable, as pointed by Costa in a recent article (Costa, 1999).

Different schools have presented several conceptual hypothesis on the topic but in common is the difference of human science's object. This vein of reflection has brought a lot of debates to the philosophical arena of our time and yet has not come to a definite answer, if there is one. The specificity of our object of concern is due to the fact that "social reality has a specific meaning and relevance to human beings who live, act and think within it, who previously select, experience and interpret reality based on the common sense of their everyday life. The objects of thought that an expert in social science constructs to understand this social reality must be based on the thoughts that men share while living their quotidian life immerse in their social world."(Schutz, 1952, p.79-80, free translation). The social world, while an object to be known, is already given by a *pre-theoretical interpretation* and, therefore, restores the importance of our everyday life meanings.

Interpretation. When someone speaks of *interpretation* we usually associate with artistic or literary work. The ordinary reader of a poem, a romance, the musician, they are all interpreting a series of marks on a page. It does not cause any argument about this action. But how could we translate or transfer the interpretation of texts to the interpretation of our social life? *Phenomenology* has come to play a definite role to the relevance of the activity of interpretation as a method of knowledge. "One of the fundamental insights of phenomenology is that this activity of interpretation is not limited to such [readings of texts], but pervades our everyday life. In coming to an understanding of what it means to think, understand, and act, we need to recognize the role of interpretation."(Winograd & Flores, 1988, p.27). Far from discussing the existence of a meaning independent of the subject of interpretation, Gadamer takes the act of interpretation as an interaction between the text and the interpreter. For him, any individual trying to understand his / her world, is involved in activities of interpretation. The traditions or prejudices someone brings to the interpretation are nothing less than *pre-understanding* brought by our everyday life which occurs within a given cultural background. Becoming aware of some of our prejudices can emancipate ourselves from some of the limits they impose but the act of interpretation is individual, contextual, historical. As well as linguistic interpretation there are also non-linguistic experience, "it is therefore necessary to adopt a deeper approach in which interpretation is taken as relevant to *ontology* - to our understanding of what it means for something or someone to exist."(Winograd & Flores, 1988, p.30).

Along with the role of interpretation on developing a proper method to deal with social facts, the importance given to our *Lebenswelt* seems to indicate a shift from the *rationalistic orientation* towards an understanding of the world as a whole. Instead of accepting the dualism of two separate domains of the phenomena - objective and subjective worlds - philosophers, from Aristotle to Heidegger, have tried to integrate the primacy of experience and understanding without reflection. While Aristotle brought to the ground the intelligible world supported by our sensible experiences - Plato's dualism -, Heidegger stressed our existence in the world as the primary source to every interpretation and, at the end, to the production of knowledge. The assumption that detached theoretical point of view is superior to the involved practical viewpoint, current in natural sciences, is reversed by Heidegger. " Heidegger does not disregard this kind of thinking, but puts it into a context of cognition as *praxis* - as concernful acting in the world. He is concerned with our condition of *thrownness* - the condition of understanding in which our actions find some resonance or effectiveness in the world."(Winograd & Flores, 1988, p.33).

Interpretation as a method

The search for understanding is an act of the intellect as a result of a willingness to know. This most general principle is the same whether referring to objects from nature or from thoughts. As a matter of fact the results from the act of absorbing, of capturing an object comes to the production of what is known by knowledge, an *explanation* or a *comprehension* which implies an interpretation. Once again the duality from these different methodological positions gives origin to a profitable conceptual territory where concept of

knowledge is put at stand. Without going deep on the issues raised by this debate, we will try to come to a definition of knowledge first considering the structure of human life as a world of inter-subjectivity. In order to do so we must travel in time to rescue the early definition we will assume as the most accurate one.

Twenty centuries ago, one of the most startling revolution in the history of human thought was brought by the work of Parmenides from Elea, a small town in south Italy. He came to discover the rational *principle of identity* that states that something is or something is not. Another point raised by him and further developed by Plato, was the existence of two different worlds: the intelligible and the sensible. While the world full of aromas, tastes, colors in constant movement is just an appearance, the intelligible world is the world of logical and rational thought, the only guide to discover what reality is, what is outside from us. Our intellectual intuition is our reason, *being* and *thinking* come to be the same thing. This coincidence has flowed into the perception that the subject of thinking and thought also keep a close relation or, better saying, have an undeniable connectedness. But how does this reason operate? For Plato the reason operates creating *concepts* directed towards a portion of reality tied indissolubly into an unity. The unity is the essence of the object or its consistency. The intuition from the spirit confers on this consistent unity its existential reality through an idea brought by a subject. For Aristotle the coincidence among *Being* and thinking persists but he establishes the unequivocal distinction between the *ontological* and *logical* spheres, one deals with the discussion of Being and the other deals with logical discussion of its predicates. Different categories although fused. Aristotle's theology gives us a comprehensible world where to know is to form a concept about the individual object. "Conecer significa primero formar concepto, es decir, llegar a constituir en nuestra mente un conjunto de notas características para cada una de las essencias que se realizan en la substancia individual. Los processos de abstracción y de generalización que sobre el material de la percepción sensible ejercitamos nos conducen a la formacíon de un arsenal de conceptos. Saber es tener muchos conceptos."(Morente, 1960, p.111). To know is also apply the concepts we have created to the individual thing and also to cross different judgements throw rationalizations which get us to conclusions about the object. All these three instances come to be knowledge in general. While the discovery is essentially individual it must be shared through the *inter-subjectivity of existence*, through the traces of divine intelligence emanated from *Being* historically personified by the subjects.

It is also important to perceive that the process of producing knowledge is dynamic because based on *action*, based on the *relation* established among *beings*. Even when considering that for Aristotle the movement could not be properly addressed to the Being because it cannot be and not be at the same time, he was also moved by the comprehension of how reality and things come to be. According to Morente, Aristotle looked upon what reality offers as changeable and fluid. The intellectual intuition although logic is also permeated by the movements which characterize life, permeated by the essence of being in its continuous flow in search of the unknown. The subject of thinking would be first an existential subject and only afterwards, a logical subject. This premise is rather important to the point we argue in defense of different ways of producing knowledge not constrained to the rationalistic or logical sphere. If we analyze the epistemological contribution brought by the *theory of complexity* we could even argue that there seems to be a backward movement aiming to restore the first inception of philosophy: science of objects from the approach of totality and universality.

The *nuova scientia*

Notions as *uncertainty, chaos, complexity, self-organization, order/disorder* appear in the papers of different authors from several domains. From physics to biology, from biology to cybernetics, from sociology to astrophysics, from mathematics to communication, the debates promoted through the last twenty, thirty years indicates the emergence of new scientific theories in the search for the intelligibility of the universe as well as the ancient philosophical quest of knowledge. The crisis of the groundwork of knowledge that begun in philosophy during the XIX century has spread over the XX century helped by the confrontation with the new frontiers of science. The impeccable Order of the universe, assumed by natural sciences, has given space to an uncertain combination of order, disorder and organization. The crisis of scientific knowledge ground is thus tied to a crisis on the philosophical groundwork.

These new concepts point to the emergence of what is called *nuova scientia* which advocates the complexity of the process of knowing, of acquiring knowledge. The idea brings in its inception the necessity of an overall look on the process: to know is to act and react as a whole, one single action may affect the totality. The idea of *complexity* is not new, it has been object of concern of different philosophers like Husserl, Hegel and Heidegger, all of them related to phenomenological school. While dealing with objective facts from the real world, scientific theories are interested in finding and understanding what is behind the phenomena. The

delimitation of what is properly scientific is confronted with a certain zone obscure where *intuition* plays a central role. What were believed to be the exact portrait of reality became the results of social, politics and philosophical negotiations among the actors of the scientific arena. The consensus is legitimated by a community, which shares its own principles and background. There is no such a thing as complete objectivity; instead we must replace this concept by *inter-subjectivity*. On trying to identify this new trend, scientists are searching for the elements that would characterize the transformations in the mode of knowledge production such as: *context, boundaries, institutionalization of research, quality control, disciplinarity* and so forth. Summarily we will present its main features.

Characteristics of new mode of production

In the traditional mode of production, associated to the rationalistic tradition, the *context* is defined in relation to the cognitive and social norms that govern basic research or academic science (Gibbons et al., 1997). These norms are due to a certain body of disciplinary specialists who define what should be considered as good science in a specific field. In the new mode, knowledge is intended to be useful in a broader sense whether it be industry, government or society. Once knowledge is no longer bounded by certain limits, *transdisciplinarity* comes to play a major role bringing with it its own distinct theoretical structures, research methods and modes of practices, as pointed out by Gibbons (1997). Those specificities are dynamic. The discoveries can no longer be confined to any particular discipline or sites of production, instead, *new forms of organization* have emerged to accommodate the changing nature of the problems now addressed.

The *quality control* is no longer restricted to the judgment of those peers who had previously contributed to their discipline or to an institutional space. Quality control becomes more context-and use-dependent and takes more transient, temporary and fluid norms. It not only depends on the scientific authority of the practitioners from different realms, temporarily linked together to solve a problem, but also depends on the efficiency and usefulness of the solution of transdisciplinary problem. Quality is now "(...) determined by a wider set of criteria which reflects the broadening social composition of the review system. This implies that 'good science' is more difficult to determine. Since it is no longer limited strictly to the judgements of disciplinary peers, the fear is that control will be weaker and result in lower quality work. Although the quality control process [in this mode] is more broadly based, it does not follow that because a wider range of expertise is brought to bear on a problem that will necessarily be of lower quality. It is a more composite, multidimensional kind." (Gibbons, 1997, p.08).

Instead to value the individual creativity and the consensual figure of the scientific community, the new mode deals with *creativity* as a *group phenomenon* where individual contributions are part of a 'socially extended process'. "The loop from the context of application through transdisciplinarity, heterogeneity, organizational diversity is closed by new adaptive and contextual forms of quality control. The result is a more socially accountable and reflexive mode of science." (Gibbons, 1997, p. 09). Some of the originators for the emergence of this new mode of production are the dissemination or massification of education, the spread of specialists into government, industries, consultancies, but mainly, the development of information and communication technologies. The possibility of increasing interactions among scientists from different realms, brought by new technologies, has put knowledge out of institutional boundaries. New actors enter the scientific arena without being, necessarily engaged to the traditional sites of knowledge production.

Another feature identified by this research from Gibbons's, is the shift of emphasis, in many research fields, to problem solving, in the direction of problem-oriented research, instead of primary production of data and ideas - whether it be due to the expenses it involves as well as the ubiquitous research results brought by advanced information technologies. Reconfiguration of data and inputs to yield new results is the new emphasis.

The new mode, contrary to the older one, is characterized by a constant flow back and forth between the theoretical and the practical or applied. " Knowledge can no longer be regarded as discrete and coherent, its production defined by clear rules and governed by settled routines. Instead, it has become a mixture of theory and practice, abstraction and aggregation, ideas and data. The boundaries between the intellectual world and its environment have become blurred as hybrid science combines cognitive and non-cognitive elements in novel and creative ways. (...) Science no longer has a single strand, no shared method, no common preoccupations, no values which all its various branches share." (Gibbons, 1997, p.81-83).

As consequence knowledge has become "diffuse, opaque, [*sometimes*] incoherent, centrifugal". The distinctions between theory and practice, science and technology, knowledge and culture are blurred. The erosion of older ideas of knowledge is partly identified, at least, as result of the impact from technologies. The wide spread dissemination of higher education (in the industrialized countries -we shall emphasize), the ubiquitous of research methods and research results have diminished the frontiers between the traditional sites of

knowledge production and society. New disciplines were created by associating previously unconnected fragments of other disciplines, which have entered the curriculum in order to cope with different skills demanded by technology, "An overarching discipline like information technology stretches all the way from the most abstract concepts of artificial intelligence, which address fundamental ideas of mind and logic, to routine skills in the day-to-day use of computers. It has opened the way to a quantification revolution not only in the natural and applied sciences but in the human and social sciences as well." (Gibbons, 1997, p.83).

The transdisciplinarity has, as pointed before, its own characteristics. It is a continuous linking and relinking among concepts and configurations of knowledge which are tied together on a temporary basis in specific *contexts of application*. Knowledge produced under these conditions is characterized by a use or action since its inception and not left to a latter stage as in the traditional mode of production. This feature, a privileged one, of the new mode of production of knowledge certainly brings criticism even when transdisciplinarity is valued so highly. It does so because it challenges two of the main core of what is supposed to be quality on the traditional mode: consensus among a disciplinary community of practitioners and its credited institutional space (universities, national academies, professional societies). The transient and temporary context where the new mode of knowledge production takes place threatens this assumption. According to the disciplinary mode of production, knowledge brought by science should not be constrained by the market or specific context of application. But the fact is that transdisciplinarity, beyond the fact that it is problem solve directed, is also guided by a certain number of basic conditions as well as the disciplinary mode. The social constraints, the efficiency or usefulness of transdisciplinary solution are bounded together since the identification of the problem. In this sense we might say that transdisciplinary knowledge is even more reflexive and conscious than the strictly scientific, disciplinary one from the other perspective or mode.

Another feature of this trend is related to the dissemination of knowledge production. In the same way that traditional sites of knowledge production are threatened by the diffusion of scientific capabilities throughout different sectors of society, so is the dissemination of knowledge producers. Different and important kinds of knowledge are being produced not only by scientists and technologists but also by symbolic analysts, communication specialists, educators and so. Those who work with symbols, concepts, theories produced by others in different sites reconfigure them into new combinations. Instead of knowledge-based industries we now witness the emergence of *knowledge industries* where knowledge itself is the commodity that is traded. In these industries the value is added by the continuous reconfiguration of its commodity in order to solve a problem or to meet a need.

An analogy between technology and philosophy

It is not difficult to perceive that this complex whole does have impacts not only on the epistemological ground but also on the social and political spheres related to scientific production of knowledge. As we have pointed before frontiers have been broken as consequence of different features such as massification of education, free flow of communication and the spread of knowledge across different sectors of society. Information and communication technologies do play a major role in this paradigm shift. Most unlikely would we witness such revolution without an increase in the density of communication, without the basic technological infrastructure to support such activity worldwide. The infrastructure not only speeded up the process but also created more linkages, different decentered nodes across a world web. It is no coincidence the bursting of another transdisciplinary research area such as the *cyberspace*.

One of the main feature language has brought to us is the figure of analogy. It is, along with metaphor, a rich resource to explain ideas, to build concepts, in sum to produce knowledge. Intending to keep on this track already explored by different and important authors, I will try to connect the arguments presented above by establishing a parallel among some philosophical concepts and the idea of cyberspace as presented by Pierre Lévy. Before that I shall justify my choice for cyberspace by arguing that it represents the convergence of what is usually labeled as IT. Far from being just another tool aimed for different purposes, the cyberspace integrates different communication and information technologies in an environment. By environment I mean a whole where different features are perfectly integrated but keeping its own characteristics.

The cyberspace is presented by Lévy as one of the most startling technological revolution we ever witnessed. This digital technology has become a new space for human interaction, human socialization and also a new arena for the production of knowledge. Among several characteristics, the author points to its philosophical dimension of a space of *potency* applied in the sense of virtuality, of something that can potentially

come-into-being. This virtual environment is not geographically restricted and is not submitted to the linear flux of time. Another relevant aspect is related to its potentiality as a space of interactivity not restricted to exchange of data and information but also exchange of sounds, images and simulations in a multimedia sense. The web is dynamic in its essence, the flows of changes are spread all around without a hierarchical center, it is only submitted to the pace of individual discoveries and at the same time opened to accommodate and welcome creativity. The emergence of this space of rich potentialities, at the same time virtual and real, has become an instance of our existence whether to deny its importance or to explore its openness.

Far from being apologetics about its potentiality we look at it from the perspective given by analogy. If we recall some of the characteristics of new mode of production presented before and establishes some linkages among them and the philosophical discussion about knowledge, we may infer that the dynamics of the new mode of production emphasizes not only the action of the subject in dealing with reality but also the importance of flow between intellectual work and the human practices. This idea of integration or conectedness between logical and existential spheres direct us toward comprehension and interpretation. We identify among these concerns close links to Heidegger's *phenomenology* and *cyberspace* potentialities. Heidegger argues that the separation of *subject* and *object* denies the most fundamental question of *being-in-the-world (Dasein)*. We have been thrown in the world where we live, we act and also think. There is no such a thing as properties inherent to the world; these properties do arise in the act of living, in the relation established among the subject and the concrete reality of its existence. This pre-theoretical living (*present-at-hand*) comes to the status of knowledge itself when there is some kind of breaking down (*unreadiness-to-hand*), when as a result of some 'concernful action' we become aware of the existence of objects and their properties.

The whole idea of thrownness gives us the dimension of deep subject immersion, an immersion which project us far from just a logical comprehension of reality. It challenges us to perceive ourselves as part and producer of the same reality we aim to apprehend. It confront us by restoring our own status of nature.

Conclusions

From philosophy to science, from nature to men, from technology back to philosophy...

The idea of moving within a wide web of concepts brought by our living experiences which produces knowledge, may signalize a certain return to what had been the ancient concept of philosophy: an aspiration to understand the whole, a love to wisdom and most of all a living experience.

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Fromm's Paradigm of Teacher and Student Creative Attitudes vs. Modern Communication Technologies

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Abstract: The following article attempts to apply Fromm's notion of creativity to the modern teacher-student relation context. It presents the philosopher's concept of basic conditions of the creative attitude. Its aim is to show the possibilities modern communication technologies bring to the process of development of the student's creative attitude. Fromm's paradigm of creativity is presented as vitally important for education because it determines creativity as possible and attainable for each individual. Modern communication technologies are suggested among the means of creative teacher guidance. Examples are provided on use of modern technologies in application of Fromm's creativity concept to education for "seeing and experiencing".

Introduction

Fromm's concept of creativity seems very adequate to the role of teachers in advanced modern societies. They are "cognitive and educating" societies where the importance of continuous education will continue to increase. In his UNESCO Report, Jacques Delors (1998) rightly claims in the face of numerous challenges, education is the chance for humanity. International Council of Education determines the basic principles of the future advanced societies by the statements closely related to the educational aspect of the individual: learn to know, learn to be active, learn to live together, learn to be and learn lifelong.

These statements also exemplify Fromm's concept of the individual living in "being mode" vs. "having mode" orientation (Fromm 1999a). The "being mode" means performance of the creative attitude, which is ability to "see", "realise", and "respond".

Fromm's notion of the creative attitude underlies my concept of *creative orientations* determined by three factors: on the ontological level, the notion is based on the idea of advanced "questing" individual whose chief aspect is creativity as understood by Fromm; in psychological terms it is based on the interactive model of creation process postulated by Nêcka; finally it adheres to the process of continuous education in pedagogical terms.

Modern Societies Advancement Forecast

Professional "predictors" of the future expect further increase in application of science to various fields in 21st century. Computer science will develop strongly, globalisation will deepen in production, commerce, and communication, and cultural fusion processes will grow (see Kwieciñski 1998). Dalin and Rust forecast faster advancement of humanity, bigger job mobility, and more free time to people. Future societies will believe in pluralism, universal values, and individualism. There will be widespread holistic perception of the world (op. cit.). According to Drucker, modern advanced societies are "societies of knowledge" because information and knowledge replaced labour, money and natural resources there. "Information capital" determines the position and advancement of countries. 80% working population of modern societies work in either service or cognitive fields. The latter provides jobs in creation, processing, storing, using and providing information and knowledge (Kozielecki 1998). Knowledge is the key factor of wealth in modern advanced societies, where modern communication technologies play bigger and bigger roles.

Modern Communication Technologies vs. Education

According to the above, concern for education is unnecessary, however the usefulness of the traditional education model with its limited range of teaching means and the formal roles of teachers and students is subject to question. The importance of distance and continuous education is expected to increase, which means the growth of importance of the modern communication technologies. What was impossible to realise in traditional school education, may turn out to be possible in cyberspace. A modern student who comes to school has already spent much time with means of modern communication technologies. Their knowledge of the world, though scattered, is broad and diversified. Modern technologies have a great impact on the child's personality and their relations with society due to the nature, form and meaning of delivered messages. According to Jarome Lanier, the virtual reality is the first communication means that does not narrow the human soul (op. cit.). There is also growing interest in research on artificial intelligence. John McCarthy, the supervising researcher on artificial intelligence in Stanford University, describes AI as forcing computers to do things that require intelligence from human beings. Despite the lack of definite success in creation of intelligent machines, the AI research brought many useful communication tools. Easy-to-use computers and many sophisticated programs are other advantages of the research. So far, artificial intelligence research has mainly concerned robotics, "the great sage and the utter fool in one machine" (Green 1999, 105); computer seeing, which is recognition of patterns by video cameras and suitable programs; expert systems to help people with e.g. medical diagnosis; and speech synthesis, which is recognition and understanding of natural speech.

Great possibilities virtual reality brings to education like development of creative attitudes or creative solution search are not yet utilised. It is still a novelty that requires huge processor capacities in today's standards. However it can be used in so many ways, people – at least in Poland – still associate it with dark goggles, gloves, and enormous number of wires. I believe the educational potential of such technologies deserves more study. It may bring education closer Fromm's creativity paradigm that emphasises "experiencing and seeing". Virtual reality makes it possible to experience the different and the difference. It can let us experience the world's diversification without having to move –without time or space limitations.

Fromm's Concept of the Creative Attitude Conditions

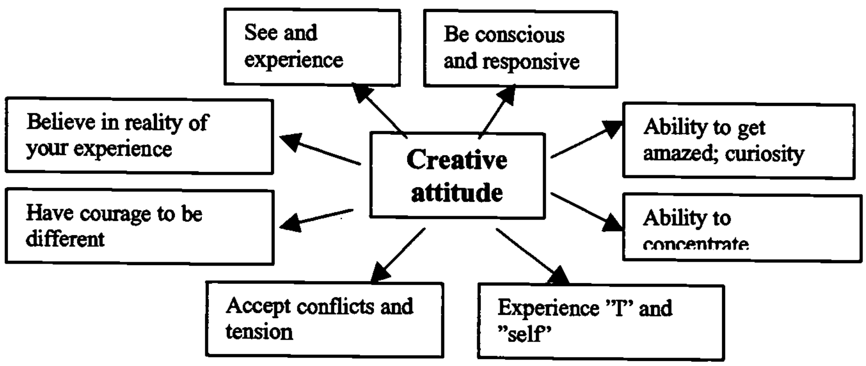
The post-modernistic prospects of today's cultures with their "changeability" and "difference" clearly determine the position of the modern teacher. They cease to be the ones to provide the ready-made knowledge, tradition and the accepted values. Instead, they are one of the numerous factors of the student education. The modern teacher should become a "transformative intellectual" as Henri Giroux says (Szkudlarek 1993). I understand the process as overcoming one's limitations and transgression (Kozielecki 1987), ability to create new quality in the social life. Teacher and student commitment links this teacher role with Fromm's creativity paradigm. Student identity and commitment and their cognitive capacity, not the syllabus, should be the most essential factor for the teacher. The emancipatory education and Fromm's creativity conceptions seem to share the deeply humanistic interest in student identity. The new teacher role is based on creativity, ability to learn and teaching the ability to others. The creative attitude of the teacher is the condition of development of student creative orientations. Fromm's "seeing and telling; being responsive to what others are conscious of" seems particularly necessary in the work of the teacher. Teacher creativity remains artificial without the ability.

Educational processes and especially teachers' attitudes often lead to decline of the original child's capacity of amazement and admiration. According to E. Fromm, to perceive another person creatively means to perceive them without projection or distortion.

One condition of the creative attitude, stated by Fromm as "being conscious of and responsive to what another person is conscious of", is curiosity – the natural ability of children (they get interested easily; the unknown attracts them; they admire things and react creatively). However, education often destroys the ability. Educated people crave "knowledge" primarily and they find amazement and curiosity ignorant, whereas any creation (in the field of art or science) must be preceded by curiosity. Amazement at and curiosity about what others had frequently watched without astonishment prompted many scientific inventions. Marcel Proust defined the issue perfectly by saying: "true discovery does not consist in exploring new lands but in watching things with new eyes" (Canfield et al. 1998).

Ability to concentrate, defined by Fromm as the state when neither the past nor the future can be really experienced, is another vital condition for the emergence of the creative attitude. Authentic concentration occurs when you perceive your activity as the most important thing, so there is no real conscience outside the full

commitment here and now. Fromm's notion of experiencing "I" and "self" is vital for the creative attitude. He says, "to experience 'the self' means to experience oneself as the true centre of one's world and the true source of one's actions. This is what being original means" (Fromm 1989, 65). Thus, E. Fromm assumes originality lies in experiencing oneself instead of discovering new things. The self-conscience differs according to social structures and cultures we live in. This conception concurs with many psychological concepts of creation that concern the meaning of originality in the process of creation. According to Fromm, creative ability is determined by experience of the self, which is creative experience of oneself as the source of one's actions. This involves reference to others so there's no egocentricity or narcissism. Also, the experience of the self should not be based on the notion of people being what they own, because it makes one his or her own prisoner. E. Fromm claims true experience of the self is delivery from oneself and experiencing oneself as somebody capable of the creative response. This concerns the division between the "having" and "being" modes, which was vitally important to the author of *Escape from Freedom*. From the pedagogical point of view, ability to accept conflicts and tension caused by various contradictions is an essential condition of the creative attitude. However, the modern education endeavours to prevent children from experiencing conflicts since they are believed to be harmful According to E. Fromm, conflicts stimulate curiosity and personal strength and they are rooted deeply within human existence. Denying conflicts results in superficial experiences. People reduce contradictions for the sake of equality they misunderstand as unification, whereas Fromm believes authentic equality is everybody's equal human dignity despite their being different. This leads to the notion of everybody's right to develop their differences and nobody's right to use the differences in order to exploit others. Fromm says, "To be creative means to perceive the whole process of life as the process of birth and none of its stages as the final one. Many people die before they are born. To be creative means to be born before one's death" (1989, 68).
The following diagram shows elements that are important for creative attitude:



This concept of the creative attitude indicates various skills that can be shaped and developed in the process of education. Fromm's notion of the creative attitude emphasises also the necessity of "courage and faith". One needs the courage to be different and to commit oneself to the truth of both their thoughts and feelings. This is impossible without faith understood as confidence in authenticity of one's own rational and emotional experience and ability to rely on the experience.

Consequences of Fromm's Creativity Notion for Education

The notion of the creative attitude does not concern extraordinarily gifted individuals or artists. Instead, it is meant as an attitude anybody can and should achieve. That's why Fromm's paradigm is so important in teacher training, since it perceives preparation for creativity as preparation for life. The traditional education seems to have big problems with such preparation because school is clearly a reactive and not proactive institution (see Morawski 1988) whose objective is to last and defend its current position. Its teachers play specific and

standardised roles that limit their independence and creativity. Instead of being encouraged or rewarded, innovative and creative activity is restricted. Application of Fromm's paradigm of creativity to the process of education means rejection of pedagogical monologues in favour of dialogues. Partnership and dialogue between a teacher and a student prevents their fixed roles of "the arbiter" and "the petitioner", or "the assessor" and "the assessed". Instead, each party has to take responsibility for their thoughts and actions. Development of the teacher's communicative and interactive emancipatory competence and their capacity of critical understanding of their surroundings are the essential factors of teacher creativity training. Pop culture and the visual language dominate those surroundings, complex and changeable as they are. Thus, understanding of this culture and language is one of vitally important conditions of emergence in today's world and development of the creative attitude.

Modern Communicative Technologies as Creative Teacher Guidance Means

Modern technologies, which offer new communication opportunities, may be helpful in development of teacher and student creative attitudes by releasing them from their traditional education roles. Modern communication means provide bigger choice of specific educational situations and more diversified experiences. They reject time and space limitations and give more insight in science and the experiences of other individuals. They give boost to imagination, which is necessary for the process of learning. They exclude stress of the traditional education and provide more access to educational resources regarding time, place, and social and emotional condition of the student. It has to be mentioned modern communication technologies create some danger too, which is particularly connected with psychological and social consequences of the communication means. Nevertheless, the concern about social and emotional development of the student need not result in rejection of possibilities offered by modern technologies. However, the technologies should be used as teaching aids and not teacher substitutes.

Application of modern technologies does not necessarily involve rejection of teacher and student immediate contact. Moreover, it can make the contact more attractive and satisfactory for both parties. First experiments in application of cyberspace to education are particularly interesting. Luyen Chou, the author if educational software for New Laboratory of Teaching and Learning, Dalton, proposed that teachers partake in Dalton School educational program. "Archaetype" section of the program involves simulated participation in archaeological excavations so that students find artefacts, determine the culture and time of their origin, and use them as basis for reconstruction of the civilisation. There is considerable emotional involvement in the task. Students invent their own explanations of various phenomena. By providing student commitment, the program meets primary conditions of the creative attitude development process. The astronomy program offers another example of commitment in the learning process. Teachers and students, who can analyse photographs taken in Mount Palamor observatory, partake in astronomical experiments in actual time (Green 1999). Luyen Chou's CD-ROM adventure game of "Qin: Tomb of the Middle Kingdom" brings another example of learning through experience (Green 1999). This remarkable educational program gives students insight into another culture and historical period. Students explore the great subterranean tomb of a Chinese emperor (Shi Huangdi – Son of the Sun). The task is to discover things and avoid traps. The game's encyclopaedia and the principle of "the more you know the more riddles you will solve" provide students with considerable information about Chinese history, culture and language.

There is explicit correspondence between such projects and Fromm's creative attitude concept of "seeing and experiencing". The employment of student imagination and modern technology potential in the process of learning changes the process into fascinating exploration, which involves the individual completely and has strong creative connotation. Students encounter conflicts, ask questions, and search for answers freely.

Hybrid CD-ROM and Internet (www) projects offer interesting possibilities too. In recent years, there has been great increase in number of strategy and simulation games where CD-ROM provides graphic and other elements that require big flow capacity while the net enables communication among the players. The net delivers information about all events, which means one player's move is sent to others. The computers keep updating their graphics so that interactivity among players is preserved (e.g. in "Quake").

Potential of similar hybrid interactive educational programs is great, however not yet developed. They might create the opportunity to overcome isolation within the new system, thus aiding the process of teacher and student creative attitude development.

Learning through imagination aided by modern technologies becomes a fascinating exploration that involves the whole individual and not only their narrow intellectual aspect like in traditional education. Good use of

modern communication technologies encourages students to ask questions and search for answers. Conflicts are provided to develop student's creative potential which, according to Fromm, each individual possesses. Information about facts and problem-solving strategies should be provided to students so that they can process them and make creative solutions in different educational and paraeducational contexts.

Conclusions

Marshall McLuhan's theory that communication means' hidden potential is the greatest power of 20th century regains its validity. Their potential and universality are widely recognised, however they are not equally accessible for all. (Green 1999). It can be predicted possibility of application of modern communication technologies to development of teacher and student creative attitudes according to Fromm's paradigm will increase.

New approach to the teacher role is necessary. Part of the educational dialogue may be conducted by means of modern communication technologies, however this requires also the application of the process of the creative attitude development to various kinds of teacher and student activities. In my opinion, the educational reality should be enriched with specific situations involving the presentation of diversity and difference as possible and necessary and not hostile; showing conflicts and tension as the sources of creative solutions; providing each individual with opportunity to make conscious choices; perceiving creativity as merit; introduction of modern communication technologies to the means of creative teacher guidance and student commitment. As Paul Saffo put it, "technology does not bring changes: it only makes them possible" (Green 1999, 129). It is human beings who bring up problems and ask questions.

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In Search Of The Revolutionary Power Of Critical Pedagogy: Issues Of Ideology, Power, And Culture In Technology Teacher Education

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Abstract: Critical pedagogy is a perspective on teaching that seeks to increase equality, voice, individual & cultural expression and democracy in classrooms. The following three authors describe contexts in which they find critical pedagogy meaningful in their own research using technology in teacher education.

Introduction

Though well intentioned and well planned, many of the methods designed to help teachers use technology in the classroom don't have a transformational effect on children because they don't address underlying and systemic societal issues such as discrimination, violence, and poverty. Political and administrative forces have proposed technocratic solutions such as: (1) attempting to push teachers to learn ever greater amounts of content and technical skills; (2) purchasing more computer laboratories; and (3) placing more 'teaching tips' and links on the world wide web. All these proposals have missed the mark of addressing important social issues. While misunderstood, critical pedagogy challenges teacher educators to recognize, engage, and critique undemocratic uses of technology in teacher education that sustain inequality and oppressive social relations. In contrast to many educational movements, there is no generic definition of critical pedagogy nor are there single defining practices. Rather, there are insights and practices which are woven into various approaches which grow out of a core group of common concerns about equality, individual & cultural expression, and democracy.

In this paper, the authors seek to illuminate and promote that core group of concerns of critical pedagogy in contexts in which technology is used to develop teachers both in the classroom and at the university. Avril Loveless, presents a few ideas on one aspect for critical pedagogy as they apply to the uses of technology in the national context for teacher education in the United Kingdom. Loveless challenges the 'National Grid for Learning' which advocates for vocational goals rather than addressing issues of culture, personal development, and equity of access.

Nicola Yelland highlights the need to consider cognitive, affective and technical scaffolding in learning environments which are sensitive to the ways in which children solve problems and build on their current

understandings. Glenn DeVoogd examines online discourse through the lens of democratic principles of advocacy, reconciling multiple sources of information, and active participation

Taking a Critical View Of ICT in the United Kingdom- What Difference Might it Make in the 'Information Society'?

Utopian and dystopian commentaries on the role of information and communications technologies (ICT) in education can be thought-provoking and promote discussion and re-examination of beliefs and practice (Negroponte, 1995; Healy, 1998). There is, however, a danger that they present a simplistic view and do not acknowledge the complexity of the interactions between people, technology and the context of the learning environment. Teachers, pupils, teacher educators and students can engage in an informed and critical discussion of the appropriate use of ICT in schools and its impact on learners' wider cultural experiences. This may require an examination of current perceptions and practices and a consideration of alternative approaches to the challenges and consolations of ICT in learning and teaching. This section will present a discussion of issues of critical pedagogy with ICT and illustrate key points with reference to a current case study in an English Primary School.

The role of education as the requisite of success and survival in the 'information society' is reflected in national and international governmental policy for prosperity in the global economy (Robins & Webster, 1999). The impact of information and communication technologies on the structural transformations of advanced societies is highlighted in descriptions of the changes in flows, networks and identities in economic and social relationships between individuals, regions and countries. Adopting a critical pedagogy perspective with ICT requires a consideration of the ways in which issues of access, culture, gender, identity, the special needs of the learner, pedagogical practices and educational systems enable learners and teachers to have experiences which are either empowering or limiting for participants in the 'informational society' (Castells, 1999)

Access to ICT resources for the 'haves and have-nots' has a powerful impact at individual, national and global levels, yet this issue is not often articulated or addressed within the education community (Moran, 1999). Similarly, claims made for the revolutionary potential of communication technologies to break down barriers of identity and relationship, are not necessarily supported in the media portrayal of 'everyday' use of ICT (Selfe, 1999). A 'cultural airlock' exists between children's use of ICT in home and recreational environments and their use in schools and classrooms (Sanger, forthcoming). Parent and teacher discourse about the purposes of ICT in young children's experience focuses on future vocational needs rather than current learning and pedagogy does not always clearly identify the differences between learning objectives for ICT skills and wider contextual capability (Downes, 1999, Loveless, 1995).

The British Government has prioritized the use of ICT in teaching and learning, both in schools and in lifelong learning. The introduction of ICT resources into all schools to support the National Grid for Learning and the implementation of a national training program with identified 'Expected Outcomes' for all practicing teachers is influencing teachers' perceptions and pedagogy in schools. The author's current research focuses on a case study of an English Primary School undergoing change in policy and practice during the first year of the introduction of the National Grid for Learning. Teachers' perceptions of the purposes of ICT in education; models of access to resources; needs analysis for personal and professional development and concerns in the implementation of national and local policy are being observed and discussed. A critical ethnographic approach is adopted in order to place the interpretations of the case study in a wider framework (Carspecken, 1996).

Autonomy & Control in Indigenous Preschool Teacher Education (Australia)

From a personal perspective, critical pedagogy offers the opportunity to address challenging issues, to engage in dialog about social and cultural aspects of our work and to ensure that all children have equal access and opportunities to develop skill with the use of the new information technologies.

Computers are more than a tool for learning. They are artifacts of our culture which can act as cognitive amplifies of mind as well as offer opportunities to access knowledge which is not possible without the technology. Sir Francis Bacon once said that "knowledge is power" but the extent to which this power can influence individuals or society will depend on being able to access and process the information acquired.

The work that I have been engaged in over the past decade in the U. K. has been related to applications of technology in teaching and learning contexts which empower learners, and in doing so fundamentally change the nature of pedagogy in educational contexts, both at the university and school levels.

In considering the notion of power it is essential to understand that teachers, by virtue of their position, are situated in positions of power in relation to students. Students will feel vulnerable and powerless in learning contexts unless teachers relinquish their power and help students not only to become autonomous learners, but also to feel in control of their own learning.

The importance of developing autonomy in learning should be an important part of any program for the preparation of teachers for the early childhood years. As teachers of young children we aim to provide environments to promote active learning, inquiry and problem solving in contexts where children are engaged in collaborations and authentic activity. The children in our centers should be provided with opportunities to work on tasks, which have been initiated from their own interests as well as those designed by the teacher for a specific purpose. The importance of working with tasks that are engaging and which afford the opportunity to build knowledge and skills cannot be underestimated. In such contexts the teacher is a facilitator who assists the children to make new discoveries in an environment characterized by whole group discussions, sharing of ideas and strategies, working individually and in small groups, communicating via a range of media, challenging tasks which integrate areas of knowledge and the development of confidence and competence in problem solving. Such notions have to be incorporated in teacher education programs not only for our credibility but also so that students can participate in communities of practice which embody such ideals.

In these contexts the importance of recognizing student's Zone of Proximal Development (ZPD) (Vygotsky, 1978) and scaffolding learning are important skills for teachers to develop. My research (e.g. Yelland, 1999, in preparation) has identified a need to reconceptualize scaffolding to accommodate the use of technology in the classroom. It is proposed that we need to consider cognitive, affective and technical scaffolding in learning environments, which are sensitive to the ways in which children solve problems and build on their current understandings. The research has revealed that when students are engaged in tasks that afford them the opportunity to work collaboratively using a variety of processes in which they can actively build knowledge, the learning experience is much richer as a result. Further, if they are able to communicate their ideas via the new information technolgies they are able to participate in knowledge building communities with their peers, where distance is not a barrier. The results of the studies have important implications for the content and structure of curricula for young children. Such programs are mostly situated in the Developmentally Appropriate Practice (DAP) framework and often contain content which has been deemed to be necessary by adults who, as experts, decide what young children need to do and know, and construct curricula accordingly.

The research contexts that I share with my students are based on situations in which children were provided with an environment for learning in which they could grow as autonomous learners. However, at the same time they were provided with support from their teacher to develop knowledge and skills that would assist them to acquire more advanced concepts and processes in new and dynamic ways. These were modeled in class contexts so that student teachers were able to experience them first hand in order to decide if they wanted to include them as part of their own teaching repertoire in their interactions with young children.

In a different context I have worked with Indigenous students at our University in a project that was designed to enhance their academic success and to ensure that they had the opportunity to become confident and competent with various applications of technology. The project created a community of practice with technology that focused on teaching and mentoring Indigenous students, as opposed to providing them with training sessions in the use of technology.

Typically training, in the use of computers, positions the trainer as expert who transmits information to the audience. In computer contexts, this often equates with imparting technical information that involves a great deal of specialist language that can alienate listeners and make them feel inadequate. This was not only the feeling indigenous students reported to us when we discussed their lack of use of technology, in particular computers, in their teacher education program. It was also interesting to note that we received similar comments from female and non-English speaking students.

Prior to our project with Indigenous students in our faculty there was not sound base of support for encouraging the use technology except in University based training programs, which were developed by computer support personnel who had no experience in teaching. The program that we initiated was constructed in collaboration with the students. The content was negotiated on the basis of our knowledge of computer applications and their descriptions of what they needed to achieve in their work. A mentor, rather than an instructor, was hired and she worked with the students in small groups contexts on the basis of their identified needs. The theoretical framework that guided the development of the project was based on the work of who argued that social practice, what people do and how they communicate about it, is the primary generative phenomenon, and learning is one of its characteristics. In fact, they located " learning not in the acquisition of the structure, but in the increased access of learners to participating roles in expert performance " (Lave and Wenger, 1991:17).

A key part of this process is imparting skill and knowledge with increasing levels of sophistication and participation. In this context, learning is viewed as being in a particular social world, not merely knowing or describing it. The characteristics of such a community, which make it particularly effective when:

- Participants have broad access to different parts of the activity and eventually proceed to full participation in core tasks
- There is abundant horizontal interaction between participants, mediated by stories of problematic situations and their solutions
- The structure of the community is transparent for the learner's inspection.

The project was successful in not only increasing participation and confidence with technology but also resulted in the University hiring the mentor on a permanent basis. The structure of the program epitomized the ideals of democratization of curriculum via negotiation of content and the style of interactions between teachers and learners. It provided another context for enacting our philosophy of teaching and learning in the University context, which was characterized by, shared power for making decisions and opportunities for autonomous learning. It also recognized that our students come from diverse backgrounds and that a *one size fits all* mentality is not appropriate when educating students to become teachers who will become professionals interested in the best ways to promote lifelong learning.

Critical Discourse in an Online Reading Course in the Central Valley of California

In inservice teacher education course focusing on reading instruction, democratic practices, in part, can be described as ways intern teachers: 1) express feelings about approaches to reading, 2) reconcile the confusion that arises over the information coming from multiple sources, and 3)express their voice and advocacy as active participants. In this section, the written discourse from teacher interns who write on an online bulletin board is briefly described from a critical theory perspective.

The context of this study consists of 19 intern teachers who are taking a course to compete their initial teaching credential. The reading course, focusing on reading instruction in grades 4-8 (ages 9-14), covers the topics such as organizing reading instruction, student reading assessment, comprehension, content area reading, and writing. Most of the intern teachers taking the course are teaching full time and take this course on the web with the exception of five face to face class meetings which are scheduled periodically in four hour blocks. Soon after the end of the course, these intern teachers are required to pass the California state Reading Instructional Competency Assessment (exam).

When the course started, 80% of students who were 90% hispanic had never used the world wide web before. Most of the teachers worked and lived in rural areas of the central valley of California where agriculture and farm work dominate as the major source of employment.

The weekly online assignments consisted of: 1) reading the text and book of handouts before each class, 2) read over the professor's notes of the topics and highlights of the readings, 3) taking a one question essay quiz online, 4) read the posts on the topic of the week responding briefly to two, and 5) write a page length essay reconciling information from multiple sources including their own thoughts, their classroom teaching, the readings, and the professors' notes. For the purposes of this study, the online responses (4) and page length essays were analyzed.

An qualitative analysis consisted of reading the online comments from a critical perspective several times to establish categories of the online posts. Using QRS Nudist software, the posts were placed into emerging categories to be later reanalyzed for the number of times the event occurred and the depth or impact of the comment on the discussion. The following examples attempt to give the reader a feeling of the breadth and depth of the comments from a critical perspective.

For the purposes of this paper, an analysis of the data describes the discourse to reflect the character of a democratic institution, 'the town meeting' (instead of a classroom), in which teacher interns act as active participants, elaborating on a range of sources of knowledge, as advocates for approaches, and with honesty admitting to failures and asking questions. The use of the bulletin board as a piece of technology and the assignments, both as context and purpose of the activity produces a radically different discourse the teacher-centered IRE (teacher initiates a question, student responds, teacher evaluates) discourse described by Cuban (1984) which had formed the basis on what in some classes was 88% of the classroom discourse. In such as discourse pattern the teacher maintains strict control over or the agenda and content of the discourse.

In the following quote taken from the online discourse, notice: 1) the feelings, 2) reconciliation of multiple sources of knowledge, 3) sense of active voice of the intern teacher and the sources of information:

I believe that students are the best PR that books can get. If one student likes a book and talks it up among his friends, they are going to want to read it as well. I take this idea one step further. Later in the year, I will require my students to do an oral book review. However, the catch is that they must present the review dressed as a character from the book and give a review in the first person. I have seen this done and the results are amazing. The response of the students and the excitement about reading is awe-inspiring. I suppose my point in this rambling response is to.) and take them one step further... or as far as your students will allow you to go!

The student writing in the online post above exhibits feeling by using dramatic words such as "amazing," and "awe-inspiring." Such comments emote enthusiasm, that give color and emotion to the passage. Secondly, the author appears to be reconciling different sources of information including their own knowledge base ("I believe"), the reading instruction textbook ("*...take these great ideas (grand conversations, lit. logs, story mapping, etc...)* and information gained in the school ("I have seen this done..."). The intern expresses his advocacy by stating what he believes ("I believe") and the sense of active voice is evident in the five times the student uses the word "I" in the brief paragraph. Certainly, the intern's ideas are thoughtful, organized, and succinct; they are much different from the kind of discourse that typically occurs orally in classrooms.

The democratic nature of the 'town meeting' is exhibited in a sense of advocacy in the voice of the writers in other parts of the online bulletin board as well. In the next examples, interns show their sense of advocacy as if trying to convince others with, "KWL is a great way to engage students in learning" and "I was excited to use this strategy..." In contrast to an exam or a class in which the student responds to a question asked by the teacher, the student isn't merely responding to the teacher's question, the intern was advocating. Certainly, if teachers are going to participate in the democratic processes in their work or develop a sense of advocacy in their students, the development of this skill is important.

Democracy requires active engagement which is typical on the online bulletin board as opposed to the passive assent which is typical of the traditional classroom. As active participants, interns normally express their feelings on the online bulletin board demonstrate a sense of honesty, ("I don't use the text to learn"), describe problems ("I have grown frustrated with conferencing"), and express support for each other ("Keep up the good work..." and "I like Travis' idea..."). Again, in these texts, one senses feelings and active voice that is not common in the traditional classroom oral discourse.

In summary, the examples of online discourse above describe ways in which this technological tool, the bulletin board, can be used to promote emotion, reconciling multiple sources of information, and active voice. In many ways, this online course resembles the democratic institution of the town meeting in which emotion and a sense of advocacy is proposed for an idea; the people in the meeting have to reconcile the different points of view to make a decision; and finally, people express their voice in communal ways that describe their problems honestly and express their support for each other.

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Drivers for Successful Student Learning through Collaborative Interactivity in Internet Based Courses.

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Abstract: Interaction and collaboration have been identified as desirable components of an effective learning environment, however it is not clear from research how they improve the quality of learning in a distance education setting. While studies have addressed the types of technologies that impact on collaborative interactivity, little has been written about other drivers and their influence on ensuring successful student learning. A tentative model for conceptualizing these drivers has been proposed. The model in the shape of a pyramid attempts to describe a progression of improved learning outcomes made possible by "technology-mediated interaction". This paper aims to provoke discussion as to whether such a model can support an investigation on effective collaborative interactivity resulting in "successful" student learning.

Introduction

New technologies, changing demands for greater flexibility and increased access, as well as marketing considerations have led universities and other organisations to offer Internet-based courses. Research has already provided adequate evidence of the Internet's ability to meet these needs and provide an effective learning environment in a distance education setting (Vargo, 1997; Owston, 1997). As technology continues to have a profound effect on colleges and universities around the world, technology must not become the focus of education, but must be seen as a tool for enhancing the learning and teaching process at a distance. The focus must be to ensure quality learning outcomes using effective instructional strategies and appropriate technologies. What then are the factors that influence an effective teaching and learning environment?

The idea of the teaching-learning process as a sort of conversation is hardly a new idea where deep approaches to learning are encouraged through dialogue, structured goals and activity (Ramsden, 1992). Computer technologies, which have evolved over the past 15 years, have enabled students to interact with the content, program interface, the instructor, and other students, both individually and in groups. Research by Berge (1999) and King & Doerfert (1996) have identified interaction as one of the essential issues in computer-based distance education. The term, interaction, almost seems to elude definition. An attempt to define the word has led to clarification in terms of types and levels of interaction in a computer-based environment. Interactivity necessitates control by the learner and requires a response to a person or object where the quality and amount will determine its effectiveness. Frequently off-campus classes suffer from the loss of the learning community and social relationships. Using collaborative learning approaches can enable Internet-based learning to be as effective as the traditional classroom where collaborative learning is a common feature (Hiltz, 1998; Hughes & Lindsay, 1998). Inherent in collaboration is interactivity. Hoyles, Healy, & Pozzi (1994) report that powerful interactions between students can lead to higher order thinking, hypothesis formation and reflection. Collaborative interactivity, which is a combination of collaboration over learning tasks and rich discursive interaction, is therefore seen as an essential component for providing a richer learning experience.

Research by Hiltz (1998) and King & Doerfert (1996) clearly points to the value of interactivity and collaboration in any learning community, but what are the drivers that stimulate such activity in an Internet-based environment where place and time are no longer tightly prescribed? The term, driver is not regularly used in the research literature, but has been chosen because of the sense of force, control and impact that it conveys, and its underlying influence on the pedagogy, design, and development of courses. Some of these drivers have been addressed in a number of studies (Hiltz, 1998; Gilbert & Moore, 1998), but the aggregation of drivers and how they interact is yet to be investigated. What drivers are significant and in what context? Are there drivers that form the foundation for successful student learning?

The following drivers are hypothesized as impacting on the effectiveness of collaborative interactivity, which in turn affect the quality of the learning outcomes. They include assessment, student characteristics, student's prior knowledge, interpersonal knowledge, available technologies, and instructor management. This paper will provide a tentative model for conceptualizing these drivers. In this model features that support the development of collaborative interactivity will be examined. This paper will analyse the drivers that foster collaborative interactivity, and how they impact on student learning. The proposed investigation of how drivers influence collaborative interactivity will inform the higher education sector on practices that lead to quality learning outcomes and assist in the development of Internet-based courses.

Review of Relevant Literature

Colleges, universities and business organisations are forging ahead in providing learning opportunities at a distance, made possible by the rapid advancement of Internet technologies. It should be noted that "The WWW does not guarantee learning any more than the presence of a library on campus guarantees learning" (Reeves,1999). The Web is a resource which must be designed to support effective instructional dimensions (Reeves, 1997). It is a medium that can provide a pedagogically sound foundation, conducive to active learning, construction of knowledge and discursive interactivity. The Internet has the potential to support a community of learners in an emerging global society. Kitchen & McDougall, (1999) in their meta-analysis of studies across grade levels on collaborative learning strategies indicate benefits in "student academic achievement, intergroup relations, diversity awareness, individual self-esteem and high level thinking".

Theoretical framework

Johnson & Johnson (1996) have provided a strong theoretical basis for collaborative learning as outlined in cognitive developmental, behavioral and social interdependence theories. Although most of the strong theoretical basis has been derived from face to face studies such theories are beginning to find support in the Internet-based environment. In order to address the underlying theoretical basis we need to understand how students learn in this environment. Learning is a process whereby knowledge is constructed and transformed into new and meaningful information. Research has found that cooperative learning increases elaboration as well as higher-order thinking, metacognitive processes, and divergent thinking (Susman, 1998). Vygotsky adds support to the value of interaction and cooperation through his premise "that knowledge is social, constructed from cooperative (in Johnson & Johnson, 1996). Students learn best by interacting with others, rather than working in isolation. Wittrocks' generative learning theory (in Susman, 1998) also attempts to add support by explaining why people learn best together. The resultant interactivity leads to knowledge-building which requires "articulation, expression or representation of what is learned" (Jonassen Peck & Wilson, 1999). Such thinking is aligned with current conceptions of constructivist learning.

Constructivism, which is derived from branches of cognitive science, emphasises the importance of learners creating, developing and constructing their ideas. Out of the notion of discovery and exploration has evolved research on interactive and collaborative learning around meaningful activities. Through such collaborative efforts learners are able to reflect and elaborate on their ideas as well those of their peers. Jonassen, Peck & Wilson (1999) identify the following attributes as indicators of meaningful learning: active, constructive, intentional, authentic and cooperative. They further depict these characteristics as being interrelated, interdependent and interactive. Of particular interest is the interactivity that leads to collaboration.

Frequently in the literature, collaboration and cooperation have been used interchangeably. For the purposes of this study, the two terms will be contrasted. Collaboration can be viewed as one element of a continuum. At one extreme, learning occurs in a competitive environment, in which students realise that their final grades depend upon their performance judged relative to the performance of their peers. This situation is described as competitive. Where criterion-based performance measures are established, and where students are expected to demonstrate their own capabilities without input or feedback from others, we see individualistic instruction. In a more student-centred environment, that recognizes the value of input and feedback from others, learning becomes more cooperative. Cooperation can require students to work on an agreed common task where the end product is a combination of the individual efforts. Collaboration goes a step further. Individual tasks may be distributed according to abilities, but the end product requires a merging of the individual efforts resulting in the culmination and achievement of a common and explicit goal through constant interaction. The interactive nature of the computer lends support to elaboration and engagement, which are crucial components of collaborative interactivity.

Behaviorists, such as Skinner and Homans, also give some support to collaborative interactivity in their recognition of group reinforcers and rewards for learning. The social interdependence theory has found that positive interdependence encourages interaction where individuals work together, promoting each others' successes towards a common goal.

Types of Interaction

Although Interaction has already been identified as an important ingredient in an Internet-based learning environment, there appears to be little consensus on what interactivity actually involves or represents. Moore (1993) identified three types of interaction. Learner-content interaction explains the learner's involvement with the content as they construct their knowledge by building on the information given. Learner-learner interaction is either a one to one exchange or communication with a small or large group. Learner-instructor interaction is the communication between the learner and the instructor for the purpose of explaining, elaborating, scaffolding and providing feedback. Hillman, Willis & Gunawardena (1994) add a fourth type of interaction, learner-interface interaction. This type of interaction explains the relationship between the learner and the technology that is used to access the material.

Another view on interactivity is provided by Paulsen (1995), who discusses interaction in terms of a pedagogical technique based on the four communication paradigms. One-alone communication refers to engagement with the learning resources, which may include online databases, learning activities, and web resources. One-one communication is between two people accommodated by email or one-one chats. One-many communication is supported through discussion lists, bulletin boards online chats and symposiums. Many-many communications can be organized within computer conferencing systems and can include debates, role plays, brainstorming as a few examples.

Levels of interactivity

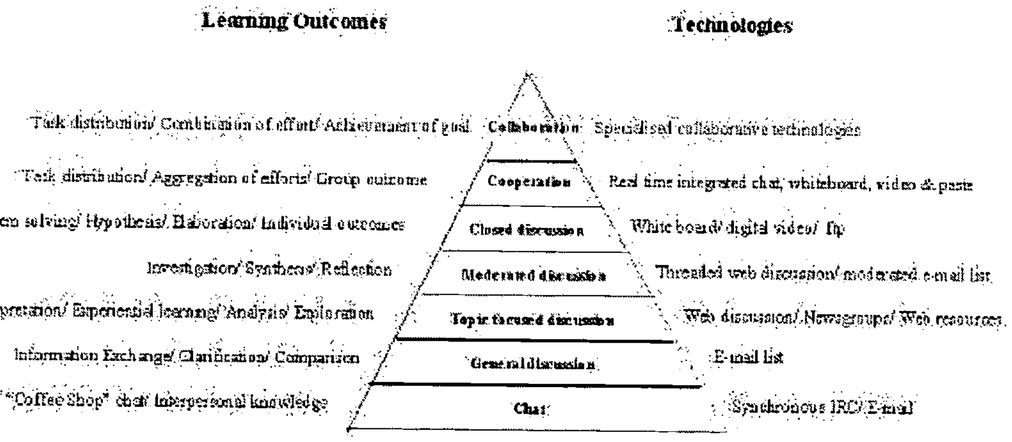
There have been a number of attempts to prescribe rubrics of interaction. Jonassen (1988) identified five levels of interactivity in terms of the user's involvement and how it might impact on learning outcomes. The levels included the modality of the learner's response, the nature of the task, the level of processing, the type of program and the level of intelligence in design. Schwier & Misanchuk (1993) detail a taxonomy of interactivity based on three dimensions: levels, functions and transactions. Spector (in Sims, 1997) suggests that the learner's mental engagement or involvement with the content impact on the level of interaction rather than the conversational interfaces. From the research it is clear that interactivity is highly desirable but do these analyses carry over to an Internet-based learning environment? The challenge must be to develop a model for understanding the complexities of the relationship between "technology-mediated interaction" and learning outcomes.

A Model of Technology-Mediated Interaction

The following model has been developed in order to explain the relationship between the various types of interaction and the suitability of various technologies to support the interaction. It also attempts to describe a progression in the levels of interaction that show a shift from surface to deep learning (Ramsden, 1992). The model is portrayed in the shape of a pyramid with a series of levels building on from each other and leading to collaboration at the apex. In this model it is assumed that adequate instruction on the use of the various technologies has been given and ongoing technical support is available. Confidence and comfort with the medium is an essential ingredient for an effective Internet-based environment. The assumption is, the higher the level, the greater the quality and amount of interaction that will occur and the more desirable the learning outcomes will be.

The base of the model comprises synchronous chat or email in a predominantly one to one exchange where group size is of little significance. There is a view that students are more likely to become actively engaged if they feel comfortable with other learners through the exchange of interpersonal knowledge in chat or email. As we move up the pyramid, we analyze the purpose and function of various levels of discussion ranging from open, unmoderated and general, through to closed, tightly focused and restricted small groups. The subtleties and specifications of these forms of discussion provide opportunity for varied levels of interaction and engagement leading to desirable and more complex learning outcomes. The model suggests hypothesised learning outcomes that may be evident at the various levels of discussion.

Model of Technology-Mediated Interaction



In the figure above, it will be assumed that each technology deployed in a previous level will be available in the levels above.

The pyramid attempts to describe a progression to improved learning outcomes made possible by "technology-mediated interaction". As engagement and elaboration increases, support and scaffolding of the peer relationship emerge which support a cooperative and eventually a collaborative community of learners. The overall course context and instructional design will determine how the various drivers impact on both the quality of learning and the progression up the pyramid. The model offers a way in which we can conceive and conceptualise questions like this: How can we actively engage students in the learning process? What drivers can be identified as impacting on the upward progression?

Drivers of Collaborative Interactivity

Assessment

Assessment has been identified as a key motivator of learning. Students tend to learn what they know will be assessed. If participation in Internet-based discussion lists is not required or assessed, the lists tend to be used very little, and only by the more conscientious student (Hiltz, 1997). Dow & Geer (1996) found in their study of an undergraduate teacher education subject that although participation in electronic tutorial discussions was obligatory there was little interactivity and little reflection, because the responses were not assessed. Other course developers have found that unless interaction is closely integrated into the overall course requirements, limited discussion will take place. Marttunen (1998) in the investigation of student's email as a medium for practicing academic argumentation found that the majority of messages were non interactive in nature and that real interaction was very rare. Conversely, Hartley & Collins-Brown (1999) raise the issue that if students feel forced or pressured to collaborate, how can a spirit of collaboration be infused amongst students? Interaction and collaboration will happen if it is a requirement, but will quality learning outcomes be achieved unless closely tied to assessment?

Student Characteristcs

As well as being influenced by assessment, student characteristics impact on the intensity and frequency of interactivity. They are also a major factor in the achievement and satisfaction levels of the distant learner (Phipps & Merisotis, 1999). Student's prior knowledge of the subject content and their expectations may lead either to problems of passivity or dominance in Internet-based discussions. Student's literacy has been identified as a limitation in text-based discussion mediums, where participation is limited to those who are literate and are able to express themselves through competencies in language and rhetoric (Ryder & Wilson, 1995; Kearsley, 1997).

There are also problems associated with participants who are relegated to passive roles in society, but who are suddenly given empowerment to express their thoughts. However, for students who lack confidence in their verbal skills, the asynchronous learning environment allows them time to reflect and formulate their response. Freedman & Liu (1996) in their study on multicultural networking found that students from different ethnic backgrounds had "different attitudes about and knowledge of computers, cross-cultural communication patterns and learning processes when working with computers". How important is group composition or general student characteristics in ensuring quality learning outcomes through collaborative interactivity?

Technology Confidence and Prior Knowledge
Knowledge of student's preferred learning style and prior knowledge will influence the course design and the type of technology used. Student's confidence with the technology as well as accessibility will further impact on successful interaction. Adequate training in the technologies as well as constant technological support during the duration of the course is essential. The transparency of the technologies and their integration into the instructional design impact on students' comfort and their ability to utilize them for interaction. The technology is adequately able to support the pedagogical shift from teacher-centred to learner-centred and from competitive to collaborative. As the bandwidth increases and even newer technologies emerge, collaborative interactivity in an Internet-based environment will closely emulate the on-campus classroom. Previously interaction occurred mainly between the learner and the instructor. Today's technologies encourage learners to interact with each other, thus changing the role of the online instructor.

Role of the Instructor
The role of the instructor in courses reliant on "technology-mediated interaction" is evolving as the technologies evolve. Instructor engagement should be seen as a critical driver of the quality of learning outcomes and movement up the pyramid. Mason (1991) outlines specific roles for online instructors, which include organisational, social and intellectual. At the same time he notes that excellence in online moderation is similar to other forms of teaching where enthusiasm and involvement, intellectual perception, insight, and scaffolding for the learner are essential ingredients. Berge (1996) preferred to categorize the role of the instructor into four areas: pedagogical, social, managerial and technical. He proposed that instructors must also be comfortable and proficient with the technology to ensure that the learners are comfortable. A successful facilitator knows how "to integrate life experience, communication, professionalism and content into the learning environment"(Illinois Online Network, 1998). Does the instructor influence the level of interactivity at which students engage and how does the involvement change at the various pyramid levels?

Interpersonal Knowledge
Johnson & Johnson (1996) have identified an extension of social interdependence theory that focuses on relationships among diverse individuals. Recent literature (Jonassen et al., 1999; Hughes & Lindsay, 1998) has begun to show the significance of social interaction on learning outcomes. Bauman (nd) identifies the affect of social factors as being significantly powerful and motivating to keep students in school. Interpersonal exchanges in Internet-based environments have the potential to alleviate some of the misunderstandings and misinterpretations that may occur due to the lack of social cues and face to face interaction. Such exchanges can assist facilitators with their instructional design in meeting the learning needs of their diverse student population. They can also help students overcome some of their reticence in sharing their views with unknown persons. The social community that is created during the learning process can impact on the nature of the learning activities and the learning outcomes (McLoughlin, 1999). Instructors are recognising the value of providing opportunities for interpersonal exchanges. Hughes & Lindsay (1998) and Hiltz (1998) recognise the value of informal socializing and have created the notion of a "Coffee Shop". In attempting to increase student comfort, it is important that prejudices such as a person's age, gender, nationality, economic status and disabilities are not unmasked within the Internet-based environment. The potential for equality is one of the strengths of Internet-based environments. Does informal socializing in an Internet-based environment increase the potential for collaborative interactivity?

Research in Internet-based subjects at the University of South Australia

A research program at the University of South Australia will examine the impact of these drivers on various levels of interaction under the pyramid model. The subjects will be students enrolled in undergraduate, graduate and post graduate subjects, which use open learning technologies. In order to generalise findings across

disciplines and levels, national and international parallel subjects will also be targeted. Research, using both quantitative and qualitative approaches through the use of survey questionnaires and discourse analysis, will be used to address questions relating to driver impact on learning outcomes.

An important outcome of this research should be better teaching practice leading to successful student learning, and that in the end, is what all educational research must be about.

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INFORMATION SOCIETY AND MODERN SCHOOL

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ABSTRACT: This article deals with the problematic of needs concerning the informational society and its educational system. It also emphasises the need for this system to be improved and modernised by the implementation of information technology, as well as the need for the implementation of modern teaching and learning methods and work patterns which this technology makes possible. The article also provides an insight into the results of the project called "ACHIEVING COMPUTER LITERACY" which was carried out in Slovenia.

Introduction

Recently we have been witnessing some crucial upheavals in the course of reforming movements in the East European school systems. As we can see more and more attention is being paid to school reforms put into practice throughout the countries with well-developed school systems. Political, economical and technological circumstances as well as the development of democratic society demand crucial changes in the established school system, which in most cases finds itself in social, pedagogical and financial crisis. As Slovenia became independent, we opted for the integration into world's economic movement as well as movements of communication, which demands from us to take into consideration the quality standards as well as costs stated by the world market. Undoubtedly international standards in the sphere of science, healthcare and especially education must be considered. In the operational research project on Slovene education an interesting premise can be found according to which the contemporary school finds itself in a revolutionary moment with regard to the following three aspects:

1. in the attitude to its own internal professional development.
2. in the attitude to the critical situation in the society and goals that demand new impulses in the school systems and functioning of schools.
3. in the attitude to the world post-industrial society and its trends that have already led to the new concepts in school reforms.

The creators of the project we are dealing with continue by explaining the three aspects just mentioned. If, according to the first of the three aspects we still may imagine the development in the education as a steady progress, and if according to the second aspect we may believe that the crisis may be solved by a few efficient actions or even by patient waiting until it is over, it is the third aspect which definitely convinces us that it is inevitably necessary to adjust education to the needs of the post-industrial innovative society on the scientific basis and with the help of all social forces being available, for this is one of the most important long term ways of solving our social crisis.

The most developed countries have already been in the phase of the development called i n f o r m a t i o n s o c i e t y in which problems of sudden interruptions in industrial production are solved by the increasing use of robots, introduction of computers on a great scale ,and enormous and rapid development of science and education. In the society like that a strong emphasis is being put on the computer- assisted educational systems in the fields of introducing computers as well as educational systems implemented by other kinds of modern educational technology. Strmcnik (1987) states: There is no modern school without modern educational technology. He points out that technologically well equipped schools (especially with computers technology) are able to offer their students better opportunities for their universal educational development than those schools that dispose of less educational technology. The theoreticians and researchers from the developed world share the same opinion. Carnoy and Loop (1987) from Stanford University in their treatise, made for UNESCO point out the importance of the modern educational technology (especially computers) being introduced into education. The state that informational knowledge cannot only be used in achieving aims, but it also plays an important role in the development of the young people's minds for the life in the informational society. According to this computer science and informatics are not only school subjects, but also they help in creating new ways of thinking, typical for the informational society. In this sense J. Hebenstreit (1986) underlines the importance of introducing the informational technology in schools, as for the developed as well as for the developing countries. He builds his thesis upon the example of the efforts of the French school authorities. With their project called *Informatics for everybody* they gave all the generations an opportunity to acquire basic knowledge in the field of informatics and computer science. And by their system called *Open school* the same opportunity has been given to school districts and broader local areas. Similar projects have been carried out in England, Germany, Sweden and the USA and in a much smaller extend in some developing countries, too. Although the developing countries are trying to do their best in making big efforts and investing high financial means in the implementation of the modern educational technology (especially computers) aimed at the improvement of their education and preparation of young people for the future informational society. By doing this they want to bridge the gap between the developed and developing countries.

School reform and modern educational – informatical technology

In general the main goals of implementing modern educational technology in education can be divided into three basic topical sets:

1. to acquire the basic skills and knowledge necessary for modern technological processes that they will have to be able to use later on being employed.
2. to provide all students with basic information about the modern technology , its functioning, its application, as well as its consequences and effects on the social and individual life.
3. .to improve the teaching and learning conditions.

The questions pertaining to the first of the topical sets just mentioned, have been dealt with for years by the most developed countries Pertaining to the first topical set seems to be the teachers and their level of knowledge. Two kinds of experts are required here: highly educated specialists who will be the planners of the technological development and members of the staff who will have the sufficient basic skills for the use of the technology mentioned.

The second goal deals with the following questions:

- Which segments of the computer knowledge necessary in achieving computer literacy should be included into the learning programs.
- What level should they be included on.
- How much information knowledge is necessary etc.

These questions seem to be quite simple at the first glance, however they cause much trouble to teachers. Different countries have adopted different ways of how to approach them.

The third topical set is multiple-dimensional and it indicates the following aspects:

- The improvement of the quality of the teaching and learning process with the help of various achievements of the modern educational technology.
- The stimulation of the development of higher forms of mental processes (modern problem -solving methods, ability to analyse and synthesise, critical judgement, researches, communication on various levels, etc.) that will make possible for every individual to take an active part in modern informational trends and which will provide the basis for better understanding of the cognitive processes, self diagnosis and will thus assist teachers in finding and understanding pupils' mistakes.

Although it would be necessary to deal with all the problems of the aims we have mentioned, in this expertise we will focus on the possibilities given to a contemporary school by the use of computers and modern informational technology in all fields of its functioning. As it is known from the history, the educational experts became relatively early interested in the use of computers. They sensed it would help them to solve some of the most outstanding problems in the educational process in those times. The computer was supposed to bridge the gap between the increasing needs (to offer the same possibilities of education to the increasing needs for permanent education and retraining etc,) and the limited possibilities (the lack of the sufficiently trained teachers and the adequate teaching aids).

At the first stage of the implementation of the computer in schools it was expected to be the magic means by the use of which the teaching and learning process would be adjusted to the differences of the individual pupils, their abilities, interests and their assumed knowledge in mass-learned classes. The expectations were great, but the results were far from being satisfying and already in the 1970s many experts started to think about the computers more reasonably and systematically. Then the advantage of the computer was studied on a more solid base, parallely with solving other problems in education with regard to the development of the entire system of the educational technology.

The appearance of the relatively cheap and more and more efficient microcomputers and multimedia systems (Internet, WWW) have drawn the attention of the pedagogical circles abroad and a little later in our country, too. And the expectations that with the help of computers the lessons will be individualised and adopted to the individual needs and abilities of every single pupil appeared again. It was also expected that it would be possible to organise lessons at different stages and to put more emphasis on problem solving activities that demand creative thinking, give better results and don't insist so much on the pupils' memorising huge quantities of information.

These facts are of an outstanding importance for Slovene school, but there is a lack of concrete examples and researches that would show, how to reach those goals, those expectations, which methods and teaching forms should be used and which additional skills for the use of the information technology in teaching process a teacher should have in order to provide his students with the mental motivation and to avoid any unwanted negative side effects.

In the world literature dealing with the use of computers and informational technology in education, we can only read about partial possibilities connected with school subjects and various fields of students' interest. In these fields there are huge discrepancies due to various social-

economical systems, the levels of development and various possibilities offered within the educational systems. Nevertheless one can also perceive some similar aspects, goals, aberrations in the attempts at the realisation as in our country. Our efforts should not be a mere imitation of projects carried through abroad, we must keep in mind the specific goals and trends of our social development, material capacities, and above all, the aims tasks and functions that we want to achieve in the new, modern school.

In the current process of reforming Slovene school system, we must be aware of the fact that teaching and learning will neither be done only at schools, as we are used to, nor in the traditional way (ex catedra) where a teacher gives a lecture in front of the class. They will be performed (or have already been performed) by the means of and through various media. They will consist of a greater range of more interesting, more differentiated subject fields and will boast of various and thus more attracting forms of organisation.

Typical characteristics of the education in the future will therefore be a great variety of ways in education and much greater students' activity regardless of their age. For such forms of work Teachers should be trained in the courses of the graduate as well as the post-graduate studies.

Our schools are relatively well equipped with the modern teaching technology (such as overhead projectors, audio and video devices, computers and modern informational networks), but a recent research has shown that all the technology is still not being sufficiently used and despite a lot of money was invested in it, there have been no expected results. Some years ago the so-called "Educational television program" appeared on the scene with a great boom; however it didn't offer any necessary changes in the didactical approach.

Nowadays the computer and informational technology seem to go the same way. We must not allow computers to be used only in administrative purposes or with the limited systems of lessons. All the teachers should use this modern technology and at the end of his schooling every student should be able to use basic tools of the information technology.

Multimedia -based education is considered to be an important constituent of the new, reformed school. Multimedia tools (e.g. CD-ROMS) should become a natural part of the teaching and learning contents by being logically linked with lessons and educational plans.

Much has been said so far about the Local Area Network (Internet) which comprises schools to be connected with e-mail based conversations, browsing through the so called "global village", teleconferences, distance-learning; all of which are based upon the modern telecommunication technology, and which shown up more and more often in terms of modern school along with the activities performed with their help.

The Tele-informational technology gives students an opportunity to get and to use up-to-date data by computers during their lessons. It has become an integral part of every-day schoolwork. By establishing a free access to the various educational resources all over the world, students are no more limited by "classroom walls", but are gradually becoming capable to do researches on their own. It allows for group learning as well as connections among individual users with various levels of knowledge.

Achieving computer literacy – Slovenia project

It is very important how to make teachers acquainted with this process. Information technology and computers are supposed to be a helpful tool and not an additional burden for teachers. We must plan our activities much more carefully by linking advanced centres (schools, advanced faculties and similar institutions) and knowledge and impulses they provide. Investing in educational technology we must at the same time think of technical aids and programs as well as didactic materials and centres where necessary teaching tools will be accessible. Teachers, their mentors and co-ordinators should be offered systematic training. The society must inevitably accept the scientific and technological development as the one and only alternative for the future. All institutions providing education (educational institutions) must take on the modern views on the educational work as well as see to the modern educational technology to be used in all of the institutions providing education. Some of the activities that are being carried out in our country show these tendencies. The project labelled as ACHIEVING COMPUTER LITERACY (to which we shall simply refer from now on as ACL) performed within the frames of the state project called "Šolski tolar" ("The School Tolar") can boast of the following initial results:

- A broad range of special teacher training has been organised. During the first four years of the ACL programme, 1225 three-day-seminars took place where over 16390 Slovene teachers, educators, headmasters and other pedagogic staff from all Slovene kindergartens, schools, dormitories and teacher-training faculties have gained additional knowledge.
- Schools have been equipped with modern, standardised hardware. During those four years 600 kindergartens, schools, dormitories and teacher-training faculties were given 5718 computers and additional equipment: printers, plotters, scanners, modems, CD-ROM units...
- The so-called "Slovene Educational Network" has been established. More than 5162 teachers and 5540 students in 455 kindergartens, elementary schools, dormitories and teacher-training faculties have got their own user-names. 42 elementary and secondary schools have got a permanent access to the INTERNET via the hired telephone lines and modems and 133 schools have got their own homepage transmitted through Slovene Educational Network.
- The so called "Central Schools Network" was established which consists of certain schools which act as information and educational centres providing support in the professional field as well as in the field of individual subjects or contents, which means that these schools represent educational centres by being in charge of teacher training in the course of the ACL programme. Throughout our country there are 41 elementary schools, secondary schools, dormitories and 33 educational centres with 350 teachers and educators responsible for the implementation of the ACL programme.
- Our schools have been given basic hardware and contents-based software that are used in 600 kindergartens, elementary schools, secondary schools, dormitories and teacher-training faculties by more than 100.000 users on 12.000 computers.
- Much stress has been put on planned research and development. In the first years of its existence the ACL programme supported 18 strategically important projects and basic tasks, as well as 33 developmental projects. In these projects 50 teacher-training institutions (schools and faculties) are involved.

As it can be noticed, the Slovene project of ACL features well planned and actively scheduled implementation of modern information technology in our schools. But it will fail if no sufficient attention is paid to this new technology (as well as traditional educational one) and if it is not given its proper place in its capacity to meet the needs of teacher training activities, individual subject fields and different levels of the Slovene educational systems.

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What Tomorrow May Bring: Trends in Technology and Education

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Abstract: Attempting to predict the future provides targets against which others may compare their thoughts. It might also stimulate efforts that either facilitate or inhibit possible futures implied by the predictions. As technology plays a larger role in education, any predictions concerning the future of education must include an analysis of technological trends. The purpose of this paper is to analyze the trends in technology and how they relate to education, and then to extrapolate these trends in an attempt to predict the future of technology and education. This paper examines how the trends of Moore's Law, Metcalfe's Law, technology fusion, and a changing world economy are redefining the way today's students need to be taught.

Introduction: Education Today

For over a century, education has remained largely unchanged. Classrooms full of students deferring to the wisdom of an all-knowing professor has, is, and many believe, will continue to be the accepted mode of instruction. Despite many technological advances and the introduction of new pedagogical concepts, the majority of today's classrooms continue to utilize this traditional mode. However, as computers and other technologies become easier to use and as the Internet grows, the definition of knowledge is changing. The students of today must now face the fact that as much as 97% of the world's knowledge will be accumulated over their lifetime (Molitor, 1998). As a result, education finds itself in the position of having to recreate itself in order to prepare students to meet these new demands. Unfortunately, it is no secret that education is slow to change, especially in incorporating new technologies.

Education's reluctance to change, especially in incorporating new technologies is described by Jukes and McCain (1997) as *paradigm paralysis*, the delay or limit in our ability to understand and use new technology due to previous experiences. It takes new experiences to replace old ones, and this simply takes time. Unfortunately, education can no longer take the time it wants. The challenge is to prepare the children of today for a world that has yet to be created, for jobs yet to be invented, and for technologies yet undreamed. Trends in technology are creating a future that is arriving faster than education is preparing for it. We must therefore ask what are these trends and how will education adapt to them? To answer this question, the techniques of H.G. Wells, the father of futurist studies, will be used. First we will take a brief look at our past to formulate an understanding of the trends of today. This will be followed by a detailed analysis of these trends. Finally, we will peek into the crystal ball and predict the future of technology and education.

The Trends of Today

Computers and Moore's Law

Since the popularization of the desktop computer in the 1980s, we have become painfully aware of how quickly computers become outdated. A trend of increased power at lower cost that is likely to continue well into the next century and has popularly become known as Moore's Law, after Gordon Moore, the cofounder of Intel Corporation. In 1965 he postulated that technology doubled in processing power approximately every 18 months. The accuracy of Dr. Moore's prediction has proven to be frighteningly accurate. The table below (Tab. 1) illustrates the effects of Moore's Law from 1984 to 1999, with additional assumptions made for memory and costs. In a 1993 speech, Randall Tobias, the Vice Chairman of AT&T, put Moore's Law in perspective when he said, "...if we had had similar gains in automotive technology, today you could buy a Lexus for about $2. It would travel at the speed of sound, and go 600 miles on a thimble of gas. It would be only three inches long...but easy to parallel park!" (pg. 244).

(Assumptions: Every 18 months RAM doubles in size, HD increase 275% in size, CPU speed increases 40%, and cost drops 10%).

Moore's Law	1979	1984	1990	1999
RAM (in Megabytes)	.016	0.128	2	128
HD (in Megabytes)	.128	0.4	24	10,000
CPU (in MHz)	2	10	50	500
Cost	$5,000	$3,900	$2,600	$1,400

Table 1: Moore's Law – 1979 through 1999

The Graphical User Interface

The graphical user interface was first developed by Xerox's Palo Alto Research Center. After a visit to this lab, Steve Jobs, the chairman of Apple Computers, eventually bought the idea and named it Macintosh. "For many, this event has been heralded as the most significant conceptual breakthrough in the history of PCs" (Jukes & McCain, 1997). Other software manufacturers quickly followed Apple's lead, with Microsoft's Windows operating system taking the lead.

During the 1990s, the graphical user interface has allowed the general public to use computers in a variety of ways never imagined possible. The skills in operating a computer have become much like those necessary to play a video game – point there, click the button, and something happens! The generation of video game players, our youth, effectively has become the best audience for computers, yet educators resist using them.

Telecommunications/Networks and Metcalfe's Law

As the power of the computer increases, so do the capabilities of communications media including glass fibers, copper wires, and wireless communication systems. For example, scientists at Fujitsu and other companies have demonstrated the capacity to send data over a single strand of glass the diameter of a human hair at a speed of one trillion bits per second (Thornburg, 1997a). At this rate the entire Library of Congress could be transmitted in seconds (Molitor, 1998), or 70 million simultaneous voice conversations could be sent on a single fiber (Tobias, 1993). Conventional copper wires cannot compete with these rates of transmission, but by using an Asynchronous Digital Subscriber Lines (ADSL) or cable television modems, broadband services of up to ten million bits per second can be achieved. Much like the phenomenon with computer memory, as these speeds increase, the cost of using these services decreases. Take for example the consistent decrease in long distance telephone rates over the last few years; the ability to transmit enormous numbers of calls through one wire has driven prices down substantially.

The combination of better, cheaper computers and increased bandwidth has caused a boon in the network community (i.e. the Internet). Bob Metcalfe, inventor of the Ethernet, suggested that the power of a network increases proportionally by the square of the number of users. Over time this has become known as Metcalfe's Law. Like Moore's Law, Metcalfe's Law has played a major role in shaping the business world, and now it is beginning to affect education. Simply put, Metcalfe's Law states that the more people that are connected to a network, the more powerful that network becomes. As millions connect to the Internet, the Network of networks, the power of sharing information and ideas grows. Education is in the business of sharing information and ideas, making Metcalfe's Law a force that will play a major role in shaping the institution in the years ahead.

Internet and the Web

The merging of Moore's Law, Metcalfe's Law, and easy-to-use graphical interfaces form the foundation of the communication revolution we are now experiencing. The International Data Corporation (IDC) forecasts that 320 million people will be able to access the World Wide Web by 2002. In 1997, 78 million devices connected to the Web; by 2002 this number will increase to 515 million (WISTA, 1998). In 1996, the U.S. Postal Service delivered an astonishing 185 billion pieces of first class mail, yet in that same year the Internet handled about one trillion e-mail messages. Federal Communications Committee Chairman Reed Hunt has said, "The communication age is connected to the greatest revolution in the history of education since the invention of the printing press" (in Thourburg, 1997).

Technology Fusion

Another event that will likely have a significant impact on education is technology fusion. Twenty years ago we saw sharp distinctions between computers, photos, publishing, TV/video, and telecommunications. Now the distinctions between these media are blurring (see Fig. 1 below). In a few more years there will be virtually no distinction between them (Jukes & McCain, 1997) (Lane & Portway, No Date). We are already seeing the manufacturing of computers that can perform all of the functions that not long ago needed separate devices. The Education Coalition (TEC) considers the merger of computing, television, printing and telecommunications as the most significant trend in education and technology. "Bringing them together results in the whole having greater impact than each individual part..." (Lane & Portway).

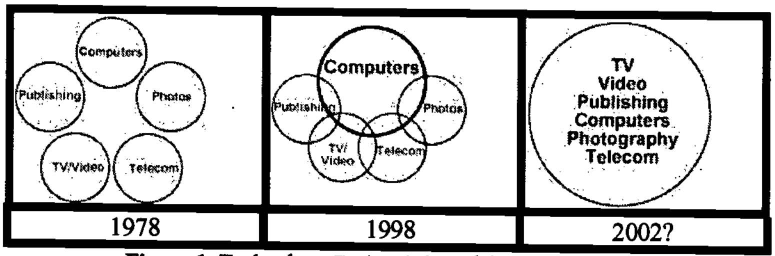

Figure 1: Technology Fusion (adapted from Jukes, 1997)

Economy

If education is responsible for preparing its students to be contributing members to the world economy (it is the opinion of the author that this *is* a responsibility of education), then we must consider what type of an economy these students will be entering. An October, 1998 report published by the World Information Technology and Service Alliance concluded that spending on information and communications technology (ICT) is a critically important element of the worldwide economy. The report presented the broadest view of current levels of customer spending on information technology and communications ever assembled. Below are some of the study's findings (WISTA, 1998):

- Information and communications technology (ICT) was responsible for $1.8 trillion in spending in 1997.
- In 1997, ICT spending was nearly 40% larger than in 1992.
- ICT spending is growing 27% faster than the overall worldwide Gross Domestic Product.
- Spending on ICT is a key accelerator, catalyst, and multiplier of a wide variety of social and economic measures, including company and job growth.
- An average of 7,200 new tax-paying ICT companies have been added in the United States during each of the last five years.

With the world economy so intricately tied to information and communications technologies, the careers of today and tomorrow are directly related to these technologies. The Thornburg Center recently conducted a study of the 54 jobs identified by the U.S. Bureau of Labor Statistics as having the highest numerical growth between now and the year 2005. Of the 54 jobs, 46 required technological fluency, and none of the remaining eight paid more than double minimum wage (Thorburg, 1997a). The lack of technologically fluent workers is already a problem. The Information Technology Association of America has warned that one out of ten jobs requiring information technology skills is going unfilled (in Thornburg, 1997a). Clearly, our educational system is failing to adequately prepare technologically fluent workers, so we must ask what does education need to do to address this problem?

The Role of Education

Being a Webmaster is one of today's hottest careers, yet five or six years ago Webmasters did not even exist. This is an example of how education must consider preparing students for jobs that have yet to be created. Alan Greenspan, the Chairman of the Federal Reserve Board, recently said (1997), "One of the most central dynamic forces [in the economy] is the accelerated expansion of computer and telecommunications technologies...clearly our educational institutions will continue to play an important role in preparing workers to meet these demands" (pg. 98). He also stated, "workers are facing the

likelihood that they will need retooling during their careers...education is increasingly becoming a lifelong activity" (pg. 100). To prepare students to be lifelong learners requires a new approach to teaching; one in which students learn how to learn.

Much of the failure to utilize technology in education today is, as Thornburg puts it, "the assumption that content [is] king...in a world of rapid information growth, it is context that matters...context is king" (in Thorburg, 1997b, pg. 5). Rather than having students learn facts "just in case" they might need them someday, educators should promote "just in time" learning – collaborative learning environments where groups of students find solutions to real-world scenarios. The 1995 Congressional Office of Technology Assessment report entitled Teachers & Technology: Making the Connection, encourages this type of teaching and explained how technology facilitates it (OTA, 1995, pg. 1-2):

> "Using technology can change the way teachers teach. Some teachers use technology in 'teacher-centered' ways...On the other hand, some teachers use technology to support more student-centered approaches to instruction, so that students can conduct their own scientific inquiries and engage in collaborative activities while the teacher assumes the role of facilitator or coach."

Since the large-scale induction of computers into America's schools in the early 1980s, there has been reluctance of educators to implement them. Teachers can hardly be blamed for this reluctance. A major barrier has been a lack of a universal agreement on how teachers should be prepared to use the technology (Willis & Mehlinger, 1996). This is not cause to write off the personal computer for classroom use. In reference to preparing pre- and in-service teachers, Bull and Cooper (1997) believe, "it is important to be realistic about the time frame that will be required to accomplish this [integration of technology] in the depth that may be eventually desired" (pg. 101).

Unfortunately, education is moving along at a snail's pace, while the world outside is speeding by at a supersonic rate. According to Fulton (1989, pg. 12), "Classrooms of today resemble their ancestors of 50 and 100 years ago much more closely than do today's hospital operating rooms, business offices, manufacturing plants, or scientific labs." If you put a doctor of 100 years ago in today's operating room, she would be lost, yet if you placed a teacher of 100 years ago into one of today's classrooms she wouldn't skip a beat. Jack Welch, the CEO of General Electric and an expert on institutional change believes that when the rate of change inside an institution is less than the rate of change outside, the end of that institution is imminent. Does this mean that the end is in sight for education? The answer is YES, if your asking if it means the end of education as we know it today. Let us take a peek at what the future might look like.

The Future

Future Technologies

If one lesson can be learned from our past it is to NOT put limits on what technology might someday produce. Assuming that ANYTHING is possible might be the best assumption. For example, consider what happens when we begin to extrapolate Moore's Law 10 and 20 years into the future (see Tab. 2 below):

Moore's Law	1979	1984	1990	1999	2009	2020
RAM (in Megabytes)	.016	0.128	2	128	17,000	2,000,000
HD (in Megabytes)	.128	0.40	23	10,000	12,000,000	14,000,000,000
CPU (in MHz)	2	10	51	500	5,500	75,000
Cost	$5,000	$3,900	$2,600	$1,400	$670	$320

Table 2 - Moore's Law Extrapolated

While Gordon Moore believes that his Law will someday hit a wall, studies have shown that limitations with existing technology might not be reached for nearly twenty years. It does seem likely that we can assume growth to continue at current rates for several years to come. At these rates, by the time today's first and second graders graduate from high school they will be using a computer that has 17,000

Megabytes of RAM, a HD of 12,000,000 Megabytes, a CPU speed of 5,500 Megahertz, and at a cost of less than $700. Extrapolating further is even more staggering.

It is difficult to imagine what a computer this powerful will be capable of. Adding the effects of Metcalfe's Law and technology fusion should lead us to believe that we will have an increased reliance on a Global Digital Network, capable of sending and receiving any form of digital communication to and from anywhere in the world at any time. A global economy reliant on these emerging technologies is evidenced by current statistics. Still, we must ask what else is possible?

In the very near future we will likely have a keyboardless computer. Voice software is already proving to be effective in its implementation and it seems only a matter of years before the keyboard will be removed from many if not most computer environments. Taking this one step farther, voice translation technologies will allow for nearly instantaneous communication with people of different languages (Molitor, 1998). The business and educational implications are staggering. For example, what if American students could instantly communicate with Chinese students? Would this change education?

Computers are shrinking in size and are now wearable. For under $5,000 Xybernaut sells a powerful speech-activated computer. Also possible are body-implant transceivers, all connected to the Global Digital Network, or medical breakthroughs such as video lens implants, which are already allowing individuals who were once blind to regain partial sight! For any Star Trek fans reading this paper, it might sound like we are slowly turning into the Borg. This idea might seem ludicrous, but the idea of students walking into class with Sony Walkmans, pagers, and cell phones was recently considered ludicrous as well. The technology might someday make unbelievable things possible. It is therefore important for teachers to work closely with technology designers "to create a world that celebrates and promotes humanity through the judicious use of technology" (Graham, 1997, pg. 14).

One must keep in mind that there are countless ways technology might develop during the next several decades. Knowing exactly what these developments will be or where they will lead is not only impossible, it is unimportant. It is the recognition of what is possible that educators must consider. Social implications could possibly be the hardest of all to predict, yet it will be education that many will look to in dealing with these implications. Adequately preparing for these implications will only occur if we look ahead, which ultimately requires us to ask, what do members of the educational community see when they look ahead?

The Future of Education

Gentry and Csete have stated, "educators are slow to recognize the need to develop a curriculum that will prepare the workforce for the demands they will face" (1990, pg. 25). Some would argue that change in education will continue to be a dream unrealized well into the new millennium, but many opinions run contrary to this argument. In 1996, the American Association of School Administrators (AASA) brought together 55 advisors from various fields, including education, business, government, psychology, sociology, anthropology, and demography to study the future of education. A short summary of these findings is (Ulchida, 1996):

- Students need to be skilled in accessing the vast array of information available through advanced technology and be able to process the information.
- Students must know how to use computers and be familiar with various types of technology.
- Schools must incorporate "marketplace" technologies and ensure that new and emerging technologies are incorporated into the school program.

A consistent point brought up by most futurists is the need to provide education to both children and adults. The Special Libraries Association (SLA) believes that schools will become around-the-clock facilities. The academic day will stretch to seven hours for children; adults will work a 32-hour week and prepare for their next job in the remaining hours. A few of the major points brought forward by the SLA are (Cetrone & Davies, 1994):

- The driving force behind educational reform will come from the new information economy's call for technologically fluent workers.
- The government will place more emphasis on the outcomes of public education (for example, America 2000).

- Improved pedagogy will revolutionize learning; learning environments will become less important as individuals will learn more on their own.
- Computer-supported approaches to learning will allow for more content-specific material to be learned.

Gentry and Csete (1990) have also written that pressures from business, industry, and government will "force the educational establishment to better prepare graduates for the workplace" (pg. 27). Several of the points they mentioned were:

- Increased access to electronically delivered instruction will provide new channels of instruction developed independently of traditional educational systems.
- Artificial intelligence will have an increased role in education; as technology becomes easier to use, more educators will become adopters.
- Technology-capable students will demand the adoption of technology; independent learning skills (lifelong learning) will need to be supported.
- People conforming to technology will shift to technology fitting the diversity of the people using it.

Jukes and McCain (1997) of the Thornburg Center offer insight into the future of technology and education. Both see education's role as being similar to that of a quarterback on a football team: "A quarterback must be a futurist – throwing the ball not to where the receiver is, but to where the receiver is going to be. It's much the same with technology. We need to be looking ahead 3, 4, even 5 generations down the road" (pg. 9). Jukes, McCain, and David Thornburg advocate a new educational paradigm that shifts curriculum from content-based to process-based. Their message is that educators need to change their mindset quickly, "or the market will find its educational experiences elsewhere" (Jukes & McCain, 1997, pg. 10). These experiences found elsewhere are already evidenced in increased home school numbers and support for school vouchers.

Conclusion: The Author's Views

Experts from all fields, including education, business, and government agree that we have moved into the information age. As much as 97% of the world's knowledge will be accumulated over one person's lifetime. Against statistics like this, teaching students a host of facts "just in case" they need them later on in life is a fruitless effort. The ability to find and use facts as they are needed becomes the skill that will enable students to become lifelong learners. Consequently, the teacher's role shifts from that of the transmitter of facts, to a facilitator, coaching students in how to find and use facts specific to a particular context. The role of education is no longer to provide educational opportunities through early adulthood, but to provide the scaffolding necessary to support individuals and families from all walks of life, throughout their entire lives. In order to prevent a further widening between the upper and lower classes, it will become increasingly important for educational institutions to provide this support by providing weeknight and weekend adult classes focused on emerging technologies.

Very soon we can look for interactive video technologies to allow parents to play a more active role in their child's education (e.g. watching a class presentation via online video). Students will utilize wireless, handheld, voice-activated computers that look similar to today's video game controllers. These devices will be connected to a Global Digital Network (Internet) and will be capable of displaying video and audio as well as text-based materials. Schools that actively pursue such avenues will be in great demand. School days will grow to seven hours in length to provide more instruction and to meet the needs of dual income families. As more states pass school voucher initiatives, a greater dependency upon private education and home schooling will result.

As mentioned earlier, knowing exactly what happens in our future is not important. It is important that educators have a sense of where the world is headed. Only then will they be able to adequately prepare current and future students to thrive in this ever-changing world. We must always keep in mind that a good driver doesn't watch the car's hood while they are motoring down the road. Instead, a good driver carefully watches the road ahead, looking for the obstacles and challenges that lie before them. It is time that education quit watching its hood and start looking at the road ahead.

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Integration of Working, Learning and Researching in Schools

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This paper proposes a procedure to conduct research on teaching at workplace, using a conceptual framework to extract empirical knowledge and information technologies to communicate it among teachers. The formalized knowledge is derived from synthesis and analysis of teaching in the form of images, categories, concepts, models and propositions, and shared among teachers to be critically reviewed and to enhance their teaching experiences through Internet. The author is pursuing this research procedure on his teaching at the university and concludes it can be applied in other situations.

Introduction

In the stable society, the professional competency developed in the early stage can be valid for the life long career and remain valuable to maintain his/her living. In the changing society on the other hand, the life span of knowledge is very short and required to be refreshed ceaselessly. Professional groups are all exposed to such pressing needs to maintain their economic value and living standards by renewing their expertise. In such changing circumstances, each teacher should develop his/her instructional theory and competency continuously during teaching profession and maintain them applicable at his/her workplace. Conventional instructional theories taught during the pre-service teacher training are academic-deviated and not necessarily practical so as to provide novice teachers with the appropriate solution to instructional problems in particular situation and of a particular student. Teachers usually develop their own theories on teaching during the professional careers referring to experiences reflectively (Schön, 1983). 'Practice theory' to be discussed in this paper does not necessarily require the criteria for ordinary scientific research such as universality, objectivity and reliability of outcomes from the studies. In everyday teaching, teachers' experiences are very influential and crucial to strengthen or modify their initial theories studied at universities. The process of thinking, judgement and action requires a rational framework to conduct practical research on teaching and to be free from any dogma or prejudice. It is urgently needed to develop a framework to integrate working, learning and researching for teachers.

Three Dominant Approaches in Instructional Research in Japan

There are three dominant procedures to conduct action research on daily teaching in Japanese schools. They are empirical approach, normative approach and systems approach. These three approaches are interdependent and mutually influential in actual studies referring to specific needs in a specific situation. In the empirical approach, we rely on our teaching experiences and critical review on its outcomes. Traditionally, teachers in Japanese schools used to share their experiences with colleagues after teaching a lesson and improve their way of teaching referring to colleagues' suggestions and advice, discussion with them and literature on teaching (Shimahara, 1997). Unfortunately, this tradition is disappearing due to overloaded work condition and their individualistic life style influenced by the present society. The lack of mutual communication and professional enhancement among teachers results in the loss of confidence on their teaching. To recover their confidence, it is indispensable to develop a new style of instructional disciplines and practical research method of which the approach is empirical and depends on intuitive ideas of teachers in service to solve problems in

teaching. This approach is discussed further in detail later on.

In the normative approach on the other hand, we refer to philosophical literature or historical studies to evaluate and criticize teaching. We put emphasis on formulating educational aims and goals, specifying instructional objectives and applying scientific knowledge of instruction in our daily teaching. In this approach, educational psychology, behavioral science, cognitive science and sociology are most influential disciplines for teaching. These disciplines give us some perspectives on instructional design and interpretation of learning observed in our teaching. However, the science-oriented procedure does not always provide us with unique, effective and ultimate solutions on our daily instructional problems. The defect of this approach is to put more importance on normative evaluation and to neglect the recognition of students' problems in real situation

In the situation where we cannot derive any specific and definite solution for instructional problems and when we have to take action, the systems approach is reliable procedure (Tennyson, 1997). In this approach, we do not fix the final goals definitely at the beginning and proceed along with rational procedure. It is entirely cyclic process of design, execution and revision in all aspects of instruction. It requires intuitive sensitivity and genuine insights of practitioners to identify problems in a particular situation and to solve them at everyday bases. The systems approach is effective to improve instructional material production or large scale instruction under development. Following the rational procedure to improve the instruction, we can achieve some consequences, but ignore the reservation of judgmental knowledge emerged from the improvement

This paper discusses a possible way to reserve empirical knowledge extracted from daily teaching and share it with other people at workplace in distance by means of information and communication technology.

Instructional Technology in Information Society

Instructional technology was introduced at the end of sixties and started to be applied to improve teaching in Japanese schools. At the beginning in the history of instructional technology, 'optimization' and 'efficiency' were major concerns to develop teaching methods and materials for effective instruction. A variety of techniques for instructional design and evaluation have been developed to pursue the optimization and effectiveness. But in the early seventies, another framework of adopting new technology in teaching was suggested to make it more creative and intuitive procedure (Nishinosono, 1973). The table 1 shows an information space described by Kitagawa(1969) thirty years ago and is still valid to give guidelines to explore an instructional technology suitable to the changing society in information technology era.

Axis of				
( ) coord i-nate	**objectivity** **subjectivity** **practice**	pattern operation optimization	chaos adaptation stability	transformation strategy learning
( ) coord i-nate	**cognition** **evaluation** **direction**	deduction efficiency control	induction reliability management	abduction plasticity creation
		control space	**Eizon space**	**creative space**
		( ) coordinate		

(Eizon means amalgamation of management and existence)

Table 1: Kitagawa's Information Space(1969)

'Efficiency' and 'optimization' are characteristics in the 'control space' according to his classification. In the creative space on the other hand, 'learning' is a value on the axis of 'practice' and 'creation' on the axis of 'direction'. This space suggests a new dimension in instructional technology. The recent emphasis on instruction is shifting from the contents-oriented teaching to the performance-oriented learning and creative activities. Motivation and learning skills are highly appreciated for continuing learning rather than quantity of memorized knowledge. This tendency is not only perceived among students, but also among teachers who are expected to learn from their experiences in teaching and to be creative to improve their professional competency.

Subject matters in conventional instruction in Japanese education have kept a simple structure of top down characteristics from the national curriculum and high traditional prestige of the teaching profession. To improve such rigid structure, the Ministry of Education is about to replace the present curriculum with the new

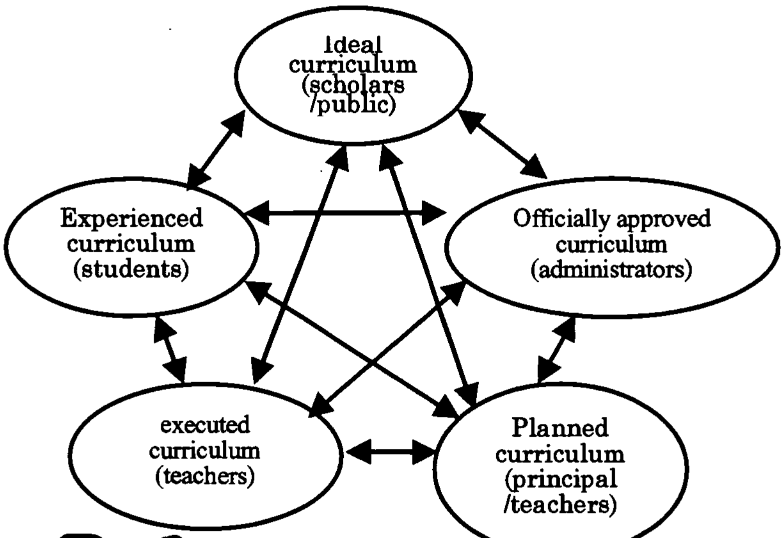
National Curriculum in 2002 at elementary and lower secondary school and in 2003 at high school. The new curriculum will spare 105-110 hours a year free from any fixed contents of subject matters after third grade in elementary schools, and 70-110 to 70-130 hours a year in lower secondary schools. These 'Hours for Comprehensive Studies' allow teachers to design any instruction at their initiatives and are perceived as an occasion for teachers to integrate working, learning and researching at workplace.

From a different viewpoint of active learning of students, another type of educational professionalism should be developed to maintain the effective instruction and teachers' dignity. Teachers should be able to interpret curricula from various viewpoints. The following diagram shows the existence of various curricula and interrelationship among them.

In this figure,

"Ideal curriculum" is one that is discussed by educational researchers/scholars, teachers and publics as a future alternative to the present one. In almost all cases, a new curriculum emerges from a critical view on the on-going curriculum.

"Officially approved curriculum" means the present Course of Study issued by the government and textbooks approved by the Minister of Education, and orients policies in educational administration and financing.



[redacted]ve phases of curricula

"Planned curriculum" is one that is formulated by principals or teachers to manage school affaires. This curriculum consists of annual plan of teaching, lesson plan of specific unit, timetable scheduling, etc..

"Executed curriculum" represents what are going on in the classroom, that is, teacher's behaviors or performance, students' responses and behaviors, and instructional environment in their teaching. These instructional events can be recorded and analyzed for empirical study.

"Experienced curriculum" is what students have experienced in the executed lesson. It differs from the planned curriculum, or even the executed curriculum. It is indispensable to study this experienced curriculum to make our instruction more effective.

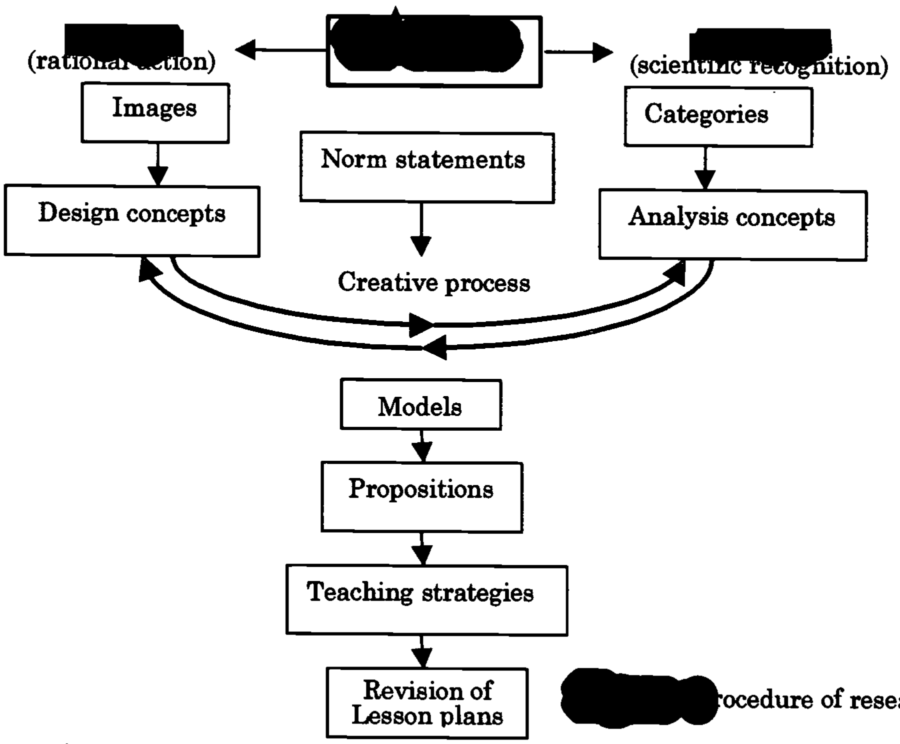
Empirical Approach on Teaching

In the changing society, teachers have to be aware of refreshing their professional competency to maintain valuable professional expertise and equipped with competency to enhance their research skills into instructional effectiveness as well as to renew their professional knowledge (Imazu, 1996). The author is developing a research methodology suitable to the in-service teacher education. In the normative study, the major concerns of research is to investigate the value of educational aims, goals and instructional objectives, interrelationships and structure between each instructional objectives and contents to be taught. In the empirical study on the other hand, the major concerns of research is to conduct observation on learners' activities, analysis of their learning outcomes, and other positivistic studies. To conduct these empirical studies, teachers have to be competent in creative and synthetic thinking for instructional design and in critical and analytic thinking for instructional evaluation. In the face to face situation in a classroom, teachers have to make instructional decision relying on their subjective observation on students and intuitive ideas on teaching. Even though teachers have disciplined themselves on theories of teaching during their pre-service and in-service teacher education, they have to rely on subjective judgement, refer to their previous experiences

and act on tacit or hidden knowledge of teaching. Teachers are not aware of tacit knowledge, but using it in their everyday teaching. On the other hand, intelligible knowledge is expressed in their conversations, monologues and writings. Formalized knowledge is represented in the form of well-defined terms, concepts, models or propositions, which are suitable to communicate each other among colleagues and conduct research on teaching.

Models used in theories of instruction are usually developed by those professionally engaged in research and not by teachers in classroom. Teachers are supposed to be knowledge consumers, while researchers in universities to be knowledge producers. This model of discrepancy between producers and consumers of knowledge does not work efficiently in the complicated and ever changing educational environment (Schön, 1983). Every teacher has his/her own educational philosophy, which are applied consciously or unconsciously and expressed explicitly or implicitly in the daily teaching. Empirical approach into teaching might be influential to their belief on instruction in depth; otherwise it is very difficult to change their behavior and attitudes in the classroom.

The assumption of empirical study on teaching is to develop teacher's competency to improve their teaching through systematic procedure of an inquiry and investigation framework using information technologies such as audio-visual facilities and computers. The framework of such study on teaching is shown in the following figure.



[redacted]ocedure of research on teaching

The method depends on the improvements of the following five modalities as basic elements for the synthetical and analytical study of teaching. They are images, categories, concepts, models and proposition.

1. **Image:** Original ideas at the very early stage are hard to be expressed in the form of statements or concrete models. Images are effective to make the ideas concrete in some case.
2. **Categorization:** Observable behaviors in classroom are categorized by teachers and employed for the study on teaching. In the case of novice teachers or inexperienced teachers, their categorization is simple and not in depth at the beginning, but improved drastically after several trials of repetitive analysis and discussion with their colleagues.
3. **Conceptualization:** After repeated categorization of behaviors in teaching, teachers arrive at the stage of conceptualizing their analysis according to the interpretation of meaning of specific series of actions taken in the classroom.
4. **Modeling:** Modeling is a next step in instructional design and analysis for the more active use of concepts

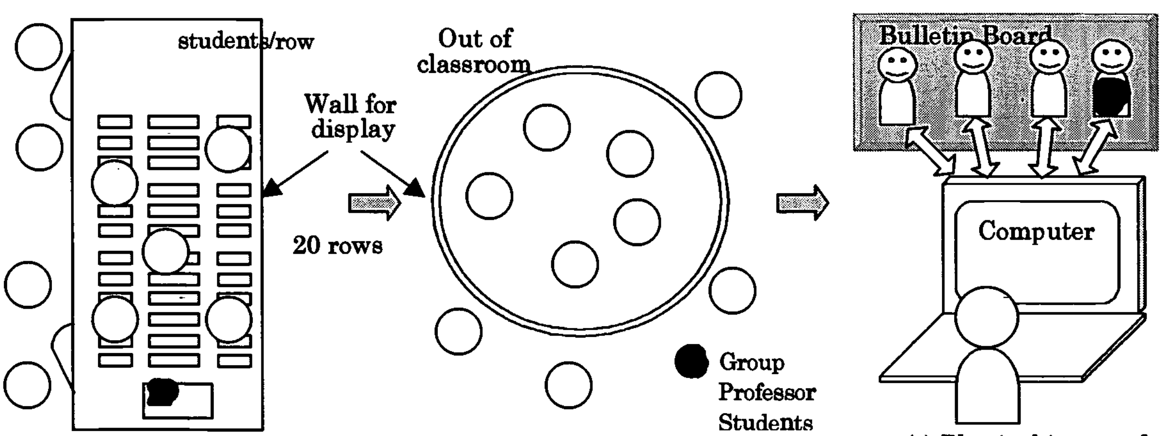
driven from categorization and conceptualization. This step should be very flexible to activate our creative idea. In the case of teaching, the schematic figures facilitate us to create a new configuration of instructional elements and concepts and to revise it after analysis of teaching.

5. **Proposition/Statement:** Statements expressed in everyday terms are not suitable to convey professional experiences to their colleagues accurately. Their experiences should be stated in the precise form of propositions and/or statements. Here, two types of propositions and one type of statement are proposed: explanation proposition, judgment proposition and norm statement.

Teaching is creative and artificial process managed by teachers referring to their views of instructional expectation and experiences. It is also actual events to be recognized scientifically to achieve effective outcomes from such instruction. There are always discrepancies between teachers' references and actual events or outcomes. In the cyclic process of improving instruction, these discrepancies are felt by teachers and utilized as causes for reflection on teaching, but rarely expressed in the written or communicable form. Their knowledge extracted from teaching experiences should be explicitly described and communicated to other teachers using new information technologies. There is always some discrepancy between design concepts and analysis concepts in two procedures of the study. This gap requires creative efforts and intuitive solution to initiate a new teaching strategy suitable to the real situation of students. A new idea emerges very often during going back and forth between two concepts. There is no definite procedure to create a new teaching strategy and reflection is not sufficient to create this strategy. During the design process, teachers develop their lesson plans referring to their previous experiences, but at the same time generate a new plan unfamiliar to them with help of a model and/or propositions of which there is no fixed procedure to follow.

Any lesson plan has hypothetical presumptions behind concrete descriptions of instructional events composed of teacher's actions and learners' activities. In the conventional method of describing a lesson plan, teachers usually refer to previous experiences and feel difficult to accommodate new instructional setting. The reference of model and list of concepts or items facilitate us to formulate hypothetical propositions applicable to a specific teaching situation of a group of students or an individual student. The propositions derived from this procedure don't require to be tested strictly in the light of positivism research.

Another example of using concepts and schematic model is to design a learning environment. The following conceptual model is utilized to accommodate 150 students of my course of 'Theory and Practice of Teaching' in a conventional lecture room. In this lesson, they are requested to work together in group and develop a plan of imaginary school and teaching plan of specific subject. They display their works on a wall of the classroom to share ideas with classmates and are very satisfied with the outcomes of this course. It is intended to implement this lesson to a computer-mediated course with the same objectives and contents in another class.



(a) Physical configuration of a conventional classroom (b) Conceptual model of learning space (c) Physical image of learning at computer

[redacted]ysical arrangement and conceptual model of learning space

[redacted] explanation proposition and judgment proposition, the final conclusion is 'true' or

'false' after the analysis of actual teaching. It is possible to confirm the validity of the propositions through the teaching and to modify these propositions referring to the evidence of teaching. On the other hand, the value of norm statement is 'agree' or 'not agree'. In this case, teachers don't necessarily change their norm statements after the teaching even though they have not achieved the educational aims and/or instructional objectives. The above model and this proposition convey the idea of managing the instruction for group work in a large conventional classroom. They are also transmitted easily to other workplaces through communication channel.

Teachers in a school usually share common educational aims to achieve and work together collaboratively. The national curriculum in Japanese education describes instructional objectives in form of statements. If they want to keep the same norm statements after teaching, they have to replace judgment propositions presumed before the teaching with other propositions and change the teaching strategy to actualize the same norm statements. In many cases, teachers confuse these two different characteristics of norm statements and judgment propositions.

Conclusion

Educational problems are getting too complicated and interrelated to solve by adopting a predetermined procedure of problem solving. Teachers have to invent their original solutions to tackle teaching problems in particular situation. Under this circumstance, they should enhance their competence of creating a new solution and conducting research to solve these problems. Thanks to the new information and communication technology, teachers in service can take records of their teaching, analyze them by using application software such as Excel or Lotus, interpret them and derive analytical concepts. The widely used Internet opens an entirely new community in communication facilities. It is indispensable to formulate a research method and form a 'social network'(Garton, et al., 1997) in the Internet to make experience sharing more effective and reliable among teachers in service.

In the convention education for pre-service as well as in-service teachers, we transfer our knowledge and skills of teaching by the formal training in the face-to-face situation. Thanks to the development of information and communication technology, we can transfer our experiences through various media. In this situation, the experiences should be described in brief but clear expression to convey its essence. For this purpose, two procedures to lead to model and proposition are introduced: one from the design by images and another from the analysis by categories. There is, however, discrepancy between design and analysis concepts. To overcome this discrepancy, creative thinking and new idea are required to formulate models and propositions. Using these models and propositions, we can share our experiences with other people in distance.

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Talent Development through the uses of Technology

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AbstractThis papers begins via a synthesis of theories targeted at innovative practices in the field of adult learning. Folowing a review of the current literature, the author discusses different strategies and methdos used to enhance adult learning and talent development. Learner-centered methodologies are examined. Environmental, biological, social and emotional conditions and uses of technology are also items factored into the discussion of talent development. comparative assessments of methodologies used at educational institutions are reported. In other words, What are the learning theories that best help the learning practices to best suit the needs of talented and gifted individuals? What are the best uses of the technology to develop the potential talents in professionals?

Introduction

Nowadays adults are expected to be computer literate people. new generations are involved in learning the new technology from their first moments of life. The percentage of people using or having access to technology increases every minute.

But the way we are learning and teaching have remained unchangeable. The paradox exists becauss the new ways of accessing the enourmous amount of information, still the question remains unanswered How can we improved our learning? How can we use technology to develop our potentialities and talents?

In one hand, students need to follow special programs, specific contents and prove their knowledge in the traditional way by taking exams or tests. In the other hand, other alternatives have appeared , between them the possibilities to access to unlimited information, without adding credits, tramits, and almost with no more requirement than having a password, or an email address.

The possibilities to access unlimited information, opens the possibilities to kids, youngsters and adults, to access to a whole universe of information. This is maybe the first time in the human history, that the possibility of accessing any kind and amount of information is almost effortless, we just need to access to Internet for example.

At the same time, we already know, we need to develop certain skills to access fluently into the enourmous amount of irrelevant and "trash" information. Taking into consideration the possibilities of having unlimited information, we can ask ourselves What are our possibilities for developing our talents without a formal institution? or without a formal program? Maybe we can develop our potentialities only by strategic organization of the information? The main purpose of this paper is to show the need of further development of learning strategies and individual centered environments.

Learning Theories

Theoreticians from different domains explain the alternatives we have to learn. Psychologist are still discussing if we are able to go beyond our limited possibilities of knowing. Educators have endless debates about how to teach and how to evaluate the learning.

Some new possibilities have arrived. The innovator educator can help their students to find the best way to learn and access to the relevant information he needs.
The learning style models, have shown the importances of the environment to support learning. The physical distribution of the elements in our environment can help us or not in the process of learning.
The innovators and enterpreneurs are looking for creative people who solve complex real problems in real organizations.
That means, we need to reform the way we are teaching the new generations and help them to manage the new situation of learning. This means, teaching thinking, specially the creative and critical thinking. Sternberg (1997) discusses the possibilities to teach practical solving problem and creative skills in the learners.
The question remains unanswered, how to teach in the new technology area?
If we have almost irrestricted access to all kinds of information, we need to develop some strategies to learn in the best way, successfully and efficiently the new contents.
The universities have the challenge to form the new professionals. Undergraduate students have enourmous possibilities to find information. But they need to develop their learning potential by using and transfering the information to meaningful purposes. This means, that information is not enough requirement to be a good student or professional. The requierements are more complex. We need to be autonomous learners, what means be able to detect relevant from irrelevant information.
Students need to learn to think creatively and they need to solve complex real problems. The new requierements in teaching is how to teach students (from any level, starting in elementary to higher education) to be more creative, and how to teach them to apply their knowledge to solve problems.
The basic principles for learning are
1. Understanding is in our interactions with the environment
2. Cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned,
3. Knowledge evolves through social negotiation and through the evaluation of the viability of individual understandings.
With the new technology, either we learn how to interact with our environment in more productive and ecological ways, or either we will be in danger of not surviving long. The cognitive conflict and the puzzlment are intense stimulus for adult learning. The knowledge is developed by the negotiation and individual and community understandings.

Learning Outcomes and Challenges for Educators
One of the big issues in educations is how to evaluate what we are learning. The first step to evaluate is determine the criteria . The evaluation should be real, that means it will enable the decision taking and the problem solving. Another important challenge in adult education is learning to innovate, learning how to change the environment, and how to improve the results and productivity in organizations.

Learning in todays contexts means flexibility. Schools and organizations are still learning how to be flexible. The paradox here is that we already need people with flexibility in almost every place.

Rote memorization, is no more a way of learning. We need to find different strategies to help adults to learn. And by learning we need to consider adult's individual learning styles. Adults are challenged to learn more and more new things, including unlearn old meanings.

Transfer in learning

Schools and universities ressit changes, and they follow their way of teaching and evaluating the learning process. We need to learn in an active autonomous way. Our mind is not a vessel to be filled. Lifelong learning can not be pursued by passive learners. Adults need to learn and apply learning from one context to another. Transfer of learning is promoted only by the contextualization of the process of giving meaning to concepts, ideas or actions.

Learner-centered methodologies

The individual learner mos be responsible for his or her own learning. The environment, including the community can help in the learning of their members. The way of teaching that needs to be developed is centered in the learning styles of the learner, considering his or her specific ways of processing the information and knowledge construction.

Teachers can not avoid their responsability for teaching lifelong learning skills and knowledge. Institutions can not avoid either their influence in training teachers for fulfilling these purposes.

New ways of assisting learning processes

The design of the learning materials is basic for the lifelong learning. usually organizations, schools do not pay enough attention to this step. If skills development is needed, then the materials should be carefully designed by experts. The instructional design should be as specific, as it will be required.That means, every learning objective should be considered in the classes plans and in the materials design, and evaluation of learning outcomes.

Uses of Technology

Techonolgy is involved in the new learning processes. More technology in learning environments has been involved, and this would be the rule in the close future. The development of new technologies is not usually followed by the support of its utilization. This situation turns dramatic when considering poor countries, they can not invest in the technology, and can not invest in training professionals to manage the technology they buy. For the developed countries, technology is used frequently to learn, in the poor countries, the imposibility to manage new technology makes them twice times poor.

How can schools and universities develop the talents of their students?

Talent students have been discriminated in many countries because of their learning and performance potential. With the new possibilities to technology access, talented and gifted kids, youngsters and adults will be able to learn important topics. The information is maybe one of the most important steps in talent development. The other no less important aspect is the learning of the persistence and tolerance to the ambiguity. Talented people need to develop skills to become effective learners and later on, succesful professionals. they need emotional and social support to make their potential, a reality.

One option is the distance learning environments. These environments can be recommended to the gifted students, not only because it is an interesting option to study, but because ee are not far from the days when students fror elementary schools will access to expert knowledge by

themselves. One of the compromises of the universities and schools is to teach students to be autonomous learners, and that means that schools and universities are responsible for forming students with emotional, intellectual and social skills. These means that the programs and contents should be recontextualized to prepare the students to access by themselves the relevant topics in their professionalization and to form them as autonomous learners.

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Does Everybody Want IT?

How can we get everybody involved in the IT society of the future?

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Abstract: Is there a place for everyone in the new IT society? Is everyone prepared for and willing to be involved in the new society? The aim of the current study is to examine ordinary peoples' beliefs about the IT society from a social science perspective. Interviews were conducted with nine tenants. The tenants live in a housing area built in 1969 in a typical town in Sweden, and none of them currently use the Internet.

Most of the tenants were either very negative or ambivalent about IT. None of the interviewees thought about IT as a communication tool and they had not been able to come to terms the new possibilities that the IT society can offer. We propose for these groups an education with a pedagogical perspective that involves the use of participatory design methods.

Introduction

In Sweden more than half of all households, 2.1 million, have at least one computer at home and more than half of those have Internet (IT-research 1999). During the month of January 1999 more than three million out of all eight millions Swedes surfed the net (Sifo Interactive Media 1999), the majority of whom were men. Among those with Internet less then thirty-percent used Internet based bank serves and only a few bought travel tickets, everyday commodities and other articles over the Internet.

Adoption of IT-society

The information technology revolution is accompanied by concerns as to whether all members of society will be suitably equipped to enable them to fully participate. Individuals in a social system do not adopt an innovation at the same time, (Fig. 1). Rather, they adopt it in an over-time sequence, and thus individuals can be classified into adopter categories on the basis of when they first begin to use a new idea, which, in our case, is the computer and the Internet. Instead of describing each individual adopter in a system in terms of time of adoption it is more efficient to use adopter categories consisting of individuals with a similar degree of innovativeness (Rogers 1995).

We have found that mostly of related research are all working with the same adopter category – Innovators or early adopters. Schuler (1998) has initiated a community research project where the central focus is on current and future public communications systems. This network community has members from many countries all over the world. The work of this network is related to Computer Supported Collaborative Work (CSCW), netgames, virtual communities, and other "cyber" areas but with distinct differences. The democratic aspects are also represented in this network (Ranerup 1998). Some other examples of interesting related research are HomeNet at Carnegie Mellon University – Why People Use the Internet (Kraut et al. 1999) and Internet Paradox – A Social Technology That Reduces Social Involvement and Psychological Well-

Being? (Kraut et al. 1998). Project 2000 Vanderbilt University has published an interesting article about – The Evolution of the Digital Divide: Examining the Relationship of Race to Internet Access and Usage Over Time (Hoffman & Novak 1999). Net Life Research Group at Umeå in Sweden are also working with early adopters – Virtual Community Life: A Disappearance to Third Places for Social Capital (
same adopter categories are also involved in different research activities/ articles in the virtual society (ESRC 1999-05-10).

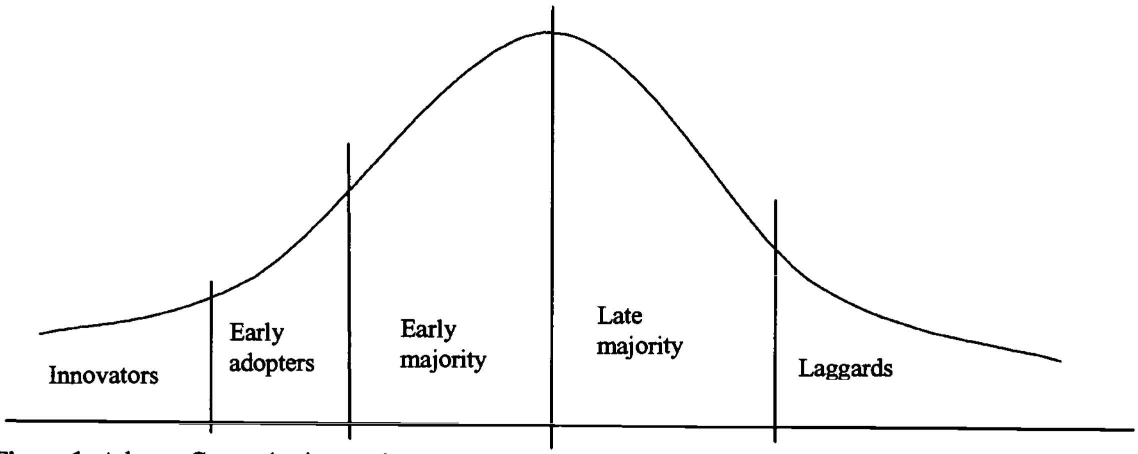

Figure 1: Adopter Categorisation on the Basis of Innovativeness (Rogers 1995).

However, we have identified a gap in this current body of knowledge. Ongoing research are either technical or are undertaken by involving people that have already accepted the concept and are very interested in the use of computers. Who cares about those people who do not have the requisite knowledge about IT or the interests or the opportunities to be a member in a digital city? We hope to fill that gap in contemporary knowledge, by examine late adapters and recommend how to introduce IT and Web-technology to those who today do not have those opportunities.

We believe that the greatest obstacle that the IT society has to surmount is neither economic nor the access to technology, but more the fears and prejudices of people.

One of the most important questions we have to ask is where in the new society is there a place for the individual. There is a step between the technology and the use of technology, and that step is the acceptance of what the new technology means for us. We have to accept that we still are humans, even if the manner of our existence changes. We have to accept that social interaction is still social interaction, even if, in part, we communicate in a different way.

The new technology scares people more then it attracts them (Dahlbom forthcoming). Dahlbom thinks that in agrarian society the home was the focus and that was where all activities took place. When rural-dwellers moved into the cities they took their homes with them but they didn't use the technology as much as people in the city. Gradually, the home has become just a place to live and the working place the place that gives security (Dahlbom 1997). He argues that when the home is no longer a place where people work, it loses the character of being a home. Dahlbom's question is; how shall we look at new ways of living and how shall we live on the Internet?

In terms of evolution, people have always had to adjust to the roles and traditions of society. Ljungberg (1991) describes this adjustment as a capitulation/surrender mechanism. This means that if the individual disclaims certain biological behaviour, reactions and experiences, the individual must consequently find a new way of acting. Ljungberg believes that this is what many people have been doing and what many people will have to do. The reason that a new social order is able to develop is because of the fact that most people use this capitulation mechanism.

Dahlbom (1987) believes that when the individual has identified her with society a new more technological self-identity is developed. Loyalty, honesty and solidarity were highly valued in industry society. Today other values as efficiency, competence and success have replaced those values. One reason for this is that work occupies a greater place in people's lives and that society demands higher levels of consumption

(Dahlbom 1987; Dencik 1994). A consequence will be that the individual will have to adjust to technology to be able to fulfil society's production demands. To manage the technology it is necessary to be able to think logically and rationally (Ljungberg 1991).

Hegel (cited in Dahlbom 1987) claims that the individual changes in interaction with other people and their environments – each individual compare themselves with others. Dencik (1994) believes that we are all victims of our time and that we perceive our surroundings in a specific way depending on which time we live in. He also thinks that we will have to find a new way of looking at normality, because, "a society in constant change will put high demands on mental and social flexibility". New technology gives the individual a possibility to be in more then one place at the time and that means that the individual can be part of many different contexts and a consequence can be a more diffuse identity (Dencik 1994; Sennett 1998).

The aim of the study is to examine the beliefs, perceptions and visions of people about the development of the IT society in Sweden.

Method

We have done nine interviews with people living in a housing area in an average community in Sweden. The nine tenants were recruited randomly from the same housing block, in a town in the West of Sweden. The tenants (5 men and 4 women) were ranging in age from 22 to 76 (M=38.3 years, SD=18.7).
Four of the informants were unemployed, two were factory workers, and the other three were, respectively, a nurse, an accountant and a senior citizen. One of the women and one of the men had non-Scandinavian backgrounds. Only three, all men, of the nine informants had computers at home. Only one (a woman) used a computer on regular basis at work.

A long qualitative interview was conducted. The method was used to obtain a spontaneous answer to each question asked. A single interviewer conducted each of the interviews. The qualitative approach and the content analysis, which were used, are inspired by the Grounded Theory tradition (Strauss & Corbin 1994). We are interested in patterns that occur in the data. From the content analyses of the interviews three common themes could be identified; experiences about computers, the advantages and disadvantages with the new computer society and visions about the IT- society.

What do They Think about IT?

There where three variables that recurred in the analysis of the interview data, and which were identified as core concepts. They were:

1. *Experiences about computers.* In this main category responses from all of the interviewees are included in order to demonstrate how as separate individuals, they experience the computer and information society.
2. *Advantages and disadvantages with the IT- society of the future.* This main category was evidenced in several different forms throughout the interviews, it was also a question that was asked of each of the interviewees. It has been chosen to be a main category because it was mentioned several times in the interviews.
3. *Visions about the IT society of the future.* In this category the visions of the interviewees were of course quite different.

The analysis is based on how the informants related to the new technological society. In the investigation four different behavioural attitudes can be identified.

- In the Go-ahead attitude the new society was experienced as being something positive.
- In the Accepting attitude the informants chose to view changes to an IT society as something that was unstoppable.
- The Ambivalent attitude is reflective of those individuals who have not confirmed one single attitude, and are generally ambivalent.
- The Dissociate attitude reflects the individual's desire to return to "the old society".

The attitudes reflect the respondents' experiences and beliefs about the IT- society in its present form and in the future. None of the respondents used just one attitude, but made use of several, which indicates that the boundaries between the attitudes are fluid.

How can we Involve Them in the Future?

Our results contained statements that reflect different attitudes towards experiences with, the advantages and disadvantages of and visions about the computer/IT. The aim of the study was to examine peoples beliefs, perceptions and visions of the IT society. We ordered the individual's attitudes in a 12-section table, (Fig. 2), then we got a picture of each individual. The four columns run from Go-ahead attitudes to Dissociate attitudes. The three rows are positioned in an increasing level of abstraction, from the interviewees own concrete experiences to their visions about the future IT society.

	Go-ahead attitudes	Accepting attitudes	Ambivalent attitudes	Dissociate attitudes
Experiences with computers	A	B C D E F	G	H I
Advantages and Disadvantages with IT society		D E G	A C F H	B I
Visions about the future IT society	A B G	D		C E F H I

Figure 2: The different attitudes of the interviewees are distributed into the main categories. The different persons are;

A – woman, unemployed, 22 years of age.
B – woman, unemployed, 25 years of age.
C – man, unemployed, 25 years of age.
D – man, factory worker, 22 years of age.
E – man, pensioner, 76 years of age.
F – man, factory worker, 49 years of age.
G – woman, accountant, 30 years of age.
H – woman, auxiliary nurse, 40 years of age.
I – man, unemployed, 56 years of age.

The results showed that only one ("A") of the nine interviewees was positive about the use of computers today and not more then five people ("B, C, D, E, F") accepted the potential uses that the computer offers. A minority of three persons of the group ("D, E, G") accepted these advantages. Three interviewees ("A, B, G") who had a positive vision about the new IT society were all women, in the age between 22 and 30 years. They have all ordered computers that are to be delivered soon. We can se that one of the women ("G") changes her attitudes from having Ambivalent attitudes toward experiences of computers, too Accepting attitudes toward the computer's advantages and finally ends up having Go-ahead attitudes toward the IT society of the future. The opposite pattern is shown by persons ("C, F"), both of who are men. Two of the individuals have attitudes, which are the same for all the categories, both men, "D" have in all categories an Accepting attitude, and "I" has in all categories a Dissociate attitude. The two unemployed women ("A, B") have a Go-ahead attitudes, and the two unemployed men ("C, I") have a dissociate attitudes, toward the IT society of the future. According to Dencik (1994) the new society belongs to women; the gifts of being able to listen and to sense things that can't be put into words are important factors in our future network society. We are moving towards a society that will focus on hard questions, so in the future research should be focused in a more multidisciplinary perspective where we put the soft issues in the centre.

A fear of and objections about the future and the use of IT are voiced by a majority of the people in the study. Five of the nine persons were negative toward the future IT society. Four of these persons were older than 40 years and one person was a younger unemployed man, but at least two of them have computers at

home. They express a fear for the individual's existence in the future, and they were all sceptical about social interaction on the Internet. None of these five people think about the computer and the Internet as a communication tool, and perceive interaction, more as the "thing that will take your soul away and a thing that you have to put trust and friendship into". These people haven't found a new, comfortable, way of acting toward the new possibilities that computers and IT offer (Ljungberg 1991). They haven't been willing to identify themselves with the IT society and therefor haven't developed a more technological self-identity (Dahlbom 1987). They are all frightened about the possibility that more flexible ways of communicating and interacting will contribute to a more diffuse identity (Dencik 1994; Sennett 1998).

It is important not to force people with a negative visions about computers into an IT society. If we do, they will be left with a sense of a diffuse identity and a feeling that IT has not been of any use for them. It is necessary to find a way of introducing IT so that they can perceive of it for what it is – a useful tool.

Implications and suggestions for a new IT introduction

Three of the nine persons that were interviewed had ordered computers (all women) and three have had a computer in their homes for a shorter time (all men). Only one of the people interviewed had computer experiences from work. The main part of the group can there for be characterised as late adapters or "laggards" (Rogers 1995). Laggards are the very latest adopters of a new idea. This is a group of people that very often are left behind when it comes to new technologies and changes in society, changes that are themselves caused by technology. There has not been much research about "laggards", and our study has its focus on this unexamined group.

Our result shows that many of the people in the study have negative attitudes toward the advantages of IT and have negative visions about the future IT society. On the other hand they are positive about their own experiences with computers. One explanation can be that this group of people find it hard to see the future advantages of IT. This can be because they just have started to use computers and they haven't yet adopted the use of the computer into their every day life. They can understand the practical use by computers in their own situation, but they can not generalise their use in other situations. Furthermore, they think that the future will mean fewer physical activities in the daily life.

When introducing computers and IT to this group of people, it is important to consider their opinions that the computer not is a useful tool – but rather a threatening mechanism that they don't understand. In our study a majority of the interviewees have a dissociate attitudes against the future IT society. They were afraid that the technology. Below, we provide some suggestions as to how future education for this group might be presented. How can new information and communication technology (ICT) be used in order to support the democratic communication of private citizens? De Cindio (1998) is of the opinion that community networks cannot be conceived and designed without citizens' participation.

Participatory design (Schuler & Namioka 1993) was born as system designers became aware of the need for involving users in the development of computer based systems. This method has been used in the "new" field of communication technology for gaining experiences and understanding learning processes together with the users. We shall use the theories in participatory design method to introduce the ICT for the tenants in the housing area. The method involves the participators, late adapters or laggards, in the design of their own ICT education. We shall study if their attitude changes after they have got an education, which is based on participatory design method.

In our ongoing research project – Live in IT - we have started to create a new form of education together with five different voluntary associations and their members. This is one step in involving the tenants in the housing area to participate in the ICT design process.

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Cognition and Courseware Design by Teachers: the Concept of Multimediatizing

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Abstract: Cognition and multimedia language teaching seem to be at the two extremes of a very long axis. But the evolution of multimedia today makes it necessary to clearly define some seemingly transparent cognitive notions and functions that may otherwise deceive the teacher in his expectations. Furthermore, teachers are the only entitled persons to design courseware application after a very precise analysis of their own didactic needs. The question to be asked then is "*how?*", and the answer to that question may not be easy.
We shall try to demonstrate in this paper that this axis is in fact very short by introducing three fundamental concepts. The concept of Multimediatizing is one of them and enables satisfactory courseware design by non-programming teachers.

Introduction

"I'm just a language teacher!", you would say to apologize for your rather short studies that make you able to read, speak and as a whole master a foreign language so that you can be entitled to teach it. Basically class teaching is not presenting a show, even if this presenter role should not be excluded at a particular point of the teaching schedule, e.g. at the end of a learning cycle for knowledge assessment or reinforcement purposes.

But language teaching and particularly second-language teaching is more than that and most teachers know it. In fact the amount of personal skills and knowledge competence necessary to achieve this so-called "simple" goal may somewhat be impressive.

The teacher must first be a linguist not only to be able to describe the surface of a particular language but preferably to explain the underlying mechanisms of language activity at a level common to both the mother tongue and the target one.

A second language teacher for science students for instance must then be sufficiently scientifically aware of the informational content carried by the language to be able to communicate with learners in their specific specialized fields. After a time, an L2 teacher in a science university in France must have an operational competence in scientific domains such as physics, astronomy, mathematics, electronics, computer science and technology since his or her students need to master these subjects in English for their future jobs.

If the word "language" in "language teaching" refers to linguistics and to the different specific purposes or specialty domains involved (literature and civilization are two of them), the second element is "teaching". Far from being an innate skill, even if taste, common sense and conviction should be put through it, teaching is a science. As a science, teaching starts from observation. The object to be studied is the teaching situation. Learners and the learning environment make up this situation.

This learner-centered approach should thus focus on the learner's needs. The individual needs will be identified and analyzed from the triple point of view of language knowledge, language use and specific purposes defined in each learner's syllabus (understanding science texts will not entail the same type of activities and learning tasks as trading on the phone for a company). After this analysis a specific teaching curriculum for this language can be set up.

Moreover the learning environment will set the place and time for learning,

Time is the key element. The contact with the language is ridiculously short if you consider the 20 to 30 hours a year a university student has in France. Didactic theories show that *how* to do things is then more important than *what* to do. Language acquisition cannot be intuitive in that instance as this could easily be possible with 10 hours a day in the country of the language.

Place was traditionally the classroom. In a class of 30 to 70 students, the syllabus has to suit a hypothetical virtual student that would be the average of all of them and therefore would be appropriate to none of them. Moreover, the teacher is the only language provider. Oral language production on behalf of the students is then reduced to a few seconds per hour, when it takes place.

Technology changed these place and time constraints. Distance-learning is possible through the Internet and even in the language lab in the presence of the teacher, computerized learning induced a new didactic role on his or her part (i.e. a guide for individualized learning). He or she must learn this new role, he or she must know what multimedia can bring to the learners and thus multimedia technology has to be mastered. Collis (1996, p. 22) contends that the teacher has the responsibility for "the eventual success or lack of success of any computers-in-education initiative". Teachers should then be prepared to teach with technology, which is, after linguistics, specific fields and didactic theories, the fourth aspect of their training.

"Don't overdo it !", anybody would say to me at this point. Meanwhile a fifth competence is needed because multimedia technology makes it indispensable now. Individualized teaching calls for a multimodal interface that would suit the whole set of learning attitudes that cognitive sciences have clearly characterized for long.

Cognition is thus another field of competence for any teacher today that cannot be ignored. "Who still wants to be a language teacher ?" Positive answers will probably come from the ones who would take pleasure in seeing their students taking pleasure by working with their own customized software !

The concept of "Mediatizing"

The word "cognition" comes from the works of Plato and Aristotle. But cognitive sciences have only arisen since the 1950s (the MIT Symposia on Information Theory) and now are part of what philosophers call the unity of science: « perhaps as a consequence of the ever-increasing specialisation in science, scientists have found it important to work in an interdisciplinary manner where they can draw upon the research skills and knowledge bases of scientists trained in other disciplines » (Bechtel, 1998).

This necessary interdisciplinarity is more and more observed after the specialisation recommendations extolled at the beginning of the 70s. It now allow us to have a heuristic attitude towards any mental production. Before trying to imagine how to implement a didactized content according to different cognitive modes, it is essential to consider the status of this content. It is in fact something the teacher has in mind and something he or she has to express. At least a general idea of how things work from mind to expression may be useful.

Kathryn Bock has characterized this process in an interestingly synthetic way: « Psycholinguistic research on language production concerns itself with the cognitive processes that convert non verbal communicative intentions into verbal actions. These processes must translate perceptions or thoughts into sounds, using the patterns and elements of a code that constitutes the grammar of a language. For theories of language production, the goal is to explain how the mind uses this code when converting messages into spontaneous speech in ongoing time » (Bock, 1995).

A lot of research is being done in that field now (Pottier, 1992) and a theory is needed to formalize in a hierarchized and dynamic way the construction of representations drawn from experience and the personal calculations completed on these representations. Artificial intelligence or language translators[1] would need such a theory and cannot go on using words instead of concepts. A concept cannot be represented by a word, necessarily a discrete element in a particular language. Concepts belong to mind and have no linguistic colour. They may be represented by codes (Toma, 1984, p. 279) and these codes should then be organised according to different categories.

It is not possible here to develop this theory, still under construction. The theory has nevertheless nothing to do with chronogenesis and does not try to reproduce what happens in the human mind. Medical researchers may one day find it out, but as far as cognitive scientists are concerned, the construction of what

[1] PC Expert (November 1999, p. 168-174) has tested four leading translator systems: Reverso (www.softissimo.com), Systran (www.systransoft.com), Transcend 2.0 (www.transparent.com) and Power Translator (www.lhsl.com). None of them could properly translate in French the sentence " And God said, 'Let there be light,' and there was light". The correct translation is: "Et Dieu dit, 'Que la lumière soit,' et la lumière fût".

The obtained translations were respectively: "Et le Dieu a dit, 'Laisser là être léger,' et il y avait léger", "Et Dieu dits, 'laisser là léger,' et il y avait lumière", "Et Dieu ont dit, 'laisser il y a léger,' et il y avait léger" and 'Et Dieu ont dit, il y ait lumière, et il y avait léger" ! None of these translations make sense. The imperative form has never been translated properly and a general mistake has been made on the interpretation of light as an adjective ("léger") instead of a noun ("lumière").

happens in this "black box" has just to be imagined and tested through experiments. A brief outline of this construct can reveal a possible structure starting from a small number of metaconcepts, or "meaning atoms", that assemble in concepts (or molecules) according to the type and strength of the relations between them, then in groups of molecules (basic ideas) and in conceptual networks (sets of ideas) according to the different calculations occurring on these elements under specific conditions or goals[2].

According to Sperber, « mental representations are themselves objects in the world, and therefore potential objects of second-order representations or metarepresentations » (Sperber, 1999). So the task involved is in fact an artificial objectivation of subjectivity.

Even if metacognition is not a new science (James, 1890), the important point here is to clearly identify the frontier between the 'black box' (what is in mind, what is processed in mind, what is on the point of being expressed under a certain form or medium, still in mind), and what is expressed under a particularly chosen medium.

This medium can be *sound* for oral language and music, *image* for still pictures, films, painting and even writing, *movement* for dance, mimics and body expression, or *several media* linked together for a multimedia support (talking movies, television or multimedia computer).

This passage, this act of expression is what I call "*mediatizing*" ("Mise en média" in French). Mediatizing for me is a *semiotic* inscription. This term will NOT refer to the classical way of translating some different media (images, texts, sounds) already edited in a discrete way into a multimedia form ("Médiatisation" in French). On the contrary, it consists in the **direct** use of any medium, that is of any way of expressing oneself.

The concept of "Multimediatizing"

When a multimedia support is chosen to express a didactized informational content, the act of expression can therefore be called "*multimediatizing*". Multimediatizing is just a specific form of mediatizing even if it encompasses three different media: oral wording when a language is used under the form of sounds, written wording when a language is used under the form of letters and still or moving images to serve as a prop to the discourse situation.

Compared to television, computerized multimedia offers hypernavigation (direct access to any part of the informational content), interactivity (reaction to any action to assess the learner's tasks or to help him or her in case of errors) and multimodality that I would define as the possibility for the receiver to adapt the reception of each medium to his own cognitive mode (Toma, 1998)[3].

All these possibilities have to be exploited for an enlarged, deeper and richer learning process. But when you think "multimedia" to express yourself under a multimedia form, the problem is "Where to start ?". As far as language teaching is concerned, and particularly when English has to be taught to French students, the answer is undoubtedly from the SOUND and not from the text.

French students learning English usually have a fair level in understanding written English but would be at a semi-beginner level to understand spoken English. The reason is simple. Students have memorized the written form of words because it resembles the French written form. The pronunciation of the words, i.e. their oral form, which needs an effort to be remembered because the phonological system of English is completely different from the French, is either ignored or wrongly learned. Phonetics, the only way to write sounds on paper such as a score allows it for music, should be taught in high schools but is not, since most students do not even know what phonetics is about after 10 years of English! The University is there to make up for this lack of initial knowledge hoping that late is better than never.

Aural comprehension is therefore an urgent need for most students since they have a minimum of two years of English left (an equivalent of 20 to 40 hours!) before quitting the University.

Easy access to the sound should then be facilitated.

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[2] This branch of metacognition that I might call the « **cognitivo-discursive** approach » should even help us solve linguistic problems such as why in the two semantically close sentences « He went out in spite of the cold » and « the cold did not keep him from going out », the constraint laid on the concept of « going out » by the concept of « cold » is expressed in one sentence by the prepositional phrase « in spite of » and in the other one by the verb « keep from ».

[3] The learner should be able for instance to change the size of a picture (larger if he or she is of the visual type, smaller for the auditive types), or move it from the right to the left if this suits him/her better, but these possibilities must have been anticipated by the designer.

At the beginning of the 90s when sound cards began to be installed in most computers, I imagined a new system enabling an automatic segmenting of the sound track according to the blanks or the volume drops in the sound signal detected by the system. The background noise can be parametered allowing a distinction between what is language sound and what is not, which makes segmenting possible even in case of a background music. The value of the blanks to be detected can also be parametered (from 0.2 second to 8 seconds). A "hard" segmenting rate of the sound track at a value of 0.2 second will give a large number of short sound segments (one word or more) to suit weak levels of students whereas a medium rate of 0.5 second will give a smaller number of longer sound segments for average-level students. Values above 1 second are simply used to segment a sound track in large paragraphs.

I called the system "*LAVAC®*" for "Laboratoire Audio-Visuel Actif-Comparatif " (Audio-Visual Active-Comparative Laboratory). This system which was first an authoring system gave birth to a student interface and a teacher software for distance and real-time tutoring in a computerized laboratory. The LAVAC system has been used in more than 150 universities in France and abroad since 1992.

Moreover during the automatic segmentation process, the system also creates an answering time span after each segment proportional to the length of each created segment. The proportional value can also be parametered in a 10 to 999 % range. I usually use a 150 % value, which means for instance that there is a 3-second answering time after a created sound segment of 2 seconds. This answering time can either be used as an automatic pause in aural comprehension for a better understanding process (because slower) or for note taking. But it can also be used for repetition of each segment, which is not as easy as one might think, since comprehension, memorisation and language production are involved in limited time.

Nevertheless few courseware programs take into account the notion of a **time-limit** for an answer. « *Only recently has temporal perception become a central issue again, because cognitive processes cannot be understood without their temporal dynamics* » (Pöppel, 1997). But this notion is fundamental to prepare the learner to react quickly in a virtual environment in order to make him/her ready for action in a real one

The sound track can of course be listened to without answering time and up to 24 ways of accessing the sound are possible in a LAVAC lesson with just a simple real-time segmenting of the sound track. The visualisation of the sound spectrum can be proposed for a better perception of the sound. But most importantly the sound segments are automatically numbered and visualised. Even if a segment selection is played in a listening or recording mode, any of them can instantly be accessed by a right click of the mouse. Any type of segment selection (continuous or discontinuous) is also possible.

These 24 ways of accessing the sound will obviously suit the different cognitive types of learners. Not surprisingly, the analytic type will listen to the sound track segment by segment, the synthetic will prefer a global listening of segments and the kinesic will listen to groups of segments. It is important to note that these different ways of accessing the track are generally independent from the learner's level or the difficulties of the material to be listened to.

In the LAVAC system, each numbered sound segment is in fact a sequence that can be given a name and that can be linked to a text (and/or a text answer), one or several images, a video and all types of exercises. In case of an error, an hypermedia link to one or several sequences of another lesson for revising or reinforcement can be set up by a mouse click.

Since all these possibilities can easily be implemented by a non-programming teacher, it is essential at that point to have minimum of knowledge of what cognitive science and particularly activity theories can bring us in the understanding of a learning process: the subject becomes the product of his or her own interactions in a conscious learning process.

Leontiev in 1972 posed three hierarchized levels of relations between the learning subject and the goals to be attained. The first is the intentional phase that defines the need to be satisfied (improved knowledge for example), the second, the strategies to be implemented and the third, the specific routines or acts that will involve and put into use pre-existing knowledge procedures.

Bruner in 1990 adds a recursive cycle at each step of this structure for assessment of the results obtained. The analysis of the discrepancy between the expected and the observed effects is the « fuel » of the dynamics of the system (feedback and auto-correction processes) until final satisfaction or failure.

The key phrase in language learning in a virtual environment is probably "learner's control for an accepted effort". The learner will better mobilize and stimulate his or her mental and cognitive abilities if he or she has a personal challenge to win. But he or she must be sure to win it with the necessary tools provided by the teacher.

Thus allowing an easily accessible solution with no time-limit to answer is certainly not the right solution to improve learning through multimedia teaching.

Videos that can be played with a "tickable" transcript option should then be avoided since aural comprehension is then transformed into understanding of oralised written English. At least this possibility of help for weak learners should come after a certain number of errors in the exercise section.

In the same way some (rare?) method designers should have a better epistemological insight of what they propose to their learners. Questions asked after a video played without any help of any sort cannot be answered if the sound has not been understood. But when multiple-choice questions are proposed, the learner can have the average if he is lucky! Is this still language learning ? What is the point of knowing that an answer is wrong without being able to understand why? If on the other hand the sound has been properly understood, questions should be better raised in a non-virtual environment with the teacher and the student alone or in small groups to check memorisation and favour oral expression and reuse of learned vocabulary.

In fact a machine must be used for what it can do best: tireless playing of the sound track with always the same quality, segmentation of this track, recordings, listening of recordings, visualization of segments, visualization of the sound track, comparisons of spectrograms, insertion of indexes in the segments for shorter ones if needed, recap functions for immediate listening from any index, role play, etc.

This is why I designed two new tools derived from LAVAC to help non computer-literate teachers create their own specific software in real time: the Audio Sequencer (Virtual recorder®) in 1998, and the Video [4]. These tools may also be used by teachers who consider that computer exercises are long to implement and can be given to the student in a "normal" session in a traditional classroom. In some cases access to the language lab is limited because of the large number of groups who want to use it, and again it is wise to choose to do with a machine what is impossible to do in the classroom.

But these tools could nevertheless be linked to the LAVAC student interface to give them what the machine alone cannot process: different levels of help. Help, missing in most software applications, are what will enable the student to find the solution by him or herself when they are presented in a graded way. There is no need of a Bayesian approach to distinguish between imposed hints, necessary for all the students and proposed ones only for those who need them or to assess the number and types of hints to be implemented.

Different values of the automatic segmenting enabled the same document to be used for different levels of students. Here again different levels of help in succession will make any document appropriate to a wide range of students, as long as there are no beginners or semi-beginners.

The aim in this approach is to base the software application more on the implementation of metalinguistic activities than on a classical acquisition of lexical or syntactic data.

The problem to be solved (with the problem of time) is then to implement the metalinguistic learning activities that will suit the different cognitive types, knowing that each learner more or less belongs to most or all of these types. Three sets of metalinguistic activities shall be introduced and most of these are based on the hypothetico-deductive techniques the learner commonly uses in everyday-life deductive reasoning.

- for sound discrimination and word recognition: a hierarchized list of different deduction help starting from wave spectrograms, phonetic transcription, lexical hints, written form of words
- for word and sentence meaning: etymology, knowledge of the discourse situation (solve a linguistic problem using an extralinguistic element of knowledge), contextual logic (the sentence is considered as in a crossword game where missing words are missing letters, and the context gives the clues) will be put into use to enable the learner to find the meaning of the words or the group of words by him or herself
- role of the image medium in understanding: an image can seldom be used to illustrate one particular word. It is only a prop for the understanding of the current language situation, especially if it is authentic. The learner will not have to wonder about the place, the look of the characters, even their self-expression, and all sorts of elements that might perturb him or her in his/her understanding process (Toma, 1996).

The concept of "Re-multimediatizing"

Even if different level segmenting of the sound track has been completed and a whole set of gap-filling or matching exercises and multiple-choice questions with hypermedia links in case of error has been devised, the work of the authoring teacher is not over.

[4] See Toma, T. (2000). *Real-time course design: the LAVAC Video Sequencer*. SITE 2000, San Diego, Ca.
The video sequencer allows automatic real-time segmenting of sound AND images, with an automatic insertion of an answering time span after each segment.

Even though or a range of possible help has been implemented with a semiological code coherent throughout the courseware, the authoring teacher should better go into the language laboratory to see what happens.

Cognitive types (analytic, synthetic, kinesic) are one thing, personality types are another. It is necessary to be in the language lab to observe different learning attitudes, most of them based more on work evaluation than on knowledge acquisition. The cautious or unadvanturous type will refrain from imagining any type of solution. The hints may be modified to make things easy and avoid any logical risk. The confident type on the contrary might not see the traps. Question marks, specific color codes should draw his or her attention to make him avoid simple mistakes. Others may be of a passive type. They want the solution immediately. Special tutoring is then needed, which is possible when a communication area has been designed in the language lab.

CD-ROM programs with a fixed content designed for a hypothetical didactic situation cannot be satisfactory then with these methodological prerequisites. The necessity to meet specific user requirements gets stronger and stronger. LAVAC software allows precise follow-up of each learner's activity and all sorts of fast and easy modifications are possible even in the presence of students: change of answering time for a whole group for any lesson in case of different student level, modification of the size or position of one or several images or texts thanks to multiselection tools (the set-up for one will be applied to all selected elements), addition or suppression of one or several questions, change in marking, creation of hypermedia links, etc.

This concept which few cognitive scientists are concerned about is what I call *"re-multimediatizing"*.

Conclusion

Thanks to the familiar cognitive operations implemented by this type of methodology, the learner will be able to successfully identify the new linguistic and extra-linguistic data he or she has progressively acquired, in relation with his or her pre-existing knowledge network.

The assessment of the unconscious mental organisation of the acquired data should then become conscious through final testing in order to improve it if possible, with the help of the teacher, if necessary. Language skills and knowledge acquisition will then normally occur through 'participative coupling' (Varela, 1994) and representation construction.

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The Integration of Technology Into A Constructivist Curriculum: Beyond PowerPoint®

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Abstract
For teachers who are at the moment in the objectivist's camp, technology usually becomes a tool for a more effective way of transmitting knowledge. In this context, the integration of technology usually takes the form of some type of PowerPoint® presentation or the use of some other multimedia presentation software to supplement teacher-centered instruction. However, for those times when a teacher views knowledge from a constructivist perpective, the question then becomes, how can technology be effectively integrated? This paper is a report on a three year study of a model that uses the tenets of constructionism to integrate technology into a constructivist curriculum. The model has been used in regular face-to-face courses, in interactive instructional televisions courses and an on-line course. The model has proved to be effective both from the stand point of being able to achieve the course objectives and the student's view of their success and learning in the classes.

Introduction

What is knowledge? How does one teach this knowledge to others? Looking at educational pedagogy from a very elementary approach, the way one answers the first question will determine how they approach the answer to the second. One can approach the answers from the standpoint that knowledge exists outside of the learner, that there are fundamental truths and teaching helps learners master them. If this is a person's view of knowledge, then teaching usually takes the form of direct instruction and instructional goals center around students acquiring and repeating factual information. Most printed textbooks are designed for, and many teachers are trained in, this type of model. Students usually read or are told factual information, and then repeat this information as a part of assessment. This model of knowledge is often referred to as the objectivist model.

From another perspective, one can view knowledge as something beyond a set of facts, or concepts, or laws that are to be memorized. One can possess a view of knowledge that incorporates an understanding of causes and effects involving ideas and actions that requires the use of higher-order or critical thinking skills. This view does not conceive knowledge as something that exists independent of a knower. Zahorik (1995, pp. 11-12) summarized this view of knowledge in the following way:

> *Knowledge is constructed by humans*. Knowledge is not a set of facts, concepts, or laws waiting to be discovered. It is not something that exists independent of a knower. Humans create or construct knowledge as they attempt to bring meaning to their experience. Everything that we know, we have made.
>
> *Knowledge is conjectural and fallible*. Since knowledge is a construction of humans and humans are constantly undergoing new experiences, knowledge can never be stable. The understandings that we invent are always tentative and incomplete.

> *Knowledge grows through exposure.* Understanding becomes deeper and stronger if one tests it against new encounters.

This model of knowledge is often referred to as the constructivist model. Constructivism's central idea is that human learning is constructed, that learners build new knowledge upon the foundation of previous learning. The constructivist model relies on cognitive psychology for much of its theoretical foundation and has roots in philosophy, sociology, and education. It is important to understand the implications this view of learning has for teaching. The Southwest Educational Development Laboratory News (SEDLetter) in August, 1996 stated:

> First, teaching cannot be viewed as the transmission of knowledge from enlightened to unenlightened; constructivist teachers do not take the role of the "sage on the stage." Rather, teachers act as "guides on the side" who provide students with opportunities to test the adequacy of their current understandings.
>
> Second, if learning is based on prior knowledge, then teachers must note that knowledge and provide learning environments that exploit inconsistencies between learners' current understandings and the new experiences before them. This challenges teachers, for they cannot assume that all children understand something in the same way. Further, children may need different experiences to advance to different levels of understanding
>
> Third, if students must apply their current understandings in new situations in order to build new knowledge, then teachers must engage students in learning, bringing students' current understandings to the forefront. Teachers can ensure that learning experiences incorporate problems that are important to students, not those that are primarily important to teachers and the educational system ....
>
> Fourth, if new knowledge is actively built, then time is needed to build it ...

In educational pedagogy, the reality of the situation is, teachers can find themselves in both the objectivist's camp and the constructivist's camp depending upon the objectives they are targeting. There are times in our classrooms that we are actively involved in the "transmission of knowledge from enlightened to unenlightened." There are others times that our learning objectives are such that we do our best to create situations where "students must apply their current understandings in new situations in order to build new knowledge." Teaching is often described as being an art. The art of becoming a master teacher can be seen as an awareness of when to be in one camp or the other and an understanding of how to be effective no matter what camp one is in.

In contemporary education, the complexity of teaching and learning has been heightened with the integration of modern technology. For teachers who are (at the moment) in the objectivist's camp, technology becomes a tool for a more effective way of transmitting knowledge. In this context, the integration of technology usually takes the form of some type of PowerPoint® presentation or the use of some other multimedia presentation software to supplement teacher-centered instruction. But for those times when a teacher views knowledge from a constructivist perspective, the question then becomes, how can technology be effectively integrated?

Constructivism and Technology Integration

In social and developmental psychology, according to von Glasersfeld (1994), constructivist models view the learner as a builder of knowledge, not a passive receptor, but an active constructor. Two important notions orbit around the simple idea of constructed knowledge:

The first is that learners construct new understandings using what they already know. There is no *tabula rasa* on which new knowledge is etched. Rather, learners come to learning situations with knowledge gained from previous experience, and that prior knowledge influences what new or modified knowledge they will construct from new learning experiences. The second notion is that learning is active rather than passive. Learners confront their understanding in light of what they encounter in the new learning situation. If what learners encounter is inconsistent with their current understanding, their understanding can change to accommodate new experience. Learners remain active throughout this process: they apply current understandings, note relevant elements in new learning experiences, judge the consistency of prior and emerging knowledge, and based on that judgment, they can modify knowledge. (SEDLetter, August, 1996):

> If learning is a constructive process, and instruction must be designed to provide opportunities for such construction, then how can technology be integrated into the instructional processes such that it promotes teachers to teach in "constructivist's ways?" The answer may come form a series of research studies described as *constructionism.*

In the 1960's, Seymour Papert and colleagues initiated a research project on how children think and learn and to develop educational approaches and technological tools to help those children learn. From this beginning has evolved a theoretical foundation, which has become known as constuctionism. The term constructionism, first coined by Papert (1991), involves two main tenets. First, it affirms the constructivists view of learning and asserts that knowledge is not simply transmitted from teacher to student, but actively constructed by the mind of the learner (Kafai and Resnick, 1996). To this constructionism adds the idea that people construct new knowledge with particular effectiveness when they are engaged in constructing *personally meaningful products* (Bruckman & Resnick, 1996). Thus constructionism involves the construction of knowledge in the context of building personally meaningful products (Kafai and Resnick, 1996). It is perhaps through this avenue of "constructing" that technology can be integrated into the instructional process such that it promotes teachers to teach from a constructivist model. This was the premise in the development and research of the curriculum model discussed here in.

The Model

The curriculum model that was implemented was designed around constructionist reseach emphasizing that "constructing" be done in the framework of *personally meaningful products.* The blending of course objectives and personal meaningfulness into a single coherent design while adhering to constructivist ideals is what this curriculum model hoped to achieve. Csikszentmihalyi (1997) in his research on creativity found that when a person likes what he does and is motivated by it, focusing the mind becomes effortless even when the objective difficulties are great. However, this meaningfulness must also exist within the context of the learning goals of the course.

In Phase I, the student working with the teacher establish the specific topic to be studied based largely on the personal environment of the learner and the learning goals of the course. Learner's abilities, learning style preferences, the availability of materials, resources and facilities, and the learners understanding of the academic goals for the class influence the choice of product to be produced. As stated before, achieving "meaningfulness" is difficult, for this reason each student was required to submit a narrative that establishes for a reader why the Personally Meaningful Product has personal meaning

In Phase II, a plan of action is developed and the nature of the product to be produced is determined. It is critical that the learner understand that there has to be some tangible creative product that is the result of this process. This must be a created object or artifact that is external to the creator, something "in the world" that can be "shown, discussed, examined, probed, and admired" (Papert, 1980, 1991, 1993). Sharing a creation will result not only in the learner obtaining a deeper understanding of other people's perspective on the object and on the ideas to which it is related but it will also provide the completion of the human experience of creativity.

Figure 1: The Construction Model used for the creation of the Personally Meaningful Product.

During Phase III, the Construction Phase, the learner hopefully will become immersed in the creative process and gain a personal understanding of "Flow" (Csikszantmihalyi, 1997).

> "What is common to such moments is that consciousness is full of experiences, and these experiences are in harmony with each other. Contrary to what happens all too often in everyday life, in moments such as these what we feel, what we wish, and what we think are in harmony. These exceptional moments are what I have called flow experiences. The metaphor of 'flow' is one that many people have used to describe the sense of effortless action they feel in moments that stand out as the best in their lives. Athletes refer to it as 'being in the zone,' (p. 29)

The role of the teacher at this phase is to provide guidance and clarification by observing, listening, and offering helpful feedback as required. During this phase, much valuable information about process skill mastery, content acquisition, personal learning style, and other factors are obtained and help guide the direction of the project.

The final phase is the Evaluation Phase where the product is exhibited for peers, adults, and the instructor to view, admire, discuss and provide feedback. The importance of this phase is not to be underestimated. It is important that the product be viewed by a variety of groups all of which provide feedback to the learners.

Testing the Model

The pilot semester for the model was Spring Semester 1998. Students enrolled in the course that semester represented a diverse range of educational backgrounds as well as a wide range of familiarity with technology. Of the eight students enrolled, only two had any extensive experience with technology. The majority of the class had used computer technology to write papers for their studies, and one had virtually no experience with technology in any form. Degree programs represented in the course ranged from anthropology to English to curriculum and instruction. Several students were completing doctoral programs while others were at the master's level.

The course was held once a week for a three-hour evening session. Each session was usually segmented so that students and the instructor met as a seminar for part of the evening and broke into project work for the remainder of the session. During the project portion of the class, students could opt to work with other students or work independently on their own work in progress. Every student was equipped with a laptop computer that not only served as their link to project design, but also allowed them to keep in touch with other students and the instructor at any time. The software provided by the instructor also gave students avenues to connect students with other sources and agencies of expertise that would help support individual projects.

Outside of class time students could use this same technology to reach the instructor and other students for help or advice. students used a "web-based" conferencing software provided by the university that created a "Virtual Conference Center" (VCC) which gave students a place to collaborate on-line at their own convenience. The VCC was available at any time e and from any location, allowing interactions between students to occur even when separated by time and distance. The conference software also archived all conversations so the writer, instructor, or other classmates could visit or revisit interactions at any time. As a distributed constructionist model of learning advocates, the means for communication between students, and between students and instructor were readily available for collaboration about course content and individual projects within and outside class time. As a constructionist model of learning advocates, the means for communication between students, and between students and instructor were readily available for collaboration about course content and individual projects within and outside class time.

Data Collection and Findings From the Pilot Study

The instructor and the students evaluated the course twice during the semester. At mid-term students were asked to write a report that included evaluation of five aspects of the course: the readings, interactions with others, individual projects, the instructor, and oneself. At this point in the course, the instructor wrote his own evaluation of the students, their progress with projects, and their understanding of constructionism. . At the end of the course both students and instructor repeated these tasks In addition to the evaluation process, the instructor and the students in the class were individually interviewed during the second half of the semester.

From the analysis of the data, three significant themes emerged. All are strongly tied to the guiding tenets of constructionism. While data touched on other issues and concerns, these three themes were strongly represented in a wide cross section of data sources.

Theme One: The Nature and Characteristics of Successful Learners
Theme Two: The Power of Project-Based Instruction
Theme Three: The Power of Interaction and Collaboration

Students in this course represented a diverse range of educational backgrounds as well as a wide range in familiarity and use of technology. Even with such diverse backgrounds, students in this course were almost unanimous in describing the characteristics of someone who would be a successful learner in this course. To be successful in a course based on a constructionist theory of learning, a student must be a "self starter", highly motivated to learn and explore without constant reassurance from the instructor both within and outside class time. This includes a willingness to make mistakes while learning something totally new. Along with this, a successful student must be able to search for multiple sources of information and assistance and be flexible enough to listen to feedback from those sources.

Several students cautioned that learners who need to be told what to do or what to pay attention to would fail miserably in this course. "People that need 'today were going to learn about..' and have their hands up all the time to say 'guide me and I'll be okay' are going to feel lost in this type of class". The characteristics of successful learners described by course students emphasize the active nature of learning demanded by a constructionist notion of instruction. Students in this type of learning environment are not passive recipients of knowledge, but must be actively and passionately involved in their own learning.

One of the reasons that students cited for their own feeling of success in this course was the project-centered learning. In both evaluation and interview data students reported that working on a project that had personal meaning to them opened up new realms of possibilities. "This project was so useful to me and others [in the class]. I was initially skeptical, but this has turned into an enormous personal experience (EG, interview). This student went on to say that to make decisions, find the appropriate resources and to create something with them is something she is confident that she will be able to continue to do well after the course is over.

The ability to interact with a variety of people, in and outside class time was found to be a key component for success in this course. Students reported that at the beginning of the course the nature of these interactions were almost more social than academic. "You can do it", Let's meet for coffee and discuss the hot buttons for your web site helped them to form bonds with other students. Once the course was underway interactions over the web and in class helped the class develop into a true learning community.

Conclusions

As a model for course design in educational technology, distributed constructionism shows a great deal of potential. In a field in which both content and process are ever evolving, distributed constructionism allows for students to begin with the knowledge, skills, and dispositions that they bring to new courses and use these as a basis to create new understandings. The structure in which these new understandings must take place within, however, must be well thought out and provide students opportunities to engage in active, collaborative experiences that facilitate new learning. With further refinements, distributed constructionist models for learning may allow students to grow in ways that traditional courses don't. ECI 751 shows that

project learning is powerful and meaningful for both students and instructor. We advocate the use of such a model to design educational technology courses

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YOUNG CHILD

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The papers in the young child section this year focused on describing possible contexts and activities in teachers can use technology to promote learning with young children. Without exception the papers draw heavily from principles of practice common in more progressive early childhood education literature.

Judith Robbins and Jacqueline Bedell draw from the new expanded definition of reading to include viewing and representing, to justify the use of digital cameras for use in literacy instruction. Even as representing events in pictures is traditionally done with paper and crayons, Robbins and Bedell suggest the use of a digital cameras. Similarly, whereas viewing activities take place traditionally viewing picture books, television, CD ROM, video and digital cameras provide contexts for critical viewing of information. Children today need to be literate both consuming and producing media.

Also drawing heavily on viewing and representing, Nancy Yost describes a project in which preservice teachers learn to co-author multimedia books with young children. Preservice teachers meet with the professor, review the technological context of the room and finally work with kindergarten students in a series of meetings to write and illustrate their multimedia books.

The next two papers draw on the early childhood literature to describe the teaching and learning of mathematics using technology. Both of the papers on the use of mathematics call into question the blind use of technology strongly encouraging teachers not to sacrifice principles of learning when using technology to teach mathematics. Sarah E. Irvine and Andrea I. Prejean observed computer buddies (preservice teachers) working with different software. They discovered that teachers must consider the aptitude of the children, the difficulty of the program, as well as what the programs allow a teacher to teach. Though adding and subtraction appeared to be common activities in software, Irvine and Prejean found problem solving and reasoning to be less popular activities with software.

Picking right up where Irvine and Prejean left off, Yelland and Masters offer similar criticisms of the existing practice of the use of technology in the teaching of mathematics and provide three specific activities in which teachers make use of problem solving and reasoning. Using web based applications, Powerpoint, and Microworlds, students are forced to be active participants while solving problems in mathematics.

Previous research emphasizes the computer station as a place where young children love to socialize. The final paper describes a study in which children with disabilities demonstrated less sophisticated language and lower levels of play at the computer center than at all other centers. McGehee and Heckaman suggest that perhaps teachers need to be more thoughtful and direct when teaching social strategies when using the computer to learn.

These papers all focus on the importance of considering principles of practice when using technology. Certainly, if these papers are any indication, the importance of teacher thought and subsequent guidance of children when using technology is becoming the major challenge in early childhood education.

Read, Write and Click: Using Digital Camera Technology in a Language Arts and Literacy K-5 Classroom

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Abstract: In today's elementary classrooms literacy education includes teaching about and through various media. In the past, teachers used traditional methods as a means of motivating students to read and write. Students, however, are much more likely to learn through listening and viewing. Consequently, multimedia tools are becoming an integral part of the teaching and learning process. Using the digital camera is one of the simplest ways to accomplish the task of creating and integrating multimedia into the curriculum. This paper will investigate how the digital camera can be used with the young child in the elementary school classroom to promote an understanding of language arts and literacy.

Introduction

The publication of the "Standards for the English Language Arts" (National Council of Teachers of English, 1996) expanded the traditional definition of language arts. In addition to the language modes of reading, writing, speaking and listening, viewing and visual representation has been identified. Further, of the twelve standards, seven incorporate media literacy which broaden the view of literacy to include competence in communication using both traditional print, as well as, non-print media. Specifically, media literacy is "an ability to comprehend, use and control the symbol systems of both print and non-print media, as well as, understand the relationship between them (Cox, 1994, p.13)."

This new focus reflects the complexities of communicating in our continuously evolving technological society. In order to be truly literate, students must learn how to draw meaning from a variety of media sources and understand how electronic and print media interact.

Role of Technology in Language Arts and Literacy

The definition of literacy not only includes the ability to read and write but has been expanded to encompass thinking critically, reasoning logically, and awareness of technology and its impact on a global society (Hunt, 1983). Media literacy is a part of an expanded definition of literacy in general. With the publication of the standards, text has been redefined to include spoken language, graphics, and technological communication (Cox, 1998).

Throughout history concern has been expressed about new technology and the teaching of language arts. At first fear was expressed by orators that writing and print material would relegate speech to the past. While language arts instruction changed with the advent of print, speaking and listening were still considered important basic skills. Today, language arts and literacy professionals voice the same concern about new digital technology. The students of today live in a world where much more information is communicated through listening and viewing. Competent use of media, therefore, becomes essential to effective communication.

While in some classrooms electronic media has been used mainly to motivate students to read and write, in today's classrooms, instruction in both print and non-print texts is vital. Technology, in the form of digital media, is one of the new environments that is capable of focusing ideas for communication though the use of language in formats that include text, visual images, sound and motion. This form of technology provides expanded capabilities for the use of powerful new tools to create, organize and deliver effective communication (Rose & Meyer, 1994).

Cox (1999a) proposes a model for teaching media literacy as part of an effective language and literacy instructional program. She states that experiencing media means students:

1. Use their experiences with media outside the classroom (e.g., print and electronic news, television, advertisements, music, video games, etc.) as a common experiential basis for classroom exploration through talk and writing. Students also gain a more equitable access to language-learning experiences through talking and writing about media events outside the classroom, as well as, print and non-print texts in the classroom.

2. Use their experiences with media in the classroom (e.g., film and videotape, audio recordings, computers, etc.) as a common experiential basis for classroom exploration through talking and writing.

3. Gain a more equitable access to language-learning experiences through talking and writing about media events outside the classroom and both print and non-print texts in the classroom (p. 452).

This model encourages students to analyze various forms of mass media and other symbolic systems to understand and appreciate their structure and effects. It also allows students to create projects using a variety of media, including print, drawings, graphs, diagrams, photographs, and videos (Cox, 1999b).

The Digital Camera

The incorporation of visual images into language and literacy projects in the classroom provides exciting possibilities to enhance creativity and motivate children. Computers, as well as related technologies, give students a wide variety of powers and incentives (Marcus, 1990).

Today, a wide variety of multimedia technologies are available for use in elementary school classrooms. They range from camcorders to computers including digital cameras and scanners. For example, using digital media students can read books on the computer using CD-ROM and Hypercard programs, as well as, write using word processing programs. They can view dramatizations of stories on videotape or laserdisc and create visual representations of stories using Hypercard programs, scan their drawings and add them to books they are writing on the computer. Sound has also been digitized. Students can now add their voices to projects. Interviews, outside resource persons, dramatic productions, and oral histories or other oral reports may be videotaped and added to multimedia productions (Tompkins, 1998).

While digital cameras are one of the newest forms of technology, they have a wide application for classroom use. The majority of these cameras are extremely easy to operate and use the point and shoot method for capturing images. Audio, video and still capabilities are available in these cameras. Several of the newer model digital cameras provide functions that allow the recording of sound and motion. These two media are usually combined in a format that permits the user to verbally describe the action of a particular scene being photographed. The task is accomplished by setting the camera to the movie setting, focusing on the action, and holding down the shutter until the selected action is captured. At the same time, the built in microphone automatically records any and all sound onto the storage device. Still photographs are recorded by simply setting the camera to the still mode, activating the camera and depressing the shutter.

Digital cameras record the still images and motion videos usually in JPEG and MPEG formats respectively on two types of storage media, either flash cards or computer disks, in place of traditional photographic film. Since the formats are basically universal they can be downloaded on any type of computer. Additionally, software to manipulate the image is usually bundled with the camera when it is purchased thus providing a complete package for the user. The cameras range in weight from a few ounces

to several pounds. This permits the cameras to be easily handled by young children. Most digital cameras also have a Liquid Crystal Display (LCD) screen that can be used as an indicator for composing a picture. Digital cameras are equipped with an automatic focus feature coupled with a zoom device to permit wide and tight angle focus similar to the controls on a camcorder. These features make the digital camera very easy to use with early elementary school students in a classroom environment.

Because photography is such a commonly used medium and because the digital camera is so easily used by both young and older students, it is easy to incorporate photographic activities across the curriculum. Introducing the concept of photo illustration is easy through the use of children's literature. A list of children's books that use photographs to illustrate text can be viewed at Appendix A.

Benefits of Using the Digital Camera

Use of the digital camera in the classroom provides a number of distinct benefits for students. One of the important benefits is the fostering of the creative process. Through the mechanics of photography students are able to express their creative thoughts and ideas by visual composition. After the photograph is snapped the image can be downloaded and, depending on the application software that is used, the photograph can be manipulated to enhance or change the orientation, color, and size, etc. Along with the creative process, communication is promoted through the use of photographs to illustrate and explain written communication as in an illustrated story. Another benefit relates to correlating visual and writing skills. Students learn to integrate visual images that they have taken and manipulated with writing. Through mastering these skills, photography can be used as an incentive to writing or as an inspiration for stories or other forms of writing. Creatively conceived photographs can also be used to illustrate stories or poems after the writing is completed.

When an activity is designed using a single digital camera, cooperative learning opportunities can be integrated into a collaborative experience where students share ideas, knowledge and skills. In this way the digital camera provides a creative learning experience and promotes the use of socials skills among students.

Teachers can also use digital cameras to document students' projects. Visual, as well as multimedia documentation better represents the information and skills that students have learned. This information easily becomes part of a multimedia portfolio of student work documenting receptive language skills such as listening, reading, viewing and expressive language such as speaking, writing and visual representation.

Conclusion

Multimedia technology is an integral part of teaching and learning in the elementary school classroom. This technology expands the range of language and literacy materials and tools available to teachers and students. The traditional language arts have not been abandoned, but rather expanded through the standards and redefined through technology.

These multimedia tools provide powerful ways through which to learn and therefore, educators must find ways to use this technology in ways that support curricular programs rather than supplanting the programs with technology (Lapp, Flood & Lungren, 1995). Generally children are excited about using multimedia and are enthusiastic about using them in order to creatively express themselves. Through the use of digital cameras, as well as other technologies, media literacy can easily and effectively be incorporated throughout the curriculum as children learn to become competent members of our increasingly complex world community.

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Appendix A

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Technology for the Tiny: Educational Software and the Young Child

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Abstract: This paper describes how computer applications (including multimedia software and the Internet) can be used to help young children learn mathematical skills and strategies. The effectiveness of software applications for young children (ages 1-4) were evaluated based on criteria from the National Association for the Education of Young Children (NAEYC) as well as curriculum standards developed by the National Council of Teachers of Mathematics (NCTM). Recommendations for young children who are beginning to explore mathematical concepts are presented.

Introduction

Young children have a wealth of mathematical knowledge acquired through both informal and formal experiences which helps them make sense of their world. They touch, squeeze, and examine everything and these experiences form the beginnings of their mathematics education. Young children construct their own knowledge and learn to think more abstractly with each new rich experience (Kennedy & Tipps, 1994). Developmentally appropriate practice in early childhood education should occur in a rich mathematical environment that includes a variety of mathematical experiences. Parents, teachers, and caregivers should explore mathematical concepts with students so that all will have a foundation for a lifetime of valuing and appreciating mathematics. Kamii (1985) reported that social interaction is important for the construction of logico-mathematical knowledge. Technology can be utilized to provide some rich educational experiences for children. The use of technology has potential advantages, and real disadvantages, and it is the responsibility of teachers, parents, and caregivers to make informed decisions about how they will use children's valuable developmental time. Through the careful selection of software that is matched to the curriculum, early childhood educators and parents alike can enhance children's development of mathematical concepts.

The National Council of Teachers of Mathematics (NCTM, 1989) has described five general goals for K-12 students of mathematics. Educators and other adults should provide experiences so students can: (1) learn to value mathematics, (2) become confident in their ability to value mathematics, (3) become mathematical problem solvers, (4) learn to communicate mathematically, and (5) learn to reason mathematically. Keeping these five goals in mind as young children construct mathematical knowledge will provide them with firm foundations for further study of mathematics.

A rich early childhood curriculum for toddlers, preschoolers, and kindergartners should include explorations and experiences such as the above, in which children are allowed to explore all the processes in both structured and unstructured activities. For example, play time should include the opportunity to make

and describe patterns with blocks and other concrete materials and opportunities for students to keep their own charts; recording, for instance how they traveled to school, how many days it rained this week, or who is buying lunch on any given day. The National Association for the Education of Young Children (NAEYC) prepared a position statement in 1996 outlining the use of technology with young children, specifically from ages three to eight (NAEYC, 1996). The criteria for the appropriate use of technology includes the following components:

Technology is age appropriate, individually appropriate, and culturally appropriate.
Technology should be used to enhance children's cognitive and social abilities.
Technology should be integrated into the regular learning environment to support children's learning.
Educators should promote equitable access to technology for all children and families.
Technology should not stereotype any group, and should eliminate exposure to violence.
Teachers should advocate for more appropriate technology applications.
Pre-service and in-service teacher training should be provided (NAEYC, 1996).

Even with the advent of technology, it continues to be critical for mathematical development that experiences with concrete objects form an integral part in the education of young children. Perl (1990) advocates the pairing of manipulatives (three-dimensional objects used for mathematical modeling) with complementary software. In this way young children receive the benefit of both mathematical strategies. For example, their exploration should include concrete items as students predict what pattern comes next in the "Wilbur Worm" software application.

Before we use technology with young children, educational software should be examined and evaluated. Specifically, educational software should meet the criteria established by the NAEYC, and be matched to curricular standards. Additionally, Haughland and Shade (1994) developed a checklist for evaluating software that identifies features that teachers should be sure are included in software, from developmental appropriateness to the ability of the software to "make learning fun". Evaluating educational software should be an ongoing task of teachers and parents, and the software should grow with and maintain the child's interest. The key is matching software to the interests and needs of the children who will be using the program (Shade, 1996), as well as finding software that meets the guidelines developed by NAEYC and NCTM.

Finding software that meets the needs of students and that is matched to educational goals can be an exhausting task for the most energetic teacher or involved parent. During long hours shopping for software in technology catalogs, in computer and toyshops, and on the Internet, teachers and parents are likely to encounter technical jargon, pushy salespeople, and more often than not, a very limited idea of how the software actually performs. Teachers and parents need to truly evaluate software in order to illuminate exactly how it will enhance children's learning prior to purchasing. Sometimes, the most telling information is the actual observation of a child engaged in using the program, and what, if any, developmental appropriate practices are encouraged by integrating this software into the curriculum. In an evaluation of software conducted by the magazine Family PC (Bishop 1998), teachers and parents were enlisted to evaluate eight software products on their age appropriateness, ease of use, and use of color and colorful images. Through this process, the observers were able to gain insight into how the children interacted with the software. In this project, software was evaluated not only on these criteria, but also on the connection to providing children opportunities to experiment with mathematical concepts important to their building of logical-mathematical thinking and rational ideas.

Methodology

In order to evaluate the software introduced in this article, two groups of young children ranging in age from one to four years old were observed using different types of mathematics software. The children were enrolled in the campus' Child Development Center, a daycare program for young children of students, faculty, and staff. The children were grouped according to their ages, one group of children ranging in age from one to two and one half and the other group of children ages two and one half to four. According to the

childcare providers in the center, most children had had at least some exposure to computers, either at home or in the center.

During this observation, each child was matched with a computer-buddy, a college student who guided the child as they interacted with the software. A total of 35 students were observed using the various software packages described later in this article. During this project, the authors encouraged the computer-buddy to support and facilitate each child's exploration of the software. While watching the children work with the software, the college students identified elements of mathematical concepts, and each piece of software was evaluated using an evaluation form that incorporated all the elements suggested by NAEYC and NCTM.

Themes Uncovered

During the process of evaluating the software with the children, three main themes emerged.

- Children in these groups had a wide range of abilities with regard to computer aptitude as well as understanding of mathematics. Some children were quite able to hold the mouse with their right or left hand and watch the screen, while others of the same age were not able to perform with this level of eye-hand coordination. For example, one child was using the mouse and came to the end of the mousepad. His buddy mentioned that "Sometimes you have to pick up the mouse and move it around", so the child picked up the mouse and moved it in the air.

- Software designed to teach mathematics, both available free on the Internet as well as commercially available in retail stores, varies widely in terms of technical components (such as graphics and animation) as well as in the software's ability to teach mathematics. Many software applications are available to teach children to count, add, and subtract however, software is limited in the areas of data collection, patterning and communicating about mathematics. In addition true problem solving and reasoning experiences were rarely found in the software that was evaluated in this study.

- When evaluating for young children, the degree of difficulty in operating the software needs to be considered. In this project, each child was paired with a buddy, who helped answer questions like "What do I do next?" When teachers select software for their own classrooms of young children, they need to consider the degree to which the child will need help with the basic operation of the application. As most of these children are non-readers, the teacher should look for software with a minimum of text-based instructions. The degree of eye-hand coordination needed to operate the software needs to be considered, as well as the placement and size of button and "clickable" graphics. The software needs to be carefully examined "through the eyes" of the child who will be using it.

Conclusions

Technology has the potential to enhance the education of young children. Several factors must be considered before using technology with students. Chief among these factors is the appropriateness of the content. Mathematics Software must be chosen carefully so that it reflects developmentally appropriate content that is broad in scope and reflects the spirit of the NCTM Curriculum and Evaluation Standards. As stated by NCTM:

Knowing mathematics means being able to use it in purposeful ways. To learn mathematics, students must be engaged in exploring, conjecturing, and thinking rather than only rote learning of rules and procedures. Mathematics learning is not a spectator sport. When students construct personal knowledge derived from meaningful experiences, they are more likely to retain and use what they have learned. This fact underlies teachers' new role in providing experiences that help students make sense of mathematics, to view it as a tool for reasoning and problem solving. (1989, p.5)

The implications are clear. Teachers, parents, and care givers must choose software that enables children to question and speculate, to discuss and guess, and to supplement other strategies of exploring content with rich ideas. In addition to the content, how the content is presented in the software must be evaluated. The software must be attractive and pleasing to children. Recommendations by the NAEYC should be used to facilitate the evaluation of software used by young children. On occasion technology has been described as the savior of all educational ills. If we wire a school and provide a lab for students, students' achievement will improve. While it is true that technology can help enhance the preschool and kindergarten curriculum, technology can not cure the ills of education. Technology offers a strategy, with the help of an adult's guiding hand, to optimize the instruction that young children receive.

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AS COMMONPLACE as LEARNING CENTERS?

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Abstract: This paper is a report on the findings of an observational study which investigated the social and language skills of preschool children with disabilities while playing at computer centers. Research in the area of computer use by preschoolers primarily has centered upon children who are developing in a typical manner. Although the literature in this area is limited, there are clear indications that young children demonstrate gains in social development, pre-math, and early literacy skills through computer use. Some studies confirm that typically developing preschoolers frequently demonstrate higher levels of cognitive and social skills while playing at a computer than while playing in typical learning centers. Therefore, the young children who might have the most to gain from computer use are children with disabilities. In this observational study, the verbal and play behaviors of 4 preschoolers with disabilities, while playing at a computer center and a typical developmental learning center, were observed and recorded. An analysis of play behaviors and verbal behaviors revealed that these behaviors did not differ between centers. Suggestions for teacher directed instruction for young children with disabilities while playing at computer centers are discussed.

Introduction

The role of computers in the education of preschool-age children is still relatively unfamiliar territory. Inservice training in computer use continues to be a high priority for preschool teachers who, to date, receive little preservice training in computer use unfamiliar with computers and do not believe that computer use in the classroom could have a significant A survey of major academic publishers' early education textbooks will reveal that few authors include discussions relative to the use of computers in preschool classrooms. Inquiries into the nature of preschool computer use show that much of the software developed for young children is not developmentally appropriate. (Haugland, 1997).

Despite these challenges to the use of computers in preschool classrooms, initial studies in computer use by young children yield optimistic data about the effectiveness of computers as learning tools in preschool classrooms. Yost, (1998), in an action-based classroom research project, revealed that preschoolers in her classroom tended to exhibit higher levels of language, pre-reading, and writing skills while working on a computer than they did while working in typical developmentally appropriate learning centers. Earlier studies have confirmed that computer environments with concrete manipulable events teach pre-mathematics skills as well as interactions with traditional concrete objects. (Clements, Natasi, and Swaminathan, 1993). Furthermore, research continues to provide overwhelming evidence that pre-school children prefer to socialize around a computer than play with it alone. (Clements and Nastasi, 1992). Even children who tend to be social isolates tend to socialize more when playing with a computer. (Clements, 1994). Preliminary evidence, therefore, points to several possible benefits of using computers in preschool classrooms.

Unfortunately, research which demonstrates possible benefits of computer use has not been replicated in preschool classrooms which include young children with disabilities. McGehee (1999) pointed out that, relative to the education of young children with disabilities, the topic of computer use

tends to take a back seat to such pressing issues as family-centered service delivery, provision of services in least restrictive settings, and developmentally appropriate instruction. Furthermore, most activity and inquiry into the domain of computer use for young children with disabilities has centered around the need for assistive technologies which facilitate computer access for children with motor and sensory impairments. The 1995 "Amendments to IDEA" (Individuals with Disabilities Education Act) mandated that assistive technologies be made available to all school age children (3-21 years of age) who required them for learning to occur. Thus, the emphasis on assistive technologies had a legal push as well as an educational one. There has been almost no research, however, related to children who have mild or moderate learning problems and their interactions with and around computers.

Although there are many questions which need to be answered regarding computer use by young children with disabilities, none can be more pressing than the inquiry into the potential use of computers in helping to develop language and social skills. Seventy five percent of young children with disabilities who receive educational services in preschool classrooms have been labeled as having a "communication disorder." (U.S. Department of Education, 1996). Communication disorders include such problems as speech and language delays. Another area of significant delay for many young children with disabilities is the domain of social skills and play. These children often experience significant problems in establishing positive peer interactions and relationships. (Odom, McConnell, & Chandler, 1993/1994). Since language development is closely associated with social development in young children, and research has shown that young children will tend to socialize more around a computer, we must begin to focus upon the language and social behaviors of young children with disabilities while engaged with a computer. Furthermore, if pre-reading and writing behaviors of young children without disabilities are enhanced by computer use, then we must determine if we can replicate those effects with young children with disabilities.

The Study

The objectives of this study were, relative to preschool age children with disabilities; 1.Describe, quantify and document social and play behaviors while at a computer, 2. Describe, quantify and document verbal behaviors while at a computer, 3. Describe the differences in social and language behaviors of children while in typical developmental learning centers (e.g.: "blocks" center) vs. the computer center, and 4. Ascertain directions for future research.

We must have an idea of what young children with disabilities are doing at computer centers before we can manipulate variables which might have an influence on language and social development. Therefore, this research focused upon observational data. The researchers began their observations with the question "Will we see differences in children's language and play behaviors while playing at computer centers vs. other centers in the classroom?"

The location of the study was an early intervention preschool class for three and four year olds with disabilities. All observations occurred at times and days convenient for the teacher. The researchers observed and recorded behaviors of four preschoolers with disabilities while in typical learning centers and at the computer center. All of the preschoolers in this study displayed delayed language skills. The behaviors under observation included 1. Verbalizations, and 2. Solitary, parallel and/or cooperative play behaviors. Anecdotal evidence relative to such behaviors as attempts at "reading," "writing," and time-on-task also were noted. Using an interval recording form, observers recorded all verbal utterances and coded the occurrence of play behaviors. Play behaviors were coded "S" solitary, "P" parallel and "C" cooperative. "Solitary" play was defined as any play, which was clearly unrelated to what other children were doing. "Parallel" play was defined as two children playing the same thing (or using the same software while at the computer center together) without interacting, and "Cooperative" play was defined as two children playing and interacting together. All observations were conducted while two children were in the same learning center and the observation ceased if a child left the learning center. The observers focused upon one child at a time even though verbalizations of both children were recorded. Approximately 45 minutes of data for each of the four children was obtained and analyzed.

Findings

Since research has shown that typically developing preschoolers tend to demonstrate more sophisticated behaviors while interacting around a computer center, we had hoped to find that these four preschoolers would demonstrate more complex verbal and social behaviors while at computer learning centers. Analysis of the data from this observational study, however, surprised the researchers. Not only were behaviors unchanged from center to center, there was a slight tendency on the part of two children for less sophisticated verbal and play behaviors while engaged at the computer.

Of the four children who were observed, (J, W, M, and E), two, J and W, demonstrated less sophisticated verbal behaviors while at the computer center than at other centers. J, for instance, demonstrated a "Mean Length of Utterance" (MLU) of 1.5 while at the computer center and an MLU of 2.5 while in other developmental centers. His most sophisticated utterances at the computer center were "My turn" and "Turn page." While in the "housekeeping" center, J's utterances sometimes included three words and included "You hurt me" (to M while she was combing his hair), and "Help me, please." W also demonstrated less sophisticated verbal behaviors while at the computer. His MLU was 2.0 while at the computer center and 3.0 at the art center. His verbalizations while at the computer center primarily consisted of "My turn," and "Faster." On the other hand, when W was playing at the art center, his verbalizations were more sophisticated with regard to both semantic and pragmatic functions, in addition to length of utterance. He volunteered beads with "Here, M... bead," and information, "I do blue, red and yellow." The two other children in the study did not demonstrate differences in verbal sophistication from center to center.

Of the four children in the study, three demonstrated higher levels of parallel and cooperative play while at typical developmental learning centers than at the computer center. While at the computer center, J, for instance, engaged in solitary play 66% of the time, in parallel play 34% of the time, and did not engage in cooperative play. When he was in the housekeeping center, J engaged in solitary play 5 % of the time, in parallel play 50 % of the time, and in cooperative play 45% of the time. W engaged in parallel play for 70% of the time and in cooperative play for 30% of the time while at the computer center. Those figures were exactly reversed in other centers. M engaged in parallel play 10% of the time and in solitary play 90% of the time while at the computer center (most likely because J wouldn't give her the mouse) and in cooperative play 75% of the time while she was in the housekeeping center. E demonstrated higher levels of parallel and cooperative play than the other children at all learning centers.

Discussion

Definitive statements regarding verbal and social behaviors of young children while at computer centers, vs. the same behaviors while in other centers, cannot be made when four children in the same classroom have been the only participants in the observations. Many such observations would have to occur in order to draw any conclusions regarding children's behaviors at computer centers. In addition, there are many factors, for which controls must occur, which might have influenced the outcomes of these observations. Such factors might include familiarity with the items at the computer center (software and/or peripherals) vs. familiarity with the items in other centers (housekeeping utensils, toy refrigerators, etc.), relationships among specific children, or the inclusion of typically developing peers into the scenario. The results of these preliminary observations with regard to computer use by young children with disabilities, however, point to several possibilities. The first possibility is that computers could prove to be a very valuable tool in the acquisition of verbal and social skills in young children with disabilities. The second is that specific language and social skills will not automatically generalize across situations unless certain conditions are present, and the third is that early intervention preschool teachers will need to acquire many more skills themselves in using computer centers as instructional arenas.

Although the children in these observations did not demonstrate the more sophisticated behaviors while at computer centers that the researchers were expecting to observe, it was clear that all of the children were highly motivated to play with the computers. Perhaps the lowered level of utterances and play behaviors at the computer, with most of the children demanding turns and fighting over the mouse, had to do with increased excitement and novelty. These preschool children clearly were excited to be able to use a computer and were motivated to attend, for the most part, to the images on the screen. In fact, there was

some indication that "time on task" might have been improved at the computer center for one child. (This would concur with data that suggests that children with autism might have improved attention while at computer centers.) There was nothing to suggest, in these observations, that computer use might be inappropriate for preschool children with disabilities. In fact, it seemed clear that, given appropriate teacher guidance, the computer could be a valuable tool for the instruction of verbal and social behaviors.

It was clear from these observations that the highest levels of social and verbal behaviors possible for children will not necessarily generalize from one setting to another. Special educators have, for many years, insisted that instruction in any skill for children with disabilities must include techniques which facilitate generalization. A discussion of instructional techniques which facilitate generalization in early intervention settings may be found in McCormick and Noonan's Early Intervention in Natural Environments (1993). Early intervention teachers must begin to focus upon instructional strategies which facilitate the generalization of important verbal and social skills for young children.

The third possibility suggested by these observations is that preschool teachers will need to receive more than a new computer with early education software packages if they are to use computers as teaching tools. They will need direct instruction in the use of computers for facilitating the acquisition, maintenance, and generalization of verbal and social skills in young children. As previously mentioned in this paper, there has been very little research which could provide data based strategies for teachers in this area. It is clear that young children with disabilities will need direct instruction in the use of computers and in the necessary social skills to interact with other children while at a computer. Furthermore, teachers will need a clear picture of the cognitive prerequisites required in order to benefit from computer use for children with disabilities. For instance, one little boy in these observations had not made the connection that he could "click" on a picture to make something happen (cause and effect). His strategy for using a mouse was to move it all around the table. It was clear that he did not have an understanding of the causal relationship between the mouse and progress within the software program. Researchers have suggested that one of the prerequisite skills for children's use of computers should be knowledge of cause and effect relationships. (McGehee, 1998).

The approach of the teacher in this study was to command "Share" when the children would fight over the mouse. Generally speaking, this was an ineffectual strategy because the children's interpretation of her command would be to relinquish control of the mouse for about 10 seconds and then grab it back! Teachers need to be clear that children who are not in a cooperative stage of play will not automatically acquire the skills necessary to interact with other children at the computer center. As with all developmentally delayed skill areas in young children, specific skills related to using computers with other children must be targeted and taught via direct instruction.

As we understand more and more about the importance of early intervention in the lives of young children with disabilities, we must begin to develop a clear picture of instructional techniques which enhance early learning and remediate early deficits. If there is, indeed, a possibility that playing with a computer could enhance the language and social skills of children with disabilities, then the implications for preschool teachers and for early intervention research are obvious. Researchers should begin to investigate the pedagogical challenges presented by the special learning needs of young children with disabilities who could potentially benefit from computer use. Early education teacher training programs must begin to include computer competencies for preschool teacher education majors, and school systems should begin to equip all early intervention classrooms with computers and appropriate software. The most important component in this equation, however, is the necessity for teacher training in the unique requirements of young children with special needs for effective learning at computer centers. If and when these issues are addressed, computer centers in early education classrooms should become as commonplace as block centers.

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Creative Computer Contexts: Teachers Building Computer Based Resources for Young Children.

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Abstract: The purpose of this paper is to explore ways in which teachers can use technology to create learning environments for their students. Such contexts are characterised by knowledge building and information exploration, which enable learners to use processes and develop skills fundamental to discovery based learning principles. We have developed a number of courses at the University level which, while the students enrolled in them attend classes on campus, contain resources that the students may need on line and also provide a context in which students can share their work, based in technological environments, with others – both at the production stage for constructive feedback and when completed in order to share their ideas with other professionals

Introduction

A number of government initiatives have been implemented in order to get computers in schools and to coax teachers into using them. It would seem that education for the information age is recognized as important to governments across the world. The United Kingdom has established a National Grid for Learning (NGfL) which will connect education facilities to homes and services such as libraries and museums and all Local Education Authorities are required to develop plans for Information and Communications Technology (ICT) in order to receive funding. The stated priorities of the NGfL are connecting schools with minimum access charges, the development of curricula which will be available on the Grid and supporting the development of ICT in all schools. In Queensland, the Primary computer program ($20 million, 1993 to 1996) provided funds so that year 6 and 7 classes throughout the state could have one computer for 10 students and more recently this has extended "down" to the lower grades so that they may enjoy the same children to computer ratios. In the plan, money was to be set aside for both software purchase and professional development, but in reality many schools spent their allocation on hardware and had to rely on other funds to support the purchases of essential software and professional development opportunities were rare for staff. Since this time numerous other official documents such as the Schooling 2001 Project have reaffirmed government commitment to the use of technology in schools. Yet one only has to walk into a classroom today to see that while technological advances in society have been stunning over the past two decades, the developments in school have been somewhat lagging.

Papert (1996) was scathing in his condemnation of policy and practice in terms of computers in schools:

> The cyberostriches who make school policy are determined to use computers but can only imagine using them in the framework of the school system, as they know it: children following a predetermined curriculum mapped out year by year and lesson by lesson. This is quite perverse: new technology being used to strengthen a poor method of education that was invented only because there were no computers when school was designed. (p.25)

In a similar vein Hawkins (1993) suggested that the discussions about the promise of technologies to improve the quality of teaching and learning in schools has been too narrowly focussed on isolated learning with machines. Hawkins recommended that a new approach characterised by a deliberate emphasis on designing and using technology to improve

the organization of schooling and learning opportunities in them, was needed. It was evident that early courses related to the use of technology in classrooms tended to focus on the machines rather than how to use them to support teaching and learning. This was often achieved under the banner of 'computer literacy' when, what teachers really needed was support and ideas of the best ways to incorporate technology into their curriculum and activities that might promote new ways of thinking as well as to enhance existing tasks via technological applications.

Contemporary research (e.g. Resnick, 1987; Scardamalia & Berieter, 1992) has revealed that effective education is characterised by providing contexts in which children can engage with materials and ideas in collaborative and individual learning activities in which they are afforded the opportunity to use artefacts of the culture in an atmosphere of challenge, inquiry, decision making and experimentation. In essence two basic conditions have been extrapolated from the large body of work. These include knowledge about when students learn most effectively, that is:

- when they are motivated and can actively explore materials and ideas, in open ended tasks using a variety of problem solving techniques, and
- when they feel confident that their contribution is valued and they are personally known by their teacher(s) who is sensitive to their individual needs and interests.

Preparing Teachers for the 21st. Century

It has been noted that teachers lack confidence in using technology and identify experience with computers as a high priority in their professional development (Hargraves, Comer and Galton, 1996). Many teachers can use a small range of applications (Murray & Collison, 1995) but are reluctant to go beyond that phase of development. In the United Kingdom the inspectorate have confirmed that teachers lack confidence and knowledge about the variety of applications that are available (Goldstein, 1997). They did however recognize that there were many incidences of valuable and innovative work being carried out by some teachers. These were often related to effective use of graphics packages, yet they were viewed as occurring in isolation. At the present time there are many demands on a teacher's time and the use of the various manifestations of technology rates poorly alongside basic proficiency in literacy and numeracy and the development of skill and knowledge in the core areas of the curriculum. A basic problem remains that technology, and computers in particular, are regarded more as just another thing to cover, than as a device that can enhance exploration and learning. A change of mindset is needed to address this problem.

Teachers have identified both benefits and disadvantages regarding the use of computers in schools (Bliss. Chandra and Cox, 1986). In considering the advantages, those that were mentioned most frequently included the computer being:

- A motivational tool that could promote individual learning
- A statistical tool which afforded opportunities to represent data in new ways
- Able to reform learning as a visual medium

Disadvantages included:

- The limited range of quality applications available which could be incorporated into programs
- Problems associated with access and infrequency of use
- The monopoly of the machines by particular groups of students, such as boys, the most able, and those who also had computers at home.

At the Queensland University of Technology, the undergraduate program that prepares elementary and early childhood teachers is the four-year Bachelor of Education Program. Students attend classes on campus on a full time basis and enroll in a large number of core courses. To some extent electives and choice of majors are limited and defined by demand.

In all of the core units that may be offered to these students, such as MDB385: Information Technology in Educational Contexts, MDB383: Using Information Technologies in the Curriculum and EAB 347: Early mathematical explorations and a number of curriculum and discipline electives, the use of technology is integrated into the content. These courses have on line resource pages that contain lecture content and notes, information about assessment, additional information related to readings and activities associated with them. The web sites also have e-mail discussion lists and are able to be linked to resources that assist in the preparation of assignments.

Examples from Practice

Elementary school teachers are known for their creative production of resources that engage young children's imagination and provide a context for exploration of ideas in new and dynamic ways. While the most common use of computers with young children involves commercially produced software, basically in a limited way to reinforce traditional curricula, the potential of computers to provide exciting and relevant learning environments, that are local in nature, and easily developed by teachers, is largely ignored.

In the Elective unit EAB 422: Technology and the Young Child, which we team teach, we promote the practice of teachers building resources for learning, using technology, that are relevant to their own context but can be used on a wider scale. Subsequently, a major assessment item is the development of a multi media resource for learning that will be used by children in the elementary years of schooling

Our purpose was to use utility software, such as HTML, Powerpoint and the Multimedia application, Microworlds. The resources that were developed were cognizant of key learning areas and were designed to help children work collaboratively on meaningful tasks that were based in a problem solving approach. In doing this, we considered the following issues:

- Educational software is often incompatible with a problem solving approach characterised by active learning and inquiry
- Further commercial software developed primarily in America, is often not appropriate for Australian children. For example those that use US currency, present seasons, flora and fauna that are typical to the Northern Hemisphere and have narrators with an American accent, do not afford the opportunity for Australian children to contextualise their learning.
- Teachers need to be able to adapt their applications as they observe children interacting and engaging with the materials. Such customized learning environments mean that teachers can target needs and interests of individual students.
- The need for children to be viewed as active participants in their own learning processes.
- The use of peripherals such as digital cameras and/or scanners.

The most recent implementation of this unit produced some excellent resources. The students, who were from the third and fourth year of the early childhood teacher education program, used this opportunity to develop effective curriculum teaching and learning stimuli using computer based experiences.

The following extract from the course outline indicates what the students were required to achieve.

Create a multimedia teaching resource suitable for use with children in the age range three to 8 years. This should be submitted on a 3.5 floppy disk. Provide one page of implementation notes that indicates to a teacher audience:

- the title of your application
- the age/year level for which it is intended
- the objectives of the application
- how the application will be introduced and developed with young children

It is anticipated that your resource will act as one or more of the following:

a stimulus for learning and the development of language
a problem-solving agent
a vehicle for introducing writing
a mathematical environment
a means of creating pictures and other graphics.

This task addresses objectives 3, 5, 6 of the course.

The format of the task was deliberately left open for individual interpretation by the students so that they could respond in a variety of different ways. Some chose to focus on a theme and then integrate a number of curriculum activities into the resource. Others focused on a stimulus item, such as a book, and then provided information and extension tasks that would engage the learner in specific knowledge and skill building activities. Another approach was to consider a generic activity, such as journal writing, and then create a context for the children to participate in activities in the genre related to a stimulus or theme.

Creating web based applications

Felix Around the World

"Letters from Felix" is a children's book by Annette Langen that tells of the adventures of a lost rabbit who sends home letters to his owner from locations around the world. Two students, Amanda and Melina, built their resource, a web page, around the theme of the book using Netscape composer. They not only developed their own activity pages but also set up links to museums in the locations that were identified and mentioned in the letters that formed part of the story. Their focus was both to encourage children to develop the genre of letter writing, participate in activities related to their program in mathematics and social studies, and also to engage in collaborative problem solving using technology. Additionally, they could also use research centers, that is museums around the world, in virtual contexts to compliment local visits and investigations. (http://www.fed.qut.edu.au/students/n2188031/webpage/felix_p1.html)

Powerpoint

Pirate Stew

Colleen and Gaynor used Powerpoint (Figure 1) to record a visit by Colleen's (practicum) pre-school to a drama production of *Pirate Stew*. The resource provided a context in which the children could record and recall their visit to the production. While on the excursion the students took photographs and later scanned them and created graphics files. These were then integrated into the Powerpoint presentation in order to re-tell the story. The text used in the slides was the "Queensland Cursive Font", an electronic version of the hand-writing taught in schools in the State. Additionally, Colleen retold the sequence of events and used the recording as an audio file attached to each slide and she even sang the accompanying songs. The Powerpoint presentation was then loaded on to the pre-school computer, so that the children could revisit the event during class times.

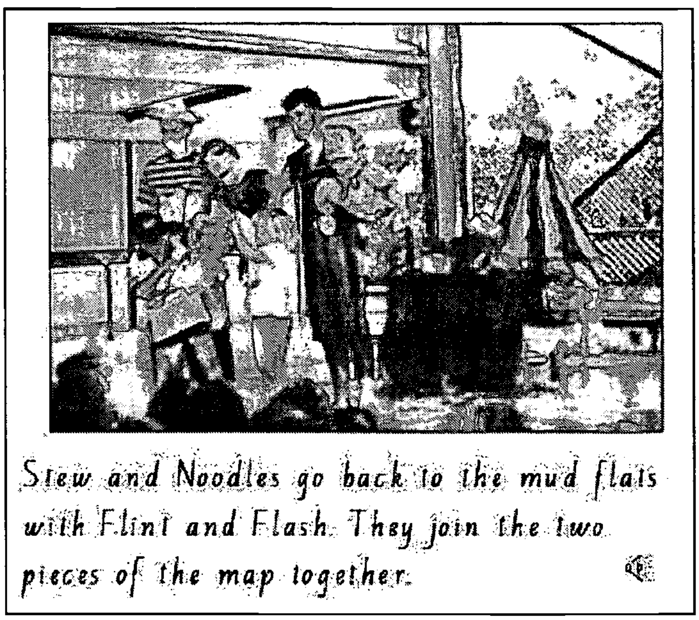

Figure 1: A slide from the "Pirate Stew" Powerpoint presentation

Microworlds

Happy Birthday, Jane

This resource was an interactive multi-media presentation developed in the "Microworlds" application. Catriona took the popular theme of birthdays and developed a number of mathematical activities which included sorting, counting and patterning as well as those associated with number and spatial concepts. Microworlds has a Logo programming interface, a drawing center, writing capability and the option to incorporate both graphics and sound into the resource. Catriona utilized these functions effectively to produce an appropriate resource. The scope of this project is revealed in the curriculum web reproduced in Figure 2.

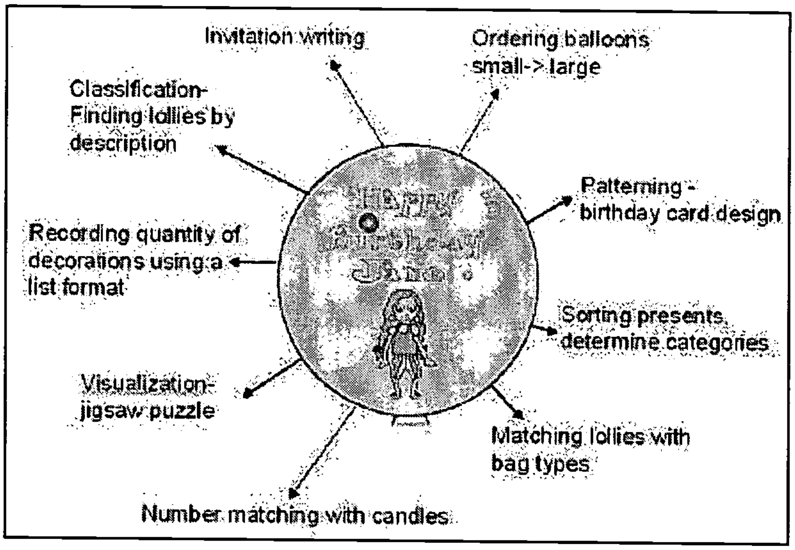

Figure 2: Birthday activities in the "Happy Birthday Jane" resource

Silkworms

Sarah and Tammie used Microworlds in the context of a Science theme to present the life cycle of the silkworm. In accordance with the aims of the University assignment, they made their resource interactive so children could use the environment to record and present information about their own silkworm projects. The multimedia functions of Microworlds were particularly useful in this instance. Buttons were use to navigate through the pages of the resource and by attaching custom designed shapes to the "turtles" on the page, the students could provide objects on the page that the children could move around according to the requirements of the various tasks. For example they could be sequenced to create the life cycle or form the basis of a classification task.

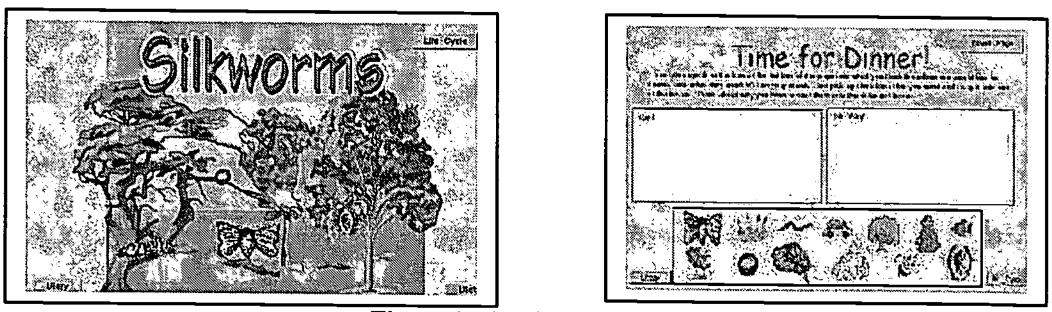

Figure 4 The Silkworms Microworld

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Conclusions

Teachers have to be particularly discriminating in their choice, and use of, computer applications and ensure that the primary goal of using the resource is engagement and learning, via active exploration and the deployment of problem-solving processes. Selecting software to incorporate and use in educational contexts is not an easy task. There are a bewildering array of titles that make wild promises about being able to engage children to learn a multitude of concepts and skills. We have attempted to show how this can be achieved with reference to a few specific examples, that have incorporated the use of utility software. We have highlighted applications that are conducive to meaningful engagement with ideas, via the use of technology, and suggested some ways in which educational contexts can be organized in order to achieve mastery over the machine, while motivated by the task and the magic of the moment. In the immediate future the challenge will be to provide opportunities for children to extend exploration in technological environments in more dynamic ways.

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Joint Ventures: Co-Authored Multimedia Books

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Abstract: This paper presents information on how to carry out an assignment that provides pre-service teacher with the opportunity to increase their understanding of how technology can be appropriately integrated into an early childhood curriculum. The multimedia projects utilize PowerPoint, a program the pre-service teachers learn as a part of their studies. The students work collaboratively with other pre-service teachers in the university laboratory school creating multimedia storybooks with kindergarten children. The result is not only better understanding of how to use technology with young children, but an increase in their technology skills and classroom management skills as they work with a small group of children. This opportunity becomes an valuable unscheduled practicum experience.

Introduction

The last several years I have had the unique experience of working with three distinct populations at my university: faculty, undergraduate education majors, and kindergarten children. My primary teaching responsibility is to a classroom of kindergarten children at a university laboratory school. However, for several years a quarter of my workload has been to assist the education faculty with integrating instructional technology into their courses. During one of these collaborations, I suggested that two of the instructors offer a "choice" assignment to the pre-service teachers, one of producing a multimedia storybook with my kindergartners. Drawing upon the work by Nancy Scali (1993) I thought we could create storybooks with PowerPoint similar to those Scali created using Hyper Studio. This has turned out to be a fantastic experience for all involved. This paper will look at the following aspects of how I assist with the coordinate and carry out the projects with the pre-service teachers.

Getting Started

The students begin their project initially when they sign up for the option of creating multimedia storybooks with the instructor making the optional assignments. They might are students in either a children's literature or an educational technology course. The instructors for both of these courses allow lots of latitude in the expectations for the final projects, basically assigning only a due date. Likewise, I have attached no requirements to the assignments. As instructors the three of us have agreed that the intent of the assignment is for the students to learn how technology can be integrated into an early childhood program and that the students will gain additional technology skills.

The next step for the project is to make an appointment with me to visit about the project. I show the students books that have been created in my room, as well in other classrooms. I point out the amount of time people have put in on the different versions of the books. A single student created a book with perhaps 5 hours of work, while others might have 40 hours of work by each of two team members. This project can be a major time commitment for the students and I want them to be aware of this up front. The students can come with little experience beyond turning on the computer up to experienced computer users; this affects the amount of time involved in the project. I explain that I will assist them as they learn to use technology and programs, so they don't have to be familiar with the equipment or programs to do the project. In addition to

the time involved increasing their technology skills, the type of book they decide to create and the intricacies involved with it affect the amount of time required.

We then discuss the different ways that books might be extended. We look at re-writing a story, creating a new meaning. Examples of how to build upon predictable stories are examined. I point out how this type of story supports the emergent reader and writer. We look at poems that lend themselves to illustrations. Songs the children know become another option for creating books. Writing original stories are explored also. As we talk, the students begin to see that there are many options, and usually begin throwing out their own ideas. As I present these options, I usually illustrate the type of book being discussed with examples of other multimedia books or books created with traditional materials.

The second part of this initial meeting looks at the type of technology available the students when they create their books. In my room, the students have access to:

- multimedia computers
- a scanner
- a Sony digital camera
- a Kodak video-conferencing camera
- microphones
- KidPix and other drawing programs
- drawing tablets

We now look at the technology skills the student has, and what skills they wish to gain. They are free to use any of the equipment. However, we do examine the project they have decided to do and what might be appropriate options for their particular project. Some book styles lend themselves toward certain combinations of technology use. The students are encouraged to work in pairs. By doing this the student are able to help each other, as well as coming to my student teacher or myself.

The final decision at this meeting is when these pre-service teachers will come into the kindergarten to work with the children. There are certain times in the kindergarten schedule that lend themselves to having small group projects occurring. If these times do not work into the college student's schedule, we look for other options when I can make a group of kindergartners available to work on the book. The students working in pairs may, or may not be actually working with children at the same time. They do come together at other times to pull the pieces together into the final form.

The Project

The students come to the classroom and present their concept to the children. Because of the child-choice nature of my program, the children are invited to participate if they choose. The college students usually end up with a group of four or five students. This makes a nice size group for them to interact with and generally makes a very manageable book. This initial meeting involves reading the book with their group of children and discussing what the activities around the book will be. The children may have input into the type of activities that will happen too. I have prepared the college student for this, and encourage them to attempt to the kindergartners' suggestions. The feeling of ownership is important for the children, just as it is important for the college student.

On a series of visits, the pre-service teachers work with the children creating the illustrations for their individual pages in the book. These illustrations might be created with a drawing program, like KidPix, or they might be done with traditional drawing materials on paper, or a third option is a digital photograph taken by the child for their illustration. When the pictures are completed, I suggest the student visit the room in the afternoon so I can explain how to use the scanner, or how to crop the pictures if necessary. I make sure the student is familiar with using PowerPoint features to create a show, to insert new slides, to save a file, and to insert pictures from files. Since I function in a networked environment, I also explain the network server space. The students save their files to the server so that they can be accessed from any of the three computers in the room or my laptop computer.

The next step for the book is usually to insert text. My kindergarten program is based upon the emergent literacy philosophy. I want that philosophy reflected in the work the children produce with the students. To do this I briefly share Clay's (1975) concepts and principles of print with the students. I have a

one-page information sheet that explains the stages of writing development that I share with the pre-service teachers. The students work individually with the kindergartners, supporting their writing at a level that is appropriate and comfortable for the individual child. The kindergartners are encouraged to do their own typing in the text box. However, if the child is not comfortable with writing the student may support in ways suggested by Don Holdaway in Foundations of Literacy (1979). Children might copy from a written text supplied by the college student; or the child might ask the college student what the letters are that go with sounds they don't know; or the child might take turns typing with the college student; finally the child might ask the college student to type for them as they dictate the text. This might be the final step for some of the projects.

Other books might include an audio file of the children reading their individual pages. A brief demonstration is usually necessary on how to use the sound recorder feature of the computers in my room. It then becomes the responsibility of the college student to record the necessary files for their book. Some of the books even include group reading of the title and/or introductory pages. The video camera is frequently used to provide a video clip of the children reading their pages. The pre-service teachers may insert the audio, or video clips, immediately allowing the children to see their page finished. The delight of the children as they hear or see themselves reading their page becomes rewarding for the students.

Final work on the book is often done when the children are not in the room. This allows the student, and me, the time to focus, uninterrupted, on the details of finishing the book. The final details might include a cover page, a project description page, or adding any transitions, timings, or animations.

The pre-service teachers make one last visit to the classroom; this is a celebration of the finished project. There is a group viewing of the finished work, often resulting in a shortcut being added to the desktop so that the children can view the book on their own. Final projects are presented to the college classes where the assignments originate, also.

Conclusions

The multimedia storybooks become meaningful and authentic technology projects for all involved, just as the National Association for the Education of Young Children suggests in their position statement on integrating technology into early childhood programs (NAEYC, 1996). The university faculty members then have a technology integration model to share with their classes with copies staying on the college server in shared folders for future use. The undergraduate students have new technology skills, a portfolio item, and an additional teaching experience with children. The kindergarten children gain new technology skills and lots of one-on-one time with an adult in a literacy project. I get extra hands in the classroom and the joy of mentoring students through an integrated technology experience. It appears to be a win–win situation for all involved.

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Evaluating Educational Technology: An invited SITE Panel

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Abstract
The recent upsurge in the application of educational technology in education, especially teacher education, makes the evaluation of the applications of new technology even more important than before. Billions are being spent on resources for major innovations and even more value is being invested in time and other commitments. A higher quality of teacher education with and for new technologies is sought around the globe, but how do we evaluate it? This panel will discuss a number of issues, approaches and methods. Two members will draw upon experiences in the USA and two on European perspectives. The participants will be encouraged to add perspectives from schoolteachers and policy makers from around the globe.

Questions for the panel

Who should be involved in evaluation of technology in teacher education?
What are the purposes of evaluation?
To whom should evaluations be disseminated and how?
What are appropriate approaches and methods?
Who can and will fund evaluation and its dissemination?

The need for evaluation in teacher education

Recently the U.S. Secretary of Education held a conference on Evaluating the Effectiveness of Technology in Education. The conference was held to explore ways in which educators can better answer calls for accountability by policymakers and to better understand ways of providing feedback to practitioners attempting to integrate technology into teaching and learning. The U.S. Department of Education, Division of Post-secondary Education is currently sponsoring the Preparing Tomorrow's Teachers to Use Technology program through which they are funding attempts to foster innovation in technology and teacher education. This program will be evaluated for overall effectiveness and grantees are being asked to rigorously evaluate their programs for effectiveness.

In Europe there is also and increasing emphasis on evaluation, both to inform future policies and also to justify the apparently large sums of money being spent on information and communications technologies. The European Commission, national and local government are commissioning much more evaluation and looking for reports from many sources. Organizations including commercial concerns and schools are also keen to have the results and some are also prepared to commination evaluation studies, and possibly to influence their design and the messages that they disseminate. Those who pay for research, including evaluation, have a major influence in what, how and when the research takes place and the ways in which it is disseminated. The Keynote talk by Peter Scrimshaw to the UK Association for IT in Teacher Education Research conference in 1999 brought into focus the UK government's literacy and numeracy strategies against colleagues' research in progress. Peter helped us to see the links between funding for research and Government imperatives and the ways in which the two were managed. He noted that agencies that were given the role of implementing government strategies and could also be called into account for not fulfilling the political imperatives. As a result these agencies may tend to be more extreme in their demands to control research and development. And they may also continue to change the aims and objectives of evaluation as their masters (the government) changes its stance in response to popular opinion. There were several murmurs of agreement from those present, many of whom had been involved in national and international projects managed in this way. Peter urged colleagues to take the long view, while responding to opportunities arising from political initiatives, which have within them immediate and interim imperatives.

The Asia Pacific Chapter of AACE at its recent conference in Japan, ICCE'99, showed less concern for evaluation. However, this is probably due at least in part to the relatively recent introduction of technology into schools and teacher education in Asia. However there were some significant studies evaluating teachers needs. For example, in Japan where IT has been introduced only recently Toshiki Matsuda and Natsuko Ishii trialled a teacher training program for teachers new to IT in Japan and found that teachers were unable to apply the criterion in selecting what to teach with technology (Ishii & Matsuda, 1999). And in Hong Kong, where IT is more common although not widespread as yet, Nancy Law and her team's evaluation of the development and delivery of an intensive 120

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hour course has led them towards a model of IT training for inservice teachers (Law, Wan, Lau, Lee & Yen, 1999).

Many countries and organizations are looking for is a transition from “isolated skills practice” toward integrating technologies as tools throughout the disciplines. Jan Hawkins argued that in order to realize high standards, education needs to move beyond traditional strategies of whole group instruction and passive absorption of facts by students. New more effective methods are based on engaging student in complex and meaningful problem-solving tasks. Technologies need to be used to bring vast information resources into the classrooms. We need a transition from inadequate support and training of teachers to support for all teachers to learn how to use technologies effectively in everyday teaching (Hawkins, 1996).

Another key evaluation issue follows from the above and centers on the definition of effective technology training in preservice education. For instance, a college of education may be operating under the assumption that the best way to prepare future teachers to use technology is to expose them to and train them in basic computer hardware and software skills. While another teacher education program might believe that a course in the basics does not address the content specific nature of technology applications in teaching in different content areas. Teachers mastering software such as Excel or ClarisWorks does not mean they have mastered the ability to integrated these tools into their instructions. So, evaluators will have to ask: "What is the basic philosophy and underlying theory of technology integration held by program participants?"

This leads to requirements for additional evaluation criteria: What are best practices of technology integration by preservice faculty and, in any program evaluated, to what extent are faculty modeling effective practices of technology integration in their teaching? What are the conditions of these best practices? And finally, what should a preservice teacher be able to do with technology in teaching at the end of her preparation program and in the first years of induction? What would an effective preservice social studies student be able to do with technology? What would an effective preservice math student be able to do with technology? Do the practices learned in preservice training carry over into the induction years?

Policymakers, evaluators and practitioners may have different answers to fundamental questions about the effectiveness of educational technology. Everyone is asking for results of the investment of technology in education. Perhaps the primary difficulty in coming up with new ways of evaluating or assessing the impact of education technology is that there is little consensus about its purpose (Trotter, 1998). Policy makers often work from a cost-benefit model with increases in norm referenced and criterion referenced test scores viewed as the primary benefits. This appears to be at odds with the view held by teachers or by the public that educational technology benefits include: preparing students for jobs, increasing student interest in learning, increasing student access to information and making learning an active experience. These were all rated above technology’s impact on basic skills by parents in a 1998 public opinion survey sponsored by the Milken Exchange.

It is therefore important to understand who is paying for the evaluation and for what purpose(s) and to remember that the evaluators and the participants may be 'paying indirectly' in addition to the formal funding agencies. This understanding is important for those involved in the evaluation and to those who 'use' its findings. Readers will be familiar with the need for such a critical reading in other fields, such as when purchasing a new brand of soap powder. Perhaps there has been less readiness to understand the need for such a critical view in education, especially when it is applied to new innovations with technology.

Putting a value on the costs and benefits of educational technology

There are few reports of failures in the research literature, but they can be instructive. Attempts to put a value on the costs and benefits of technology for professional development of teachers and more widely in higher education fall into this category. Niki Davis' early attempts to show the value (positive or negative) are one example.

The strategy adopted was that of an accountant's balance sheet. On one side went the costs of the traditional way of doing the educational activity. One the other side was the cost of the new approach using IT. The resulting balance could show a profit or loss for educational technology. Niki's first attempt for email in 1987 was a dismal failure. Even the committed network of educational email users could not come to an agreement of costs in either column! The second attempt to evaluate the use of ISDN for the professional development of teachers was more successful. The narrowing of the focus, which also drew on case studies, permitted the drawing up of list figures from actual practice. The balance sheet showed a slightly positive monetary value to the use of ISDN digital lines through which professional development was delivered by desktop conferencing (Davis, 1993), but the reliability of the figures and their range could not be expressed well. The supporting commercial companies, British Telecom and ICL, were pleased with the approach, which was coherent with their commercial culture. Educational staff, including managers, were also comfortable with the method and findings and, as I had worked in commerce as well as academia, I too was happy with the relatively simple approach at that time. Working with some staff in business studies we also developed a business plan for a Multimedia Brokerage service for education (Davis & Wright, 1995).

Some years later Niki was awarded better resources for the evaluation of Information Technology to assist in the process of teaching and learning in a research project. The English universities' funding council (HEFCE) chose Niki to lead the project to inform their work and Sir Ron Dearing's review of higher education. The ITATL project had a scant six months for its multidisciplinary and multinational team to gather and model the evidence. The project proposal was from both an educational and an economic standpoint and drew to a limited extent on the USA Flashlight project. In the event the economic view was emphasized by HEFCE (Boucher et al, 1997), although we continued to push for a more educational and qualitative balance to ensure an adequate view of the range and

complexity of the use of IT in higher education (Dillon, 1998). The methodology drew upon:

- Literature reviews, educational and economic
- Seminars and focus groups
- Case studies
- Surveys
- Economic modeling in STELLA software

The most important lessons for evaluation of educational technology are that, although we were unable to gather the appropriate data for economic modeling, we were able to explore the changes in who pays for what. The economists wanted to know how much time the various participants spent at various stages and the cost of that opportunity. For example, the university teachers told us that development took a lot of time. What were academics being distracted from? Research perhaps, or was their collaboration enhancing research and other aspects of the work in high education? The question of the amount of time and opportunity could not be answered: staff and students had, without accounting, spent time and other resources. Similarly the educational researchers were unable to put a figure on the improvement(s) in the quality of learning or wider educational benefits, such as transferable skills. Like the earlier attempt at a balance sheet for valuing education technology, the topic was too broad. However we did come up with key recommendations and an early model to develop with higher education staff, which Adrian Boucher continues to work on in the University of Warwick. We concluded that gains in efficiency and/or effectiveness of ITATL could only be identified in a limited number of instances (Boucher et al, 1997):

1. Where a large group of academics agree on course content
2. Where the course content tends to evolve slowly
3. Where IT can produce significant support for the learning process, such as in simulation of an inaccessible process

This is not to say that ITATL is not valuable beyond these pointers, only that it was not shown using the methodology chosen by the economists. To gain the figures for modeling the process requires additional research at the time of ITATL development and deployment. However, it also became clear that the choice to omit IT in teaching and learning was not an option for educational organizations: IT has already become one of the indicators of a high quality institution. The evaluation of educational technology is therefore vital to inform the process, so that cost effective high quality education MAY result. There is a clear need for a range of supporting approaches and methodology that will be accepted by a wide range of disciplines and users, including those in academia and commerce.

You may also note the undercurrents in this description. There were many influences on the processes and outcomes of evaluation:

- the funding agents' influence on the time, approach and dissemination
- the expertise and beliefs of those undertaking the evaluation

- the need for full involvement of the participants, at the very least to assist in capturing the costs of their actions

Formative evaluation with a pedagogical emphasis across Europe

Wim Veen led the evaluation of the European project Telematics for Teacher Training (T3): both formative and summative. Such a project can provide a valuable insight to projects across the world that aim to update and develop technology in teacher training across institutions and across countries in a way which sued the communications technology to facilitate the process of the pedagogy and processes within those institutions.

The T3 evaluation plan was designed for a project that can be compared to a discovery journey towards new worlds in education. We are aware of the rapidly changing technological learning environments, but no one can tell at this stage how this is going to alter educational practice. The T3 project was perceived as similar a journey across new oceans that have never been sailed before, and we were like the sailors who have to adapt their navigational skills to new environments. However, we had substantial experience from journeys in the past: we knew which direction we want to go and we were well prepared for the hazards we had to deal with. There was heavy weather to face, and we did meet some monsters from some faceless bodies. But we were convinced that there must be ways to discover our new educational horizons and we wanted to be among those who model them.

A discovery journey could not be set out in advance in full detail. One of the characteristics of good planning is flexibility. Therefore, our evaluation plan provided us with a clear itinerary, but at the same time we had built-in flexibility, so that changes and amendments could be taken aboard whenever it was appropriate. Although calculations had been made on staffing requirements to match our planned activities, new situations or changing requirements of partners led to matching changes or amendments to the evaluation plan.

The T3 Project

The T3 project (Telematics for Teacher Training) was a three year project which aimed to build an ongoing partnership among a group of university teacher training institutions, each of which was committed to experimenting with the uses of Telematics (communications technologies) as part of their curricular and organizational development strategies. The partner universities were the University of Exeter in the UK (leading partner), Utrecht University in Holland, University of Oulu in Finland; University of Minho, in Portugal; Dublin City University in Ireland; IUFM Grenoble in France; ITD in Genova, Italy, and Ghent University in Belgium. http://telemtatics.ex.ac.uk/T3

The T3 project wanted to raise awareness of the uses of ICT in teacher education and teaching across Europe by providing courses developed at different sites. By means of these courses a common understanding will be fostered of what is valuable and cost-effective enough for teacher education through Telematics. Hence, the core of the project consists of the implementation of innovative teaching practices within the partner universities. These innovative teaching practices included staff development and organizational development of the partners involved. There was an emphasis on action research with the various participating institutions providing case studies from which common themes and issues were defined.

The T3 project took place in an environment in which teacher education itself was subject to significant change. New educational policies were being introduced in many countries, resulting in new roles and partnerships for teacher education institutions and schools. This means that the evaluation of the T3 project itself had to be flexible enough to cope with changing contexts of organizations and curricula.

The T3 approach

The T3 evaluation activities focused on 'case based reasoning' and included data collection through various instruments from the stakeholders involved. A 'multi-perspective illumination' approach (Parlett & Dearden, 1977; Melton & Zimmer, 1987) was adopted focusing on the emerging new teaching practices within the participating teacher education institutions. As the T3 project was an educational innovation project, the process of implementation of the new teaching practices will be described using as a theoretical framework the 'CBAM' Model, the Concerns-Based Adoption Model (Hall, Louckes & Rutherford, 1977).

The foci of the evaluation effort, then, was on:

- formative evaluation of the development and implementation of the new teaching practices using Telematics within the partner universities involved, and
- summative evaluation of outcomes and impact of the project as a whole and of the development of pedagogical approaches for Telematics learning environments.

Identifying the Main Purposes of Evaluation

Prior to the development of the evaluation plan, the T3 evaluation team identified the general principles that guide decisions in spending manpower on specific evaluation activities. In order to involve all T3 partners in this identification of principles and purposes, the evaluation team undertook three initial activities:

- the work package descriptions as presented in the T3 project plan were analyzed.
- preliminary interviews were conducted among the T3 partners. Such interviews are advisable for projects aiming at the implementation of ICT in education.
- a first draft of the Operational Evaluation Plan was presented to all T3 partners and comments received from several of the partners.

Those activities have helped to identify the main objectives of evaluation for the T3 project.

1. To improve performance by helping project partners develop mutual understanding of useful applications of Telematics at specific teacher education institutions and identify generic uses of Telematics in teacher education across Europe.
2. To help project partners to implement the results of their efforts both within their institutions and among the T3 partners. Here, evaluation activities will focus on strategies and experiences of implementation. Dissemination of results outside the project partners will also be a focus of evaluation.
3. To contribute to the overall learning process within the T3 project as a whole that will be useful for future projects and programs.

These general purposes were made operational through various activities such as:

- support processes of information-sharing through videoconferencing, stimulating discussion forums and provision of information on the T3 web site http://telematics.ex.ac.uk/T3
- assisting in progress reviews
- providing support for the overall functioning of the project, in particular the management of the project, through regular virtual meetings with the project coordinator and through data collection using various instruments
- focused studies of the processes of development and implementation within the partner institutions, using a case study approach.
- providing evidence on the development of pedagogical approaches and their usability across Europe.

Stakeholders

A variety of stakeholders had to be considered for the T3 evaluation. These include the people whose involvement and co-operation is necessary for the project to succeed, as well as the people who are expected to use or to act on the evaluation results. Different stakeholders had different questions relevant to the interest they take in the objectives of the T3 project. They also had different views about what was useful and feasible, and how success is to be defined.

The main stakeholders in the T3 project were, in the first place, the teacher trainers involved. It was concluded that evaluation activities should focus on three domains of interest. They are:

- the pedagogy of tele-learning and tele-teaching
- the identification of usability and added value of Telematics in teacher education
- the implementation and dissemination of the uses of Telematics within the teacher education institutions involved.

The second group of stakeholders was the student teachers who will be involved in the tele-teaching activities of the teacher trainers. From case studies performed in different T3

partner institutions, student teachers appear to be critical users, having high expectations of the effects of Telematics on their performance as student teachers. They were mostly interested in immediate results and tend to define the uses of Telematics in terms of supplementary support from teacher educators, ignoring possibilities of self-help and peer-help. It was critical to include this group of stakeholders in the evaluation activities in order to get feedback on questions that are of interest to them and that can improve the range of Telematics used in the teacher training curriculum.

The third group of stakeholders are the T3 sponsoring partners that do not belong to the above mentioned groups. They were the private and public organizations interested in the opportunities of Telematics in learning environments from their specific different point of view. The most important of these was the European Commission, whose call for research had instigated the T3 project and to whom the major reports were submitted for evaluation and acceptance. It was compulsory for the evaluation to include them for identifying their interests and to include their input into an evolving definition and the subsequent evaluation activities.

A Demand Driven Model of Teacher Development

Mark Hawkes feels that there are many reasons to believe that the value of educational technology lies in helping teachers meet the increasingly numerous and complex tasks required of them in the classroom. Were it to purposefully serve teacher needs, technology's infusion into professional development would match teachers' real-life concerns, be available just at the time they need it most, build on the paths that other educators have forged, align with teachers varying skills levels and be ongoing. The use of technology for facilitating teacher learning contrasts with current situations where teachers toil all day with very little intellectual stimulation to learn. Technology opens new avenues for thinking together.

Based on discourse of researchers and other expert groups, coupled with the observation and evaluation results of several professional development products and processes currently being tested, a demand-driven model to teacher development is emerging. This model, though not fully functional in any one site, has features with unique potential to address teacher preparation through and for technology application (Hawkes & Wilber, 1999). The features of this emerging development model relegate technology to a support role, emphasizing the process of improving instructional practice. It is designed to meet teachers' information needs right as they materialize in the classroom. Such a demand-driven system would gather, organize and present a suite of cutting-edge information access and manipulation tools teachers require in their own and their students' learning environment.

A demand-driven/just-in-time approach to professional development engages teachers in reflective understanding of what they do in their classrooms, how they do it, and how they could do it better. It would help teachers narrow in on the topic of their interest and define

their research or curriculum questions. In this way, the demand-driven system would help users personalize their own professional development. It would be guided inquiry, available at the fingertips. The system also would mark trails teachers have previously forged so new inquirers can capitalize on that work or even take it in unprecedented directions.
The model is interactive, allowing users to pose challenges, questions or scenarios into a common database. In this way, the system would draw on the intellectual base of experienced teachers. It would recognize these teachers' skill in identifying key instruction process and content issues, and in presenting them in ways that make sense to their peers. This broad-level connectivity is critical to just-in-time technology capacity building. The design would accomplish two essential outcomes:

- It would model collaboration in a way that illustrates how students might be engaged in the learning process, and
- It connects teachers with peers who have vastly differing levels of expertise and divergent teaching beliefs.

For example, teachers who are at different places on the continuum of adoption/application of technology could collaborate on real curriculum issues they face. This could generate opportunities for practitioners to be mentored (via peer coaching or even student-led guidance) during the school day. Similarly, since teachers' approaches to technology use often stem from pre-existing pedagogical beliefs, just-in-time collaborative technology development can address or complement those beliefs at a level familiar to the teacher. As it is developed, the model could expand to meet the needs of policymakers from the school board level to the state house, as well as legislators, parents and others. Providing support to all stakeholders in school reform would enhance mutual understanding of the issues pertinent to each group, thereby facilitating progress.

Broadly stated, the objective of a demand-driven model to teacher professional development is based on intentionality (Jonassen, 2000). This model's ***intention*** lies in knowledge-building. Being so, the emphasis is in linking technology-based solutions to content learning. Because the majority of current discussion around developing teachers' professional capacity centers on the technology—we perpetuate the assumption that technology is something separate from the learning experience. When learning is the object of discussion, however, technology is embedded in the development of knowledge. The demand-driven model of teacher development considers technology to be the means of mediating a form of activity that teachers have not engaged in before. Instead of talking about where and how technology fits into teacher professional development, the dialogue is about what it is teachers want to accomplish in terms of student learning outcomes. The design of teacher development suggested here centers on awareness of the power and application of technology in the classroom, not just a "technology" curriculum. The model implies that professional development should take place every day, all the time. It encourages teachers to work together to collaborate on real curriculum issues facing them and their students.

Implications for Evaluation

Though only a glimpse of the not yet completely articulated demand-driven approach to teacher development is provided here, it is enough to consider how we might go about evaluating such an approach to teacher development. These criteria evolve from the model itself with a specific attempt to avoid becoming a list of fixed knowledge competencies. The rapidly evolving nature of educational and telecommunications technology suggests that fixed competencies are relevant only for the acquisition of general foundational skills (keyboarding, point and click, systems operation, navigating). The criteria presented here attempts to keep teacher and learning foremost.

The criteria listed below are framed as evaluation questions. They are overlapping with an attempt to build some internal consistency between the dimensions. These questions, however, can take a variety of forms and should net be limited by what is asked here. Each criterion is accompanied by brief elaboration.

[redacted]	[redacted]
Provide ubiquitous access to telecommunication tools?	Access to the hardware and software that support change is critical. Interaction in the form of coaching, mentoring, and critical friendship encourage teacher professionalization.
Encourage teacher understanding of the research process?	Much of technology focused and infused professional development is solution oriented. The focus on the research process puts knowledge into teachers' hands through the process of inquiry.
Involve teachers in collaborative, knowledge-building communities?	Leveraged in the right way, the powerful connectivity of network resources can bring teachers together to share collective knowledge on educational policy, subject area, and professional community.
Model authentic, inquiry-based, engaged learning?	New technology tools can help us create the kind of situations where teachers are taught exactly the same way we hope they teach their students. That is, to model the process along with the content.

Offer just-in-time support?	Information is often most useful when it is just enough, just in time. Demand-driven development gets teachers quickly to the point where their students are doing interesting work that is clearly facilitated by the technology. And, it builds skills en-route to the instructional outcomes.
Honor the K-12 teachers' knowledge base?	A quality professional development approach finds ways to reflect back the wisdom of the most talented teachers. Structures are needed (mentor/communication) that pass that knowledge to new generations of educators.
Encourage teachers to integrate and share the documentation of their practice?	There is increasing teacher awareness that documenting practice in the place where they work is an important and powerful tool to help teachers understand how to improve their teaching. Development that not only helps teachers document their practice, but finds ways to make it interchangeable helps leverage relevant knowledge—which is a repeated theme throughout this approach. Evaluators can be of special help here by helping build a common pattern language among practitioners and between practitioners and evaluators for identifying learning outcomes.
Respond to issues unique to the context in which the technology is embedded?	Learning itself contains so many interacting variables that without unique learning goals and benchmarks that measure them, the penetrating effects of the technology may not be fully noticeable.
Show how technology is and isn't capable of facilitating learning outcomes?	Technologies adaptations are limited and knowing those limitations are key to helping teachers manipulate the technology to serve their own and their students learning needs.

Address teachers' personal assumptions about teaching, learning, and schooling?	Most development programs link technology integration to external factors such as administrator support or time to practice. An understanding of how teachers' perceptions about schooling are affected by technology integration is a basis for productive development activity.
Clearly show how other teachers address problems, situations, and opportunities on common occasions and in common areas of interest?	This question inquires after the presence of a dynamic intelligent data base that gathers, organizes, and displays teacher experiences in addressing common issues. A registry of collective, evolving wisdom.

These criteria are not unique to many past and present evaluations. And a few of these criteria have found their way into evaluations of technology programs on a somewhat consistent basis. But taken together, as a set of guiding evaluation questions that target learning experiences as opposed to hours of training on certain types of applications, these criteria are rather distinct.

Summary

The frequent change in evaluation questions addressing the outcomes of technology on teacher development are partly due to the rapid cycles of innovation that technology tools have undergone. This iteration of evaluation questions could likely be the next stage of that cycle. Educators, evaluators, and developers of measurement instruments struggle to keep current with the rush of information needs having to do with technology's effectiveness. By casting key evaluation questions from the vantage of learner and teacher development rather than technology capacity, we may be able to avoid that process that often makes our evaluation questions obsolete. However, the complexity of the task should encourages us to focus and to understand the many layers that make up our complex educational environments. Perhaps one of the most important roles of the evaluation of technology in education is to focus all the actors back into re-evaluating what education could do for whom and whom each may assist during the process of lifelong education across communities and countries as well as within them.

Finally, the last year or two has marked a recent shift in schools' focus on technology, in the western world. Where once the emphasis was on building and implementing a technology infrastructure, today it is on evaluating the effectiveness of its use in school and classrooms. Parents and teachers, school boards and administrators, governors and state legislatures, and world governments all want to know if their nation's investment in technology is providing a return in student achievement and teacher development. The pressure is on to show that technology has a positive impact on what students learn and how teachers teach.

Changes in Evaluation Practices

Walter Heineke notes that evaluation means many things to many people. According to Glass and Ellett (1980) "evaluation- more than any science- is what people say it is, and people currently are saying it is many different things" (cited in Shadish, Cook and Leviton, 1991, p. 30). Experts on program evaluation (House, 1993; Schorr, 1997; Shadish, Cook and Leviton, 1991) all indicate that program evaluation have undergone a major transformation in the last three decades, at least in the USA. It has changed from "monolithic to pluralist conceptions, to multiple methods, multiple measures, multiple criteria, multiple perspectives, multiple audiences, and even multiple interests. Methodologically, evaluation moved from primary emphasis on quantitative methods, in which the standardized achievement test employed in a randomized experimental control group design was mostly highly regarded, to a more permissive atmosphere in which qualitative research methods were acceptable (House, 1993, p. 3). The most fundamental shift has been away from a blind faith in the science of evaluation and experimental research methods based on standardized test scores. These changes in the practice of evaluation have significant implications for questions about the future of the evaluation of technology in teacher education.

It is clear that teaching and learning processes are complex systems. The challenge is to develop evaluation models that reflect this complexity. Just as technology has caused us to reevaluate the nature of knowledge and instruction, it prompts us to reevaluate the forms of evaluation that are brought to bear when examining educational technology. According to Schorr (1997) we need a new approach to the evaluation of complex social programs, one that is theory-based, aiming to investigate the project participant's theory of the program; one that emphasizes shared rather than adversarial interests between evaluators and program participants. This new approach should employ multiple methods designs and aim to produce knowledge that is both rigorous and relevant to decision-makers. In order to accomplish these tasks it will be necessary to design evaluations of technology based on the experiences of evaluators, the experiences of program developers, "state of the art" in the field of technology, and learning and the various program descriptions.

Many argue what are needed more than anything else are a new set of learning outcomes for our students. New learning outcomes must clearly focus on the demands of the New World environment. We need students who can think critically, solve real world problems using technology, take charge of their life-long learning process, work collaboratively and participate as citizens in a democracy. Experts in the area of technology and education such as Jan Hawkins and Henry Becker have developed ideas that could be developed into criteria for new ways of thinking about technology, teaching, and learning. These new learning outcomes could be translated into learning benchmarks and new types of assessment and methods for measuring outcomes could be developed to measure these benchmarks.

Key questions for the evaluation of technology in teacher education center on the extent to which preservice faculty model best practices of technology integration and the competencies of preservice teachers to use technology to effectively tie content to teaching methods at the end of their preservice experience and in the first years of induction. Are teacher educators and other faculty modeling best practices and are preservice teachers learning them and using them? Evaluation must also measure the impact of these practices on the learning of elementary and secondary students.

Implementation analysis becomes important under these conditions. With all of these complexities, the effects of technology on student outcomes may not be measured in the short-term evaluations because they are not yet evident. Evaluation must take into account that different institutions and faculty are in different phases of integration of technology, including:

- Purchasing and installing hardware and software
- Training faculty
- Integrating technology into the curriculum and instruction, especially content methods courses
- Evolution of the institution and the program within and beyond its traditional boundaries

Recommendations

We need to take a formative approach to the evaluation of technology in education, because of the rate of change in technologies. Technology changes quickly while faculty and teachers are often asked to keep up and integrate new ideas at the same pace. The definition of the innovation within education is thus constantly at issue. We must spend time documenting the program that may be changing over time.

In order to get at the complexities of these processes multiple measures (quantitative and qualitative) should be used. These should include traditional experimental and quasi-experimental designs and include such methods as paper surveys, email/Web-based surveys, informal and in-depth interviews, focus group interviews, classroom observations and document analysis. Evaluation design should incorporate longitudinal studies of cohorts of students over several years. In addition evaluation designs should rely less of participants self-reported attitudes and more on observations of participants actions within learning contexts. Research and evaluation needs to demonstrate the potential of educational technology but in a way that attends to the layers of complexity that surround the processes. We need to include a wide variety of experts and stakeholders in the process of evaluation of technology in teacher education.

Dissemination of research including evaluation

One final point is that we can evolve new ways to disseminate our research to practitioners and involve them in the process. In the USA Hans Becker has created a web site and disseminated his research through conferences of researchers and practitioners.

He asks his audience for additional evaluation questions to further analyze his evidence gathered for a large study of teaching with technology in the USA is collaboration with Margaret Riel.

A new example currently from Europe is the ICT Educational Research Forum created by a team led by Niki Davis with the educational research community and practitioners in Europe (so far) at http://telematics3.ex.ac.uk/erf
This web site supports leading researchers to make presentations of their research to users, with practitioners as a high priority audience. Users are also encouraged to become involved in the discussion and process of research (Davis and Tearle, in press).

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Minorities and Mainstream Culture: Does a Technology Gap Exist?

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Abstract: The current technological revolution occurring in society is making vast amounts of information and opportunities available, but only for those who have the ability to obtain and make use of it. With the tremendous technological changes occurring the question remains: Will all individuals have the opportunity and abilities to take advantage of this new developing phenomena? Current research indicates that not all individuals will have the opportunity and/or abilities to take advantage of this technological revolution. Due to the current and potential future impact that technology will have, the technology gap that currently exists should be of utmost concern for educators, policy makers and the general public. Based on the current evidence of the existence of a technology gap the primary purpose of this paper is to examine the current state of affairs and provide some basic interventions that can be employed to help eliminate the technology gap.

Introduction

The use of and access to technology and it associated components continues to grow in today's society. America appears to be in the midst of another revolution, namely a technological revolution that is transforming all segments of society to some degree (Kennard, 1998). Most researchers and lay people alike would agree that advances in technology and computers are altering people's lives in many different ways. These technological changes are altering how individuals work, learn and play, as well as, increasing productivity and making available new ways of communicating and accomplishing daily tasks of life. Individuals who have access and have acquired the skills and knowledge necessary for high

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technological competency will have a distinct advantage in this new technological society compared to those who do not possess the skills and knowledge (Carver, 1994). The current technological revolution is making available vast amounts of information, but only for individuals who have the ability to attain and make use of this information. With the tremendous technological changes occurring in society the question remains: Will all individuals have the opportunity, demographic and personal characteristics to learn and take advantage of this new developing phenomena? Current research indicates "No" and that there is a digital divide occurring between segments of society. Malveaux (1998) posits that there exists a technology gap between young people who have access to technology in their education and those who do not. Additionally, she notes that there is a technology gap between ethnic minorities that may have serious implications for their potential education and work. Due to the tremendous impact that technology is currently having and will have in the future, this technology gap should be of utmost concern for educators, government policy makers and the general public. Based on this disheartening information and evidence, the primary purpose of this paper is to examine the current state of affairs of minority (African American) technology use. As well as provide some basic interventions that can be employed to help eliminate the gap that appears to be growing in the use of technology and technological competency.

Current Findings

The National Assessment of Educational Process (NAEP) in 1983 indicated that there are ethnic differences in terms of computer and technology use in favor of Caucasian Americans. Martinez and Mead (1988) examining the results of this survey noted that the differences concerned access to computers in schools and at home, as well as, ethnic differences in computer competencies that favored Caucasians. In 1984, 27% of Caucasian students had a computer at home as compared to 11% of African American students. However, overall African Americans were not statistically different in their level of access to technology and use of computers. The authors note that African Americans may be accessing technology outside of the home. However, it should be noted that this finding has not been replicated in other surveys examining computer use and access by different groups. When economics were taken into account, it was found that African Americans in economically disadvantaged schools did not receive or have access to computers and technology comparable to Caucasians at affluent schools (Webb, 1986). Furthermore, African American students were exposed to computers for remedial purposes, while Caucasian student's were exposed to computers to emphasize and enhance computer literacy. Kominski (1991) found that in general Caucasian students experienced significantly higher levels of school computer use than African American students. A 1993 survey of 55,000 American households found that 25% of African Americans were using computers and interacting with technology compared to 38% of Caucasian Americans (Evans, 1995). Other national surveys show that a large proportion of individuals (20% of Caucasian Americans and 40% of African Americans) do not use a computer or interact with technology at all. Additionally, a 1994 Commerce Department report showed that only 19% of African American households had a computer compared to over 40% of Caucasian households.

Student Use

Focusing specifically on students interacting with, learning and use of technology the numbers become even more discouraging. Resta (1992) found that African American elementary students were more than three times as likely as Caucasian students to attend schools that did not have computers or access to computers and technology. Hoffman and Novak (1998) found that over 70% of Caucasian students owned a computer while only a little over 32% of African American students owned a computer. Furthermore, adjusting for household income the difference remained. Other data has shown that in general African Americans have less access to computers and technology than Caucasian students (Wenglingsky, 1998). When we examine the state of affairs for college students the picture is somewhat more complex. Several studies (e.g. Kahn, 1997; Hoffman & Novak; Resta) have indicated that African American college students have less access to technology and thus interact and use technology less. However, it should be noted that for students who had been exposed to computers and owned a computer, interaction with and use of technology was similar between Caucasian and African American students. A finding of interest is that

for individuals who did not own a computer Caucasians were more likely to seek out and use technology compared to African Americans. A possible explanation posited in the literature for this finding is that African Americans have a general distrust of technology and perceive a connection with computers, Internet use, and technology with an invasion of privacy (especially tracking of ethnicity) more than Caucasians (Ervin & Gilmore, 1999). Research results indicate that there may be a difference in the use of technology and computers between ethnic groups. Resta asserted that minority students were more likely today to use the computer in rote drill and practice learning fashions; and, that these methods stemmed from efforts to improve performance on standardized tests. Additionally, Wenglinsky found that African American students were not exposed to higher-order uses of computers, as were Caucasian students, and, in fact he found that African American students were more likely to be exposed to lower-order computer uses than were Caucasians. Finally, research appears to be indicating that ethnic groups differ in how they use computers, technology and their level of technological competency. Hawkins and Paris (1997) found that African American students tend to use computers when required, while Caucasian students tend to use computers and technology for various tasks. Also they found that Caucasians tend to be multi-platform users, while African Americans were not. Along these lines assessment conducted by the Educational Testing Service (ETS) found that African American high school students had much lower levels of computer competence than Caucasian students in general. In fact, results showed that Caucasian students had an advantage over African Americans at the third, seventh, and eleventh grades. Roach (1998) posited that there is evidence that African American students come to college with not as much active computer use and competency in the use of technology as Caucasian students.

The U.S. Department of Commerce (1998) report on Telecommunication and Information Technology Gap in America shows significant and dramatic gains in American's accepting technology. Overall, the report found that the number of Americans connected to the nation's information infrastructure is soaring. However, this report also noted that "digital divide" still exists, and, in many cases, has widened over time. Minorities, low-income individuals, the less educated, and children of single-parent households (particularly rural and central cities) are among the groups that lack access to information resources and opportunities to develop technological skills. As can clearly be seen the opportunity for African Americans and other groups to interact with and learn the basic skills of technology (computer use) is limited at this time compared to Caucasian Americans. At the current time the literature is unclear as to the cause(s) of this difference. However, it is important to realize that African American and other groups are less likely to use technology and be prepared for competition in the new educational and informational age (Malveaux, 1998). The impact of this less preparedness has not been totally felt at this point and future research will need to more closely examine the impact of being technological unprepared. In 1995, a report by the United States Department of Education showed that African American students were 30% less likely than Caucasian students to have computer Internet access in the classroom and to be exposed to the new information superhighway. Malveaux noted that computer access was a key to developing technological competency and proficiency, but also basic skills and literacy are equally important. Although, we need to change our focus to some extent in education to focus on technology to make individuals competitive for the future work world, at the same time we can not forget the basic of education. The best possible solution at this time would appear to be for educators to use technology to teach and have students learn basic skills and knowledge. By using technology to teach basic skills educators would not only be educating the youth of America, but also would be exposing and helping students develop basic technological competencies that would allow them to thrive in the new information age. Based on the current research and implications for the future, America is in error if it does not address the ethnic technological gap that exists and appears to be widening. Hoffman and Novak (1998) posited that if any sector of American society is denied equal access to technology and Internet use, the businesses of the United States will lose their competitive edge in response to the lack of technological skills and competency in the work force. They have emphasized the critical need of improving educational opportunities for African Americans and other minority groups to provide for their participation in the information revolution.

Interventions

The U.S. Department of Commerce (1998) report believes that schools and libraries might prove to be the great equalizers in the quest for technology literacy. This nation needs to continue to increase its outreach efforts, especially directed at the information disadvantaged. Clearly, we are standing at the

doorway of a segmented society, those that have the knowledge and skills to make use and benefit from technology and those that do not possess the knowledge and skills to take advantage of this new technological revolution.

The question now turns to how as a society are we to rectify this problem. Several suggestions have been posited for improving African Americans and other minority groups use of computers and technology. Minority students need more points of access and encouragement to use them in all phases of their lives. One possible help in this endeavor is the development and implementation of Community Access Centers (CACs). A CAC is a locally operated computer and technology center that provides basic training and access to technology (e.g. Internet access). Currently, many CACs are within schools, libraries and other public facilities with preliminary results show that CACs are well used by those groups that lack access to technology at home or work. Providing public access to the Internet and technology will help individuals and groups advance economically, as well as provide them with the technological skills to compete in today's digital educational and economic environment. Although, technology education and its use can occur anywhere it appears to be essential that computer and technology education take place in schools and be applied to all learning experiences, especially as the world outside of education is becoming technology heavy. To ensure the participation of all Americans, but especially minorities in the information revolution, it is critical to improve educational opportunities for African Americans since African Americans appear to have a disadvantage in accessing technology and personal computers. In conjunction with this mentoring services for disadvantaged individuals may be beneficial in improving the technological skills and technological usage of disadvantaged individuals and groups. At the same time it is essential to encourage and support all students, especially minorities to seek computer literacy and technology based skills, in addition to reading and writing, as an indispensable tool of education and empowerment (Hawkins & Paris, 1997).

In education, exposing African Americans to meaningful computer technology experiences, not just drill and practice will enhance computer literacy (Carver, 1994). To provide meaningful technological experiences, the school must ensure that school computers and technological resources are available and that they change with technological developments. Additionally, schools must provide access to technology and revise curriculum and teaching methods using technology to meet the needs of students. Teachers who promote meaningful engaged learning through authentic uses of technology provide students with vast opportunities to interact with a wealth of resources and technological materials. When educational technologies such as the Internet and distance education are used at the classroom level to help achieve challenging educational standards, they provide powerful alternatives for creating more effective learning environments and more productive learning opportunities. As schools, districts, and other organizations develop and implement technology plans they clearly need to emphasize equity. To ensure that all individuals have equal access and opportunity there are three strategies that can be employed to ensure that all students have access to technology that supports meaningful learning of material and development of technological competency. First, equipment and wiring needs must be determined, such as hardware, software, and a networking infrastructure that supports a technology integrated curriculum. Second, appropriate funding must be secured not only to cover initial costs, but also for the ongoing costs of maintenance and technological assistance. Finally, there must be professional development for educators, so that technology is implemented in the classroom in meaningful ways and contributes to the attainment of high standards by all students.

Additionally, several suggestions to remedy the lack of computer competence of minority students have also been proposed by Resta (1992). Resta states that access to computers and technology with training in the appropriate use, should be a major effort of public schools. States must fund and develop plans for acquisition and distribution of technological and computer resources in an equitable manner. The federal government should integrate computer education and technological needs into existing programs. At the college level, technological competence can be enhanced by providing special programs and summer camps for minority students, sponsoring after school sessions, tutoring, and increasing the school and college counselors' awareness of computer competence for the minority student. In working with students as they prepared for making decisions about the world of work, counselors can enlighten students to the importance of gaining technological competency to be competitive in the world of work in the future. Also, training and technical assistance to minority students entering college should be provided. Along these lines, funding programs should be established to assist individuals in purchasing computers and gaining access to the new technologies that are available. Inservice training for teachers (with focus on under prepared populations) may be beneficial as a way to help teachers be comfortable and effective in

using the new technological tools for learning. It also may be the time that teacher education programs devise curriculum for teachers that not only incorporate technology into the learning process and how to use technology to teach, but also provide preservice teachers with the skills and knowledge to teach technological competency to students. Teachers need to be comfortable with technology and have the prerequisite skills to be able to teach technological competency to others. This point can not be stressed enough as we move full steam ahead into a digital world. Additionally, the recruitment of minorities into teacher training programs, outreach programs, support for research and development in technology may lead to more opportunities for minorities to gain valuable experience with technology and its many components.

Summary

Computer access can democratize educational and economic opportunity for all Americans and it must be recognized and developed (Hawkins & Paris, 1997). It is of utmost importance that educators, policy makers and the general public ensure that equal access to technology and computers is made available. It is possible the without equalization of technology between groups the technology gap may continue to widen and lead to a segmented society with it many inherent problems. With, initiation of educational programs, moving technology into classroom's and other programs focused on technology integration into individuals lives may lead to a closing of this technological fissure and allow all individuals the opportunity to be competitive in the educational and work realms.

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Technology in College Classrooms: Training Future Teachers

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"Abstract"

In order to "make it happen," pre-service teachers and their professors need to know the who, what, when, where, and how and then have the courage and motivation to "just do it!" as it relates to using technology in the classroom. This capacity building project was funded by the US Department of Education to help college professors to do more than just "talk the talk" and move to "walking the walk" by modeling effective use of technology since we tend to teach the way we were taught. This model for implementation reports the research-based development of the project and documents where-we-are-now in the process via a video presentation.

Introduction and Background

"Two million new teachers will be hired over the next decade. Will these new teachers be comfortable and skilled in using technology? What will it take to transform schools of education so that faculty feel comfortable emailing students, using listservs for projects and instruction, and introducing candidates to soft-ware that enhances instruction? As technology moves from the periphery to the center in P-12 schools, so must it move from the periphery to the center in teacher preparation," states Arthur Wise, President of the National Council for Accreditation of Teacher Education (NCATE), in a report on the needs for technology in teacher preparation programs (1997, p.v).

In efforts to support this stance, NCATE has adopted special performance criteria developed by the International Society for Technology in Education (ISTE) and is developing expanded standards of their own, due out in 2000. The ISTE criteria state the foundation standards for all teacher education students to include the following core principles:

A. Basic Computer/Technology Operations and Concepts. Candidates will use computer systems to run software; to access, generate and manipulate data; and to publish results. They will also evaluate performance of hardware and software components of computer systems and apply basic troubleshooting strategies as needed.
B. Personal and Profession Use of Technology. Candidates will apply tools for enhancing their own professional growth and productivity. They will use technology in communicating, collaborating, conducting research, and solving problems. In addition, they will plan and participate in activities that encourage lifelong learning and will promote equitable, ethical, and legal use of computer/technology resources.
C. Application of Technology in Instruction. Candidates will apply computers and related technologies to support instruction in their grade level and subject areas. They must plan and deliver instructional units that integrate a variety of software,

applications and learning tools. Lessons developed must reflect effective grouping and assessment strategies for diverse populations.

Sincere we tend to teach the way we were taught, the philosophical basis for this project is for college faculty to model the use of technology. This is supported by many including Parker (1997) when he states that, "Faculty must engage in active collaboration in planning for the systematic, ongoing integration of technology. They need to model a multi-faceted approach including critical thinking and reflection."

However, higher education faculty members are slow to embrace the use of technology. In a report by SEIR*TEC (1998) the research of several authors is reported on this topic. "Many are ill-prepared, use it inconsistently, and thus do not provide a positive model for technology integration (Northrup & Little, 1996). Another reason is that university faculty report that they have to concentrate on more traditional forms of productivity rather than on technology-based projects (Seminoff & Wepner 1994). Other reasons for lack of infusion identified are limited equipment, lack of training, no clear expectations, lack of funds, lack of time, doubt about pedagogical validity, lack of technical support, lack of appropriate materials, and absence of clear goals (Topp, Mortensenm, and Grandgenett, 1995: Baron & Goldman, 1995)."

The SIER*TEC (1998) report continues, "Other studies have found that when some of these barriers are broken, faculty still do not use technology. For example, King, Harvey, and Moller (1997) found that making an innovation available does not guarantee its use. They found the one-on-one help appears to be the most effective strategy. This is in keeping with the diffusion theory, which holds that face-to-face communication is the most effective way to persuade someone to adopt an innovation. This study also underscored the findings of other research studies with conclusions that if faculty members are going to use technology, they must feel confident that it will work properly. When something goes wrong, faculty should be assured that they can find help."

Finally, it is important to incorporate into any effort the lessons learned from past efforts. A second SEIR*TEC document, (1999) itemizes these based on their research:

1. Leadership is the key ingredient
2. If you don't know where you're going, you'll end up someplace else
3. Technology integration is a s-l-o-w process
4. No matter how many computers are available or how much training teachers have had, there are still substantial numbers of educators who are "talking the talk," but not "walking the walk"
5. Effective use of technology requires changes in teaching; in turn, the adoption of a new teaching strategy can be a catalyst for technology integration
6. Each school needs easy access to professionals with expertise in technology and pedagogy
7. While many of the barriers to using technology to support learning are the same for all poor communities, some populations have additional issues
8. In some schools, infrastructure remains a serious barrier to technology adoption

9. Educators can benefit from tools that help them gauge the progress of technology integration over time

Methodology and Results

There were three components of the research effort to develop the grant proposal:

First, a questionnaire was given to 146 junior and senior students in an assessment course required of all education majors. Three questions were posed:

1. Rate yourself on a scale of 1 to 5 for being able to use technology as a tool of instruction in the classroom
2. Rate your college professors in the School of Education on a scale of 1 to 5 on their use of technology as a tool of instruction in the classroom
3. List the ways you have seen technology used in your coursework in the School of Education.

The results on questions 1 and 2 were mostly one's (the lowest) and some two's. Question three yielded such responses as VCR's, word processing, software demonstrations, Internet searches outside the classroom, and a few power point presentations.

Second, interviews were conducted with faculty members about their use of technology in the classroom. (The faculty members involved in teaching the instructional technology courses were purposely omitted.) The resulting comments were rich in content—all really wanted to do more and learn more but obstacles kept getting in the way. Obstacles cited were: No equipment in the classroom (labs but none in the classroom), no time to learn and prepare, nobody to help if something goes wrong, and no real "push" from administration. They also reported that although many of their students are required to make presentations and do projects that require the use of technology, that they themselves are not "into" it much.

A third component of the research involved talking to current teachers in nearby school districts and to technology staff at the State Department of Education. This was done in an effort to find out what training had been offered to current in-service teachers, how much technology was being used in K-12 classrooms, and what would new teachers be expected to know when they entered the workforce. We found a tremendous gap in knowledge and training between university personnel and current in-service K-12 teachers. School district administrators interviewed said that they expected new teachers to be ahead of their "older" teachers in the area of using technology in the classroom, but were disappointed more often than not.

Project TiCC—Technology in College Classrooms

Thus the development of the proposal set out to really "make it happen" in four targeted courses each of five universities/colleges. 8 objectives were developed to eliminate the

obstacles that stand in the way of infusing technology and build the support necessary to promote the efforts of faculty to become more proficient in using technology as a tool of instruction. Activities were developed to foster the implementation of the objectives. Those objectives and activities are discussed below:

(1) develop collaborations—by establishing an on-going communication effort using a variety of strategies and providing a contact person (to receive stipend) at each institution to coordinate and foster collaboration efforts. Methods of communication include a videoconference, a newsletter, a listserve, and the development of a web page designated to the project. (Misery really does love company, and with proper care and feeding can learn and travel better together.)

(2) build knowledge base—by hosting a technology infrastructure summit and developing a resource center at each university. The purpose of the summit is to provide education faculty with knowledge of what already exists in the state as it relates to infrastructure resources. So often this information simply does not filter down to the faculties in schools of education. The resource center will provide documents, books, curriculum suggestions on the use of technology in the college classrooms. (Got to know how to get there from here.)

(3) furnish access—by reviewing and updating technology plans and purchasing equipment needed in the classroom. At the participating universities, there was not a well designed technology plan for the schools or divisions of education. Each of the universities had an overall technology plan for the whole university but needed the time and motivation to develop a plan more specific to the needs of the faculties of education. Expertise in writing such plans is a necessary prerequisite. (A roadmap and car filled with gas are necessary components of the trip).

(4) redesign curriculum—by using the expertise of consultants to incorporate specific strategies that align directly to course objectives. Very often the faculties reported that they just did not have the time to find out what to do or when they did know what to do, they didn't have the time to make it specific to the objectives of the course they were teaching. In addition, this project will develop a new course for students that focus less on mechanics and more on application in the classroom. Plans include designing this course around ISTE and NCATE standards that are part of the discussions about setting technology standards for future teachers that will be required for certification. (The roadmap needs to one printed rather recently if it is going to contain all the possible routes--hasn't somebody made this trip before?)

(5) train faculty—by building on and adding to the successful training currently supplied to K-12 teachers. We found a tremendous gap between training that was supplied to K-12 teachers in our state (by the State Department of Education) and the training provided to college faculty. Past efforts to include college faculty in these training sessions were turned down because of space , time, and money. By providing the training to college faculty they will be more knowledgeable of what current teachers are expected to know, thereby they can better prepare the future teachers they are training. (Got to know what I don't know, if I'm going to get what I need to get.)

(6) provide sustained support—by providing on-site technical assistants. This directly relates to the often heard comment, "What will I do if something doesn't work?" (We all get by with a little help from our friends.)
(7) make it happen—by providing stipends for attending the training and rewards for implementing the training. Time if valuable and limited for busy faculty and recognition of this fact provides one of the many necessary motivations to be involved. (Just do it!)
(8) insure quality administration and evaluation—by providing staff, evaluation consultants, the development of effective evaluation instruments to gauge progress and chart the course, and management consultants from the community. Having people "tell the story" of their efforts to learn and grow in the field of technology can be very motivating to both the participants and others. The management consultant is a member of the community and fosters the collaboration at that level. (Read those road signs -- Publish or Perish, Grants are Grand, Report/Reported/Reporting, Exit here. . .)

Where Are We Now

Video presentation highlighting implementation process.

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